STUDENT ECONOMIC REVIEW 2016

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Prize-Winning Essays of the Student Economic Review 2016

Best Overall Essay: Dermot McAleese Medal

Intergenerational Social Mobility in Britain: The Curse of Coal

Daniel Fallen Bailey

Best Applied Economics Essay: Donagh Lynch Medal

How Shale Fractured The OPEC Oligopoly: A Game Theory Analysis of The Oil Market in 2015

Richard Roberts

Best European Economy Essay

Competing Against Germany: Unit Labour Costs In The European Monetary Union

Jonas Peisker

EDITORS AND GENERAL MANAGERS OF THE STUDENT ECONOMIC REVIEW, 1987-2016

Year	Editor	General Manager
1987 (Vol. I)	John Fingleton	Paddy Waldron
1988 (Vol. II)	Kevin Carey	Finbar McDonnell
1989 (Vol. III)	Jonathan Wright	Joe Dennehy
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 McMahon	Niamh McDonagh
2000 (Vol. XIV)	Ana Carrie	Colette Murphy
2001 (Vol. XV)	Ronan Lyons	Charles Larkin

Year	Editor	General Manager
2002 (Vol. XVI)	Ivan McAdam	Janine Boyd-O'Connell
2003 (Vol. XVII)	Rowena Gray	Elaine Doyle
2004 (Vol. XVIII)	Denis Tkatchenko	Tara McIndoe
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 Ní Shúilleabháin
2012 (Vol. XXVI)	Tony O'Connor	Debbie Blair
2013 (Vol. XXVII)	Brian Higgins	Marielle Grigsby-Rocca
2014 (Vol. XXVIII)	Féidhlim McGowan	Cián Mc Leod
2015 (Vol. XXIX)	Gearóid Gibbs	Michael Mahony
2016 (Vol. XXX)	Gillian O'Connell	Kate Hayes

GUEST SPEAKERS AT THE LAUNCH OF THE STUDENT ECONOMIC REVIEW, 1990-2016

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 McRae	The Independent, 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)	Tom Healy	Irish Stock Exchange

Year	Speaker	Organisation
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 McStay	Key Capital Limited
2013 (Vol. XXVII)	Alan Gray	Indecon Economic Consulting Group
2014 (Vol. XXVIII)	Anke Heydenreich	Attestor Capital LLP
2015 (Vol. XXIX)	Declan Sheehan	JP Morgan
2016 (Vol. XXX)	Various Speakers	Past Committee Members

STUDENT ECONOMIC REVIEW DEBATES, 1996-2016

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 Responsibility	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 U.S. Economic Dominance	Harvard
2011	Oxford	Ireland Owes a Debt of Gratitude to Britain	Oxford
2011	Yale	It's All America's Fault	Trinity

Year	Opposition	Topic	Victor
2012	Cambridge	Ireland Should Rejoin the Sterling Area	Trinity
2012	Harvard	The U.S. 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	U.S. Education System	Trinity
2015	Oxford	100% Inheritance Tax	Trinity
2015	Yale	Opening the Mexican Border	Yale
2016	Cambridge	Will the EU Benefit from a Brexit?	Cambridge
2016	Harvard	Should We Be Afraid of Cheap Oil?	Harvard

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

'The Student Economic Review is the only student-run economics journal that I know of at any university. It has succeeded beyond anyone's wildest expectations when it first came out, over 20 years ago. As recent events have highlighted, economics is still a young discipline, and the economics profession still has much to learn, but the opportunities and questions are exciting. The Student Economic Review is an unparalleled vehicle for getting students involved in research in economics and related fields.'

Jonathan Wright
PhD Yale and Professor of Economics at John Hopkins University
Editor, SER 1989

'There's a strange alchemy to the Student Economic Review. It pulls together a diverse community of students to produce a publication like no other. Whether surveying the state of the art, or changing the state, the articles it contains bring out the best in contributor. More than that, though, the final product is greater than the sum of its parts. The ties it forges and the legacy it leaves are unique, as is clear on the faces of students, faculty and guests at each year's launch.'

Paul O'Connell
PhD Harvard and President at FDO Partners Investment Management, Boston
Editor, SER 1991

'The things I remember about being Editor of the Student Economic Review are what I value most in any work environment-intellectual rigour, collaboration and camaraderie, creativity and a small dose of pressure! It was great fun and fantastic to see what a few third-year students, with a little guidance and direction (thanks John!) can achieve. Down through the years, the calibre of the personnel involved has always been high and the quality bar continually raised. It's also really cool to get your name in print!'

Geoff Gill
MPhil and Partner Transfer Pricing Deloitte, Sydney
Editor, SER 1996

'My abiding memories of the Student Economic Review are of the tremendous efforts of the committee to meet the production deadline, the quality of the essays, the support from the Department, our pride in the finished product and a fantastic launch party. Other highlights included international interest in the Review and a debate with arch rivals UCD about the euro that evoked strong passions! Overall, involvement with the Student Economic Review provided some of the best experiences of my undergraduate days and I remain firm friends with many other members of the committee.'

Padraig Dixon
DPhil Oxford and Research Associate Health Economics, University of Bristol
Production Manager, SER 1998

'I convened the debate once and spoke in it twice. One of the few occasions in my life that I can recall my appetite failing me was at Commons in advance of my first debate which was against a Cambridge team that featured the then World Champion. As it turns out, the nerves were put to good use and we went on to win. The following year, my appetite was much better…and we lost! My involvement in the Student Economic Review debates trained me for many things-giving seminars, organising conferences, structuring a paper-but I still haven't thought of a comeback!'

David Comerford
PhD UCD and Lecturer in Economics, Sterling University
Debates Manager, SER 2003

'I found having the opportunity to submit content for peer-review and publish some original work to be an extremely motivating prospect. I participated as well in many hugely enjoyable Student Economic Review debates. My involvement on the committee also granted me the opportunity not only to make more friends from my course (some of whom remain my closest friends to this day) but meet my wife, so I'm particularly happy to have been involved!'

Cormac O'Dea
PhD UCL and Senior Research Economist, London
Editor, SER 2005

'The Student Economic Review experience opened my eyes to areas of economic research which I hadn't yet been exposed to and motivated my desire to do original research of my own and enter a PhD programme. I believe the high quality of the review reflects the hard work put in each year by the students involved and is a testament to the incredible legacy left over by the founders, previous team members and contributors.'

Cian Ruane
PhD Student at Stanford
Production Manager, SER 2011

'Ever since leafing through a copy of the Student Economic Review in my Junior Freshman 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!'

Cian McLeod
Strategic Operations Specialist at Google Ireland
General Manager, SER 2014

Further reflections available online at
http://www.tcd.ie/Economics/SER/about/reflections.php

THE STUDENT ECONOMIC REVIEW

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THE STUDENT ECONOMIC REVIEW

TIME PASSES BUT MEMORIES PREVAIL- A MESSAGE FROM JOHN O'HAGAN

It cannot be twenty-nine years since the first Student Economic Review (SER) was launched, largely thanks to the efforts of John Fingleton, a precocious young JS economics student! But it is indeed and we are now celebrating the 30th issue this year. What a vehicle it has been for me to meet and work with so many bright and innovative undergraduate economics students. Relying on teaching alone for such contact would not nearly suffice.

While the core of the SER for many years was the Review itself it soon widened out to include debates, first against UCD, then Oxford and Cambridge and more recently Harvard and Yale. These debates are now almost as much a part of the SER year as the journal itself, played to packed audiences in the GMB. And to think that the Oxbridge debates were started by a young JS economics student, Vinay Nair, against the President's wishes! The debates are held jointly with the Hist and the Phil, two of Ireland's, let alone Trinity's, premier debating societies. A reflection of how highly regarded the SER debates are, is that both societies each year compete fiercely to host them.

I have always been of the belief that economists should not leave the middle ground between economics and politics to others but be involved fully in this space through both the written and spoken word. Economic policy is inextricably linked with politics and the solutions to any of the great problems of the day, if they are to be effective, must take due cognisance of this reality. Although more mathematical and quantitative than the other social sciences, economics is still a social science with its central focus the improvement of the economy and society which it ultimately must serve.

There have also been Workshops organised in most recent years. This year though was exceptional with the two lectures given by Nobel Prize winners in economics, the first co-hosted with the Hist and the second with Trinity Economic Forum. It was a joy for me to watch on television the 2015 Nobel Laureate Angus Deaton receive his prize in Stockholm knowing that just a few weeks earlier he had addressed the Hist/SER workshop. It was also fascinating to observe a few months later the 2002 Nobel Laureate Vernon Smith mingle for an hour or so with students after his talk in Trinity.

The core of the SER though is the Review. Each year students compete to have their essays accepted, their first exposure to the 'cruel' world of academic publication! And each year we have many very fine undergraduate essays published in the SER, an accurate reflection of the very high quality of many of the undergraduate economics students at Trinity we are privileged to teach and get to know each year. I look forward very much

to seeing this year's selection, all chosen exclusively by the three student members of the editorial team. The publication is unique, produced as it is by JS students each year, with the committee from the previous year always ready to provide advice when needed.

It would be invidious to mention any previous members of the Committees, as there are far too many people involved, all of whom have had extraordinarily successful careers since. By the time you will read this you will, through the Launch, have got a taste of the extent to which this is true. Some of them have been extremely generous to the Department but thanks for this is for another occasion.

For now it is important to mention a few past students, who predated 1987 and who have made the SER financially self-sufficient. Harry Hartford has to take pride of place with his generous funding of the SER over ten years. Alan Gray, Kyran McStay and Conor Kileen, who predated Harry as a student, also deserve our rich gratitude for their funding in recent years. Vinay Nair, who as mentioned defied 'his' President, has also kindly funded the debates for many years and our most recent graduate Aoife Cunningham provided funding almost before she received her first pay package! Many others have contributed in kind, such as for example being guest speaker at the launches or as a judge at the various debates. And others contributed very generously indeed to the department through the Grattan Scholarship scheme.

For a while I wondered was the SER committee to be dominated by male students, as seven out of the eight in some recent years were male. This was all turned on its head this year, with seven of the eight committee members being female. They, like all other committees, were a pleasure to work with. From the first meeting in early October, when each committee looks awestruck by what lies ahead, it is fascinating to see the year evolve to the point where the enormity of what they have achieved is only finally realised when the first printed issues of the Review are held firmly in their hands.

Thankfully there are several members of the current staff to continue with this great student project, so that this 30th issue is far from the last. They have already been involved and have greatly assisted for several years.

A reflection of the regard which students hold for the SER over the years is the huge number of former committee members who have returned for the occasion of the Launch of this the 30th issue. Over half have come from overseas, some from the United States or further afield. Many friendships established through the SER have lasted to this day and in some cases ended in marriage!

It has been a great privilege for me to have been involved with and to have met so many wonderful students over the years through the vehicle of the SER.

JOHN O'HAGAN
Professor of Economics and President of SER.

WELCOME TO THE REVIEW

On behalf of the committee of the 30th edition, I am proud to present you with the 2016 Student Economic Review. The Review is an academic journal published by the undergraduates of Trinity College Dublin. It is a practical and instructive introduction to academic research and publishing, encouraging students to engage with the subject of their degree in an thoughtful manner.

The Review was founded in 1987, making this year the thirtieth anniversary of publication. We, on the current committee, are very aware of the giants on whose shoulders we are lucky to be. We are so grateful to all past committee members for setting the standards and establishing the traditions that we now uphold.

The help we received from your legacy is clear. In February, we sponsored a talk by a Nobel Laureate in Economics, Vernon Smith, at the Trinity Economic Forum. Last November, we were equally proud to welcome, with the College Historical Society, our discipline's current Laureate, the 2015 prize-winner Angus Deaton. The audiences had the privilege of hearing these economists speak of their areas of expertise. For her work in organising Deaton's talk, and our two annual debates, I would like to thank our incredibly capable Debates Manager Annabel O'Rourke. Those contests, against Cambridge and Harvard, were notable for the depth of understanding the multidisciplinary teams could bring to motions about Brexit and the Oil Crisis.

Ultimately, the most important part of the SER's year, and the part that makes our activities unique, is the Review itself. Every submission is evidence of a student who is interested and original. We are delighted to congratulate everyone who sent us an essay and everyone whose essay has been included. I cannot give enough praise to our Editor, Gillian O'Connell, and Production Manager, Emily Waters, for the time, skill, and passion they respectively put into judging these works, and doing them justice in publication.

The remaining members of the 2016 committee; our Copyeditor Sarah McDowell, our Launch Managers Swetha Sampath and Stephen Barr, and our Finance Manager Huda Awan: a huge thanks to you all. It's been a pleasure working together and I could not think of nicer people to be forced to spend time with.

The Review has been made possible by our sponsors. For the contributions of our long standing chief sponsor Mr Harry Hartford, we will always be grateful. Mr Vinay Nair, a past Debates Manager, now lends his name to the winner's cup and in his generosity is ensuring the continuance of the standard he helped establish. We sincerely thank Key Capital for their valued support, this year and in the future. To Mr Alan Gray and Ms Aoife Cunningham, both Trinity graduates; the fact that you continue to add so much to academic life in the college deserves our warmest gratitude.

For help of a different kind, we thank the members of the Economics department

who happily act as our patrons: Dr Michael King, Dr Tara Mitchell, Dr Ronan Lyons and Dr Michael Wycherley. Further to this, we want to show our gratitude to all other staff of the Department and the Alumni Office, who gave of so much of their time for us. Your experience and guidance are greatly appreciated.

Lastly, to the President of the Review, Professor John O'Hagan, I want to express the thanks of every past essay author and committee member, those of us lucky enough to be part of your last edition at the college, and every single student who will in the future become involved in the journal that will continue to be yours. For your encouragement, kindness, and warmth, we are deeply grateful. Any affection you have for the Review, we have for you, and more. The Student Economic Review inspires us, and in that it mirrors its founder.

We hope as you open the thirtieth edition of the Student Economic Review you will appreciate the breadth and the quality of its content. We had the joy of publishing some truly excellent essays this year. Our wish is that you catch the same feeling of excitement and awe as you read them.

KATE HAYES
General Manager, Student Economic Review 2016.

LETTER FROM THE EDITOR

It is my pleasure to welcome you to the 30th Edition of the Student Economic Review. Over the past 30 years, the Review has provided a platform for students to engage with material presented in class and to explore areas beyond those encountered in lecture halls.

This year saw 85 submissions to the Review, highlighting its continued popularity and importance. These submissions spanned a huge range of topics and the volume of work received, as well as the variety on display, emphasises the huge level of interest economics has received in recent years.

This year's Review is divided into six sections, which I will now briefly introduce. The first section, Economic History, opens with a novel essay on the 16th century origins of economic thought. One of the reasons for studying economic history is the explanations that it can provide for the present. This year's recipient of the Dermot McAleese Medal for Best Essay, Daniel Fallen Bailey, shows the continued relevance of this approach by tracing the origins of Britain's North-South divide back to the Industrial Revolution and the educational scarring which occurred in the North as a result of the availability of jobs and the high opportunity cost of pursuing education.

The second section, Economic Research, sees econometric techniques utilised to investigate the relationship of beer consumption in Ireland to the business cycle, the determinants of whether or not people are worried about the privacy of their data in an age of growing online economic activity and the characteristics of a labour force which are most important for productivity.

The third and largest section, European Economy, was also the section which received the most submissions. The level of interest and the variety of topics on display here reflects the huge role played by Europe, as well as the extent of the challenges it faces. These essays compare policy responses to the Financial Crises in Ireland and Iceland (which while not in the EU is geographically and culturally European, as well as being part of the Schengen Area), examine the Swiss model as a possible option for Britain in the event of a 'Brexit,' offer critique of some of the common claims made about the negative economic effects of non-EU immigration, evaluate the ECB's programme of quantitative easing and argue in favour of centralised decision making for the agricultural sector. Jonas Peisker receives the prize for Best European Essay for his comprehensive and meticulously researched paper on the importance of Unit Labour Costs in the Eurozone.

In the fourth section, Industrial Economics, we see an exploration of agency theory, specifically how it relates to how firms choose to finance themselves. The fifth section, Developmental Economics, includes an econometric investigation of the effect of aid on growth, an exploration of the relationship between female empowerment and economic development and an essay exploring the effect of trade on income inequality, which we

placed in this section due to its particular focus on examining these effects in developing countries.

The sixth and final section is Applied Economics. This section again is notable for the variety on display, including an analysis of information asymmetry in and regulation of the gambling market, a proposed method of investigating the effect of global shocks on the domestic economy using historical data on the development of Argentinian railways and Irish meat exports to Britain between 1857 and 1910 as well as game theoretical explorations of 'freemium' pricing and open source software. Richard Roberts receives the inaugural Donagh Lynch Prize for Best Applied Economics Essay for his use of game theory to examine the upheaval in the oil market that has been caused by the entry of shale producers.

I would like to take this opportunity to thank my fellow Editorial team members; Sarah and Kate for their hard work in selecting and editing the essays. Kate, as General Manager, also ensured the smooth running of the year through her hard work and organisation. I would also like to thank the Managerial team who organised a number of fantastic events throughout the year. Emily, our production manager, deserves special acknowledgment for the long hours she put in to ensure the Review was published.

Ultimately the Review can only be as good as the essays that are received and I would like to extend my heartfelt thanks to everyone who submitted. The quality and variety on display in all submissions was hugely impressive, making the process of narrowing down essays a difficult but also enjoyable and illuminating one.

I also would like to thank the Economics Department, especially Dr Wycherley, Dr Mitchell and Dr Lyons for all their support. Finally, particular thanks are owed, of course, to Professor John O'Hagan who has been a source of constant advice and support throughout the year. The Review would not be what it is today without his dedication and commitment over the past 30 years.

Without further ado I now invite you to turn the page and begin. Being part of the Review this year has been a fantastic experience and it is my hope that you will enjoy this collection as much as I have.

Gillian O'Connell
Editor, Student Economic Review 2016.

30TH ANNIVERSARY EVENTS

This year, the Student Economic Review had the pleasure of welcoming both the 2015 Nobel Prize Winner in Economics, Angus Deaton, and the 2002 Nobel Laureate in Economics, Vernon Smith, to Trinity College Dublin. These events provided students and academics alike with the opportunity to engage with economic affairs outside of the lecture hall.

Nobel Prize Winner Visits Trinity College Dublin

17 November 2015

The Student Economic Review and College Historical Society had the privilege of hosting the 2015 Nobel Prize Winner in Economics, Angus Deaton recently in Trinity. Students and academics alike filled the GMB to watch the Princeton Professor receive the Gold Medal for Outstanding Contribution to Discourse and hear his address.

Widely regarded as one of the forefront thinkers on welfare economics and inequality, the native Scotsman has held esteemed positions in his home country, through an honorary fellowship at Cambridge, and in the United States, where he was President of the American Economic Association. Praised for stressing the importance of individuals, households and their choice architecture in the formation of economic policy, he coined the Deaton paradox, which observes how sharp falls in income are not necessarily reflected in consumption. He has also been known to court controversy, as a vocal critic of foreign aid and its limited effectiveness.

Beginning with an overview of his family history, Professor Deaton showed how he followed the socioeconomic advancement began and encouraged by his father, a miner turned civil engineer, by becoming the first in his family to attend secondary school, and subsequently university. Peculiarly, he stressed the role of luck in his own family's success, as his father's contraction of tuberculosis saw him sent to Scotland, instead of to the battlefields of World War One. He compared this to the role of chance in the good fortune of the wealthiest in society, saying they tend to underestimate it.

Professor Deaton then ventured into his area of expertise, discussing some of the views expressed in his book The Great Escape: Health, Wealth and the Origins of Inequality. Refuting any idealists in the room, he stated that one cannot champion economic progress whilst criticising the existence of inequality, as the two go hand in hand. His exploration of some advantages of inequality proved particularly interesting, from its incentivising effects to its advancement of education and technology.

Simultaneously he cited its many disadvantages, such as those who advance blocking the progress of others, through creative destruction or political manipulation. Overall he stated that inequality, particularly in the US, reflects private returns far in excess of its social ones, such as through its exacerbation of climate change.

Following on this sentiment, he gave an insight into his current research on how the 45 to 54 age group in America have displayed an increasing mortality rate compared to the steadily declining mortality amongst all other groups. Comprised almost exclusively of whites and not reflected in any other OECD country, he cited irresponsible marketing and an 'epidemic of despair' as possible reasons.

Despite the issues explored in his address, Professor Deaton ended on an overall positive note. Economic growth and progress have seen overall living standards in the western world steadily rise over the last 200 to 250 years, which will ensure the pursuit of happiness and prosperity despite setbacks. He also affirmed that the growth of developing countries does not require the halting of that of wealthier countries.

Sarah McDowell
Assistant Editor/Copyeditor, Student Economic Review 2016.

Nobel Laureate Speaks at 2016 Trinity Economic Forum

6 February 2016

At the recent Trinity Economic Forum (TEF), the 2002 Nobel Laureate in Economics, Vernon Smith, spoke to a packed theatre of students, academics, and policymakers, from Ireland and abroad. Professor Smith's address, co-hosted by the Student Economic Review on 6 February 2016, had the distinction of making this year the first time a Nobel Prize winner partook in the TEF.

Born in Kansas before the Great Depression, Professor Smith, who is currently at Chapman University in California, has enjoyed a long tenure at the pinnacle of his field. Celebrated for pioneering the establishment of laboratory experiments as a tool in empirical economic analysis, it was about this area he chose to speak, though his expertise ranges to include capital theory, finance, and natural resource economics.

Professor Smith introduced his talk by placing experimental economics in context against the traditional experimental sciences. He explained how in physics error can be controlled through precision in experimental design, whereas due to the heterogeneity of human beings, error in his own field must be controlled through repetition. With the challenging subtleties of experimental economics made apparent to the audience, Professor Smith began to speak about disproving false economic beliefs.

The first of the beliefs in question was that a market would be theoretically perfect only when all traders have perfect knowledge of the conditions of supply and demand, the second was that bubbles would not form in markets for tradeables if prices were known and transparent.

Professor Smith surprised his audience by admitting that he initially experimented on both topics in order to confirm the hypotheses. That his work revealed that a small number of people with only private information could find equilibrium, and that even with perfect information traders in a market could create a bubble, fascinated the academic community.

Professor Smith explained that these results had far-reaching implications for the understanding of the rules that govern the markets and the interaction of people within them. He reflected that though these experiments had given him answers to questions he wouldn't have thought to ask, what he found most remarkable was how long the false beliefs persisted, and how hard it was to convince people that the evidence to the contrary mattered.

Mentioning some of the further research his work and the work of experimental economists in general had prompted, in topics as diverse as using house prices to predict recessions, and constructing markets to trade high voltage electricity, Professor Smith ended his speech on a note of excitement about what the future of his field would bring.

Kate Hayes
General Manager, Student Economic Review 2016.

The SER Debates

Since the first of the Student Economic Review debates was held in 1996, they have come to represent one of the most exciting events in the Trinity calendar. This year saw Trinity face Cambridge and Oxford with both occasions drawing large audiences and proving to be hugely enjoyable evenings. We would like to take this opportunity to extend our sincerest gratitude to a number of people and organisations. Firstly, to the College Historical Society who co-organised the Cambridge debate, particularly Auditor Julia McCarthy and Correspondence Secretary Annabel O'Rourke. Secondly, to the University Philosophical Society and their President Ludivine Rebet and Secretary Matthew Nuding who were a pleasure to work with and ensured that the debates exhibited the professionalism that characterises both the Phil and the SER. Special thanks also goes to Vinay Nair who organised the first SER debate and our sponsors Key Capital, Harry Hartford, Aoife Cunningham and Alan Gray without whom none of this would be possible.

Trinity vs. Cambridge

25 November 2015

The first of the two annual Student Economic Review (SER) debates took place in Trinity College on Wednesday 25 November 2015. The debate took place in a packed GMB chamber and was chaired by Dr Patrick Geoghegan, an expert on 18th and 19th century Anglo-Irish relations and host of Newstalk's *Talking History* programme.

Co-hosted with the College Historical society, the debate saw teams from Trinity and Cambridge tackle the motion *This House Believes that a Brexit Would be Good for the EU*. The Trinity Team; Sophie Donnelly, Cormac Henehan and Liam Hunt proposed the motion while the Cambridge team; Alasdair Donovan, James Riseley and Matt Hazell opposed.

Both teams offered different visions of a post-Brexit Europe, with the proposition describing a Europe free to pursue ever-closer union, and which would hold the upper hand in any trade negotiations with Britain following a Brexit. The opposition on the other hand spoke of a Europe that would come to be dominated by protectionism with the loss of a veto for the current free trade block. Their version of a post-Brexit Europe was a far less stable one, with Brexit leading to a contagion effect, providing a framework for other countries to leave and giving fuel to anti-Europe voices across the continent.

One of the central questions of the debate was the nature of Britain's role in the EU. On the one hand, the proposition described Britain as an agent for positive reform (pointing towards its role in reforming the CAP and EU fisheries policy) and a champion of free trade is it desperately needed in the EU. On the other side, Britain was described by the proposition as being more interested only in the economic advantages of member

ship to Britain and not in the European Project as a political and social union. They argued that because of this Britain is an obstacle to progress, specifically the further political and economic integration, which they contended is essential to the EU's future.

Above: Professor Frances Ruana, Former Director of the ESRI

While the judges left the chamber to deliberate the audience heard floor speeches from Jamie Donnelly, Oisin Vince Coulter, Olly Donnelly and Ronan Mac Giolla Rua before Dr Geoghegan offered his highly entertaining take on proceedings.

The judging panel, chaired by Professor Frances Ruane, former director of the ESRI deliberated for twenty minutes before returning to the chamber and awarding Trinity captain Liam Hunt the gold medal for best speaker and declaring the Cambridge team the winners by a narrow margin and presenting them with the Vinay Nair Cup.

Trinity vs. Harvard

11 February 2016

The second of the annual Student Economic Review (SER) debates took place in the GMB on Thursday 11 February. Co-hosted with the Philosophical Society the debate saw teams from Trinity and Harvard tackle the motion This House is Not Afraid of Cheap Oil.

The motion was proposed by the Trinity team of Oisin Vince Coulter (SS Classics and Philosophy), Jamie Donnelly (MSc. High Performance Computing) and Izzy Sweeney (JS Jewish and Islamic Civilisations) with the Harvard team of Pavan Hegde (Second Year Economics), Joy Jing (Third Year Architecture and Environmental Science) and Krysianna Papadakis (Third Year Philosophy, Political Science and Economics) opposing. The debate was chaired by Patrick Geoghegan; professor in modern history and host of Newstalk's Talking History programme.

The debate covered a wide range of areas, only appropriate given the influence that oil exerts in today's world. It centred on the political, economic and environmental consequences of cheap oil with both teams offering widely different takes on the outcomes of cheap oil in each of these domains.

The Trinity team argued falling oil prices will weaken authoritarian regimes propped up by oil revenues in counties like Russia and Saudi Arabia. Falling oil prices may reduce the capacity of these states (and the Islamic State) for military spending and subsequently diminish their ability to project their power and ideologies internationally. The proposition also argued that the West's decreased reliance on these states for energy will allow them to speak out more about human rights abuses in and by these countries.

Harvard argued that the objectives of these states will not change and they would simply find alternative sources of revenue and that lower oil-prices, and falling standards of living may actually lead to increased aggression as they attempt to shift the blame to the West.

The teams also disagreed on the consequences of cheaper oil for the economy. While both agreed that falling prices benefit consumers in oil importing countries, the Harvard team questioned whether the marginal benefit to these consumers is worth the cost to ordinary people in oil producing states (who are generally much poorer). Another point of contention was the effect of oil on the stock market. Harvard argued that low oil prices have caused a stock market crash and will cause persistent downward pressure on the S&P while Trinity contended that current low prices are merely a fluctuation caused by a re-adjustment.

The final area of discussion was the environmental consequences of cheaper oil. The proposition argued that low oil prices present an opportunity to renewable energy producers and gives time to develop more efficient alternatives to tackle climate change.

They also argued that lower oil prices would lead investors to back more profitable energy sources, leading to the development of renewables. Conversely the opposition contended that cheaper oil brought about by increased supply will lead to increased consumption and that low oil prices would damage renewable energy development as these energy sources will only be popular if oil is a worse option. If oil remains cheap, they claimed, consumers will not switch to alternate sources.

From left to right: Pavan Hegde, Krysianna Papadakis, Joy Jing, Mary Harney

While the judges Mary Harney, Aoife Cunningham, Rosalind Ní Shúilleabháin and Eoin O'Liatháin retired to deliberate, the audience heard floor speeches from Ruth Lennon (JF PPES), Matthew Collins (SF PPES), Rory O'Sullivan (JF English and Ancient Greek) and Mark Finn (JF BESS). Dr Geoghegan then offered his entertaining take on the evening's discussion.

The judging panel returned to the chamber after twenty minutes of deliberations and the panel chair Mary Harney declared Harvard the winners in a close contest. She then proceeded to present them with the Vinay Nair trophy. The gold medal for best speaker was awarded to Trinity's own Jamie Donnelly.

GILLIAN O'CONNELL
Editor, Student Economic Review 2016.

God's Economists: Economic Thought In The Sixteenth Century

Patrick McDonagh
Senior Freshman

Discussions of the history of modern economic thought usually begin in 1776, with Adam Smith's Wealth of Nations. However in this essay, Patrick McDonagh traces the origins of the Quantity Theory of Money, the Subjective Theory of Value and Purchasing Power Parity back to 16th Century Europe and in particular to the School of Salamanca in Spain. He describes how conditions at the time led to these discoveries and emphasises the importance of further research on this period.

Introduction

The sixteenth century was a momentous period in the history of early modern Europe, and indeed the world. It was an era characterised by the European exploration of the world, led by figures such as Vespucci and Vasco de Gama, and it saw the creation of a truly global economy. The discovery of gold and silver in the America witnessed the vast exploitation of these resources. As a result, huge quantities of these precious metals were sent back to Europe. This dramatic increase in the money supply led to unprecedented inflation that ruined the livelihoods of many. It exacerbated economic difficulties and fuelled religious turmoil. On the other hand, the period saw a flowering of economic thought.

The 16th century contribution to the development of economics is often forgotten, in particular the efforts of the School of Salamanca in Spain which made critical breakthroughs in the growth of ideas such as the quantity theory of money. That this area has been so overlooked is strange, considering that in this period we see the beginnings of a world economy and phenomena such as global capital flows in money. The literature on this topic is sparse. Only Grice-Hutchinson has written on this area, yet her most notable work on the topic is mostly comprised of translations of the work of these scholars. This essay will analyse the contribution this school made in several areas of economics, notably the quantity theory, and shall attempt to reassert the importance of the School of Salamanca to the development of the field of economics.

Quantity Theory of Money

The seemingly endless supply of silver coming from the Americas into Europe led to a rise of prices which was unprecedented for these times. In England alone 'the cost of living increased by a factor of seven … around 2 per cent per year' (Ferguson, 2008:27). In Spain - the main entry point for the precious metals being Seville - prices also rose substantially. Such circumstances made the intellectual climate fertile for explorations into why this was happening. Jean Bodin, in 1568, claimed he was the first to make the connection between the rise of prices and the inflow of precious metal, a perhaps primitive but evident account of the quantity theory of money. He was a prominent thinker known for his political theories. Bodin noted that the price of goods and lands had risen and attributed this to the abundance of gold and silver.

In spite of his claim about being the first to notice this connection, Bodin was in fact pre-dated by twelve years by a towering intellectual from Spain named Martín De Azpilcueta Navarro. Navarro was a great cleric scholar who made contributions to canon law, and to ideas about usury, and 'produced the clear statement that the high cost of living was a result of the import of treasure.' (Grice-Hutchinson, 1952:52). In his own words he states that the rise of prices was the result of the great quantity of money due to 'the discovery of the Indes, which flooded the country with gold and silver' (Navarro's Commentario resolutorio de usuras in Grice-Hutchinson, 1952:95) Navarro's analysis rested on a very good understanding of supply and demand which extended to money as well. He states:

> *'that all merchandise becomes dearer when it is in great demand and short supply, and that money, in so far as it may be sold, bartered, or exchanged by some other form of contract, is merchandise and therefore also becomes dearer when it is in great demand and short supply.' (Navarro's Commentario resolutorio de usuras in Grice-Hutchinson, 1952:94).*

Such a statement is not entirely alien to one made by Milton Friedman, remarking that the quantity theory of money is 'a theory of the demand for money' (Friedman, 1956: 4).Navarro parallels this remark when he states 'that money is worth more when and where it is scarce than where it is abundant' (Navarro's Commentario resolutorio de usuras in Grice-Hutchinson, 1952:94). He realised that the increase in prices was not due to other goods becoming more expensive, rather that the money used to purchase those goods had became less valuable due to the great abundance of precious metals. Furthermore, it is understandable why Navarro and the Spanish school discovered this relation first, as Spain was the entry point of the precious metals. As the wealth was transmitted across Europe, with the resultant inflation, the idea of the Quantity Theory was discovered

in other areas such as in France.

Both Bodin and Navarro, then, noted that the price of goods and lands had risen and attributed this to the abundance of gold and silver. One crucial difference though, with regards to Bodin's work The Responses to the Paradoxes of Maltestroit, was that it included 'factual discussions of monetary conditions … discuss [sic] with some authority how trade caused money to flow from one country to another' (Backhouse, 2002:62). This is a key reason for Jean Bodin's greater popularity and fame in Europe, both at the time and in the succeeding centuries. Bodin's analysis, though it may seem like crude monetarism today, was at the time a revolutionary development in the field of economics. Scholars in Western Europe at this point had shown little appreciation for the finer details of monetary thought, beyond perhaps ensuring that coinage was of high quality.

Bodin claimed that the rise of prices was due to 'the abundance of gold and silver' (Bodin, 1997:59) and strengthened this argument with recourse to historical example and the use of figures. Bodin and Navarro both independently discovered this relation. Bodin realised that the crisis was due to a combination of other factors as well, such as the 'measureless growth which has taken place in the population' (Bodin, 1997:65). Neither Bodin nor Navarro 'argued that American silver was the sole cause of the price rise' (Elliot, 1971:63). This crisis was due to a combination of factors of which an inflow of precious metals was but one - albeit an important one. Bodin's views, unlike Navarro's, would prove inspirational to later economists and lead to the general dissemination of the basic principles of the quantity theory of money.

Subjective Theory of Value

The School of Salamanca, as a rule, showed a tendency to support a subjective theory of value. This viewpoint is perhaps best elucidated by Luis Saravia de la Calle. Saravia, according to Grice-Hutchinson, notably 'denies, with considerable vehemence that cost-of - production can play any part at all in the determination of price' (Grice-Hutchinson, 1952:48). This viewpoint is one coloured by the author's position as a cleric. It was a standard trope of this period, rather like today, to view the business man as inherently greedy and evil. Persons like Saravia henceforth viewed with suspicion any analysis of value which would allow merchants to claim they were recouping costs as it was believed they would use this excuse to charge ever higher prices. Savaria's is an extreme position of this view, yet one that explicates contemporary development on the theory of value. In his own words, Saravia remarks that the value of a good is determined by:

> *'the particular circumstances and manner of the sale, the abundance of goods and money, the number of buyers and sellers, the difficulty of procuring the goods, and the benefit to be enjoyed by their use, according to the judgement of an honest man'*

(Saravia's Instrucción de Mercaderes in Grice-Hutchinson, 1952:79).

Savaria in his work expounds this analysis through deft use of examples to highlight what are, in essence, the principles of supply and demand. His view rests on the case that he, much like the rest of his school, viewed the average citizen, usually a poor one, as a consumer rather than a producer. This difference in the conception of people marks the bent towards a subjective theory, in order to protect the poor from grasping businessmen. Such a contemporary dislike was precedented as:

> *'monopolists did raise the price of the commodities they controlled. Landlords did raise rents and, in consequence, the cost of agricultural production and prices' (Koenigsberger and Mosse, 1973:23).*

The subjective theory seemed more morally just than a cost-of-production theory of value. Furthermore, it entails as a corollary the role of the market in dictating price. This was a radical view to hold in a period characterised by mercantilism and ever growing stringent price regulations. Their work on the theory of value, led the School of Salamanca to call for the market to dictate the price of the vast majority of goods except for what they saw as necessities such as bread and meat. The clerical training and background of these scholars such as Saravia led to a fascinating development within economic thought not paralleled anywhere else in Europe at this time. Saravia, and his fellow cleric-scholars, moved beyond the cost-of-production theory of value to create a truly original understanding on what decides the value of goods.

Purchasing Power Parity Theory of Exchange

One of the most truly original contributions of the School of Salamanca to economic thought is to develop the foundations of what is now known today as the purchasing power parity theory of exchange. This theory states simply that 'the exchange rate between two currencies over any period of time is determined by the change in the two countries relative price levels' (Dornbush 1985:3). The context for this development was the scale and size of the Hapsburg-Spanish Empire which straddled across Europe, comprising Spain, the Low Countries, the German Empire and other smaller territories. Due to this size, the emperor in this period, Charles V, and later King Philip II were always at war in different parts of Europe and needed to send funds to these diverse corners to maintain the military forces. The influx of precious metals meant that there were 'violent fluctuations' (Glamann 1981:509) in the value of national currencies. This chaos was combined with the need to fund the wars of the Hapsburg monarchy. The result of this maelstrom of political and economic crisis was to lead to a realisation that the same nominal figure

of money, could have different value and demand in different parts of Europe despite not changing in metallic content. As Grice-Hutchinson says:

> *'when money was sent from foreign countries to Spain a considerably larger sum was usually repaid in Spain than had been delivered abroad, but when money was sent in the opposite direction, from Spain to places abroad, only a slightly larger sum, and sometimes even a smaller one, was repaid abroad than had been delivered in Spain' (Grice-Hutchinson, 1952:54).*

This sparked a great swelling of work on this topic by cleric-scholars such as Navarro, De Soto, Mercado and De Molina. The works of these scholars on this topic often show the influence of the subjective theory of value which can be illustrated by Mercado who writes:

> *'the first is that modern exchange transactions are founded on the diversity in the estimation of money. It is understood that this estimation is to be universal throughout the whole of a kingdom, not peculiar to two or three or five needy persons in a town. Thus we see that in all Flanders and in all Rome money is more highly esteemed than in all Seville, and in Seville more than in the Indies, and in the Indies more that in New Spain, and in New Spain more than in Peru…from Seville on Medina, Lisbon, and any other place, the thing that causes a rise or fall in the market is the abundance or scarcity of silver. If it is abundant the rate is low, and, if scarce, high. Clearly, then, abundance or scarcity causes money to be little or greatly esteemed. Hence, if in Seville at the present moment money is esteemed more highly than it will be in a month's time, this is simply because in some way the market will have been altered and freshly supplied, and, since money will be more abundant, its estimation will fall. Estimation is and always will be the basis of such transactions' (Mercado's Tratos y Contratos de Mercaderes in Grice-Hutchinson, 1952:99-100).*

Mercado goes on to illustrate these points with the use of examples, but the message is clear; money itself is a commodity and its value will rise and fall depending on its external environment. This reflects the role of the exchange rate in adjusting both goods and money to their worth, based on supply and demand. Hence, goods across the world will have the same value but the value of the coinage used to pay for it depends on the scarcity or abundance of precious metals. This is a useful analysis considering the myriad of currencies present in Europe at this point of time, all with differing gold or silver content. The scholars of Salamanca were able to recognise it and consider why goods differed in price in different locations even if there was no discernible difference in the actual goods themselves.

The differing price was the result of local subjective values of coinage. This line of thought helps to highlight the interconnectivity of the differing areas of economics these cleric-scholars worked on, the views it created, and how they contributed to an analysis of different problems.

Conclusion

The sixteenth century witnessed a radical development in economic thought which has hitherto been given scant analysis and study. Such a situation is unfortunate as it limits our understanding of the growth of the field of economics. This period expounded the first principles of economic ideas such as the quantity theory of money. The School of Salamanca spearheaded this revolutionary progress. These cleric-scholars, trained in the latest developments of scholastic thought, were able to bring this mode of thinking away from its traditional theological focus to concentrate it on economic life. They were aided by the circumstances in which they lived, with the great inflow of precious metals from the Spanish colonies in the Americas and the presence of a large Spanish Empire across Europe which necessitated the use of exchanges to send off money to regional armies. These circumstances provided the external environment which sparked the curiosity of these great thinkers as they sought to explain the economic world around them. The period saw the birth of a rudimentary quantity theory of money, which helped to partly explain the Price Revolution of the sixteenth century, along with other contributory factors such as population growth, urbanisation and an inelastic food supply.

These scholars also contributed to a historically unparalleled theoretical understanding of what we now called the purchasing power parity theory of exchange. Scholars such as Navarro, Bodin, and Mercado were brilliant economic thinkers who made original advances that greatly enriched the field of economics. To further what was in their minds God's Work, these priestly economists brought about an economic revolution in thought, often forgotten today. In an age of political, religious and economic chaos they sought to understand the forces underpinning their society. The School of Salamanca, though barely known today, are a crucial focal point out of which economics grew. This topic is inadequately researched. Areas that would require further research are topics such as the transmissions of their ideas, and its relation with the reformation and counter-reformation, as well as more work on the subjects discussed within this essay. These sketches require substantial work in each particular area, but have been briefly discussed in this essay to illustrate the great advances these cleric-scholars made, advances which should no longer be overlooked today in the history of economic thought.

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INTERGENERATIONAL SOCIAL MOBILITY IN BRITAIN: THE CURSE OF COAL

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Senior Sophister

The existence of a North-South divide has long been a feature of the British economy. In this essay, Daniel Fallen Bailey traces the origins of this divide back to the industrial revolution. He argues that this divide is not the result of deindustrialisation of the once prosperous North but rather predates and was widened by Industrial Revolution. In particular he highlights the pernicious effects of people choosing not to pursue education.

Introduction

In 1986, Margaret Thatcher's government applied for assistance from the European Regional Development Fund, as the 'serious economic plight and poor future prospects of much of Britain's north' required urgent attention (Martin, 1988 p.390). A Census of Employment report in 1987 confirmed a 'catalogue of economic decay' (Martin, 1988 p.390), proving the existence of a significant employment gap between north and south. This sparked a political debate in the 1980's which centred on a Britain of 'Two Nations'; a depressed north and a prosperous south (Martin, 1988).

Worryingly in 2015, we not only see that this economic divide still exists, but that it has actually widened. Reports released over the last number of years have re-sparked this debate by showing that the scale of divergence has intensified over a number of indicators including; employment, population, educational outcomes and growth. For example, The Cities Outlook Report (2015) shows that from 2004 to 2013, for every 12 jobs in the South and South-East, only one was created elsewhere in the UK. In terms of population, they find that only 2 cities outside the South feature in the top 10 fastest growing cities, with the northern city of Sunderland the only city to see negative population growth over the period.

As for economic growth, Tyler *et al.* (2014) show that the divergence between the fastest and slowest growing cities from 1981-2011 clearly displays a broad geographical divide, with the 'laggards' mainly comprising of Northern cities. On top of this, research conducted by the lecturers union UCU (2009) on the number of degree holders per UK constituency, display "gross inequalities" in educational outcomes (Curtis, 2009a, 2009b).

Their results show that in poorer areas, the percentage of the working-age population with a 3rd level degree has fallen in the decade up to 2009, while in traditionally wealthier areas, it has pulled further away, and can be up to 50 per cent higher in some areas.

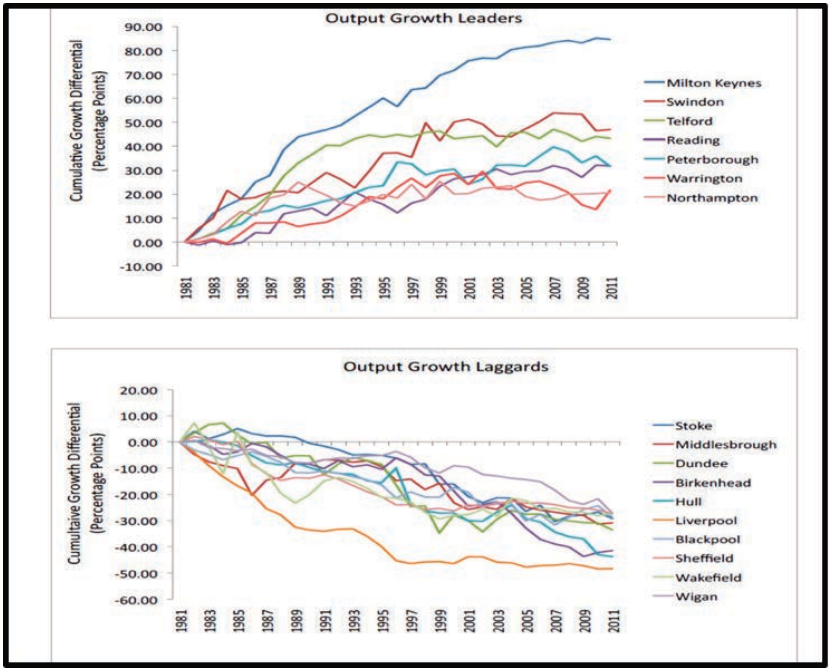

Figure 2: Cumulative Differential Output Growth Paths: Fastest and Slowest Growing Cities, 1981-2011 (Source: Tyler et al., 2014:20)

Rooted in History

This essay aims to delve into the roots of this divide. Motivation for research in this area stems from the fact that there is a striking correlation between the cities classed as the most under-performing in recent decades (based on the examples listed above), and the centrality of these same cities to the success of Britain's Industrial Revolution in the early 19th century. Many of the worst performing cities in the sources listed above make up Martin's (1988) categorisations of the Industrial and Manufacturing Heartlands of Britain. We know from the work of authors such as Allen (1979, 2009) and Fernihough and O'Rourke (2014), that the industries within these heartlands, (such as coal, metallurgy and textiles) were central to Britain's economic success during the period.

However, this striking correlation is easily misinterpreted as implying that these areas of Britain were once relatively well off, and that deindustrialisation of these heartlands lead to the relative economic decay we see now in these reports. This essay believes that this view is incomplete. Instead, it supports the ideas put forward by Massey (1979), Martin (1988) and Southall (1983), who all claim that; despite the importance of these industries to Britain's economic success, the economic divide described above has been a persistent aspect of British history, occurring long before the period of deindustrialisation in the 1970's and 80's which first sparked the debate. They support the notion that this dichotomy was evident as far back as the early 19th century, and that the onset of the Industrial Revolution only served to consolidate the divide.

A New Narrative

This essay, applying the intuition of Gregory Clark (2014), aims to present the argument that the Industrial Revolution both consolidated and amplified an economic divide between the north and south of Britain, and thus led to a persistent lack of intergenerational social mobility in the country, the effects of which can arguably still be seen today. Clark uses surname analysis to show that surnames within certain occupations reflect events from centuries before, in a way that wouldn't be possible if intergenerational social mobility was high. In this framework social mobility today is both lower and class differences more persistent than we would have originally believed.

Resting on this logic, this essay argues that a UK city, town or constituency's proximity to one of these industrial heartlands at the turn of the 19th century matters for its social mobility and economic outcomes today. Rooted in this argument are three underlying assumptions regarding a person living in one of these areas, and thus located next to one of these Northern industrial centres. They are as follows:

> **1.** In being located next to or near one of these industrial centres, you were likely to be employed, or dependent upon someone employed, in the industries of coal mining, metallurgy or textiles.
> **2.** If employed in one of these industries, you were likely to have been engaged in that employment from a young age (i.e. likely to have undergone child labour).
> **3.** You were likely to have been classed among the poorer cohorts of society, and have been paid a wage lower than the national average.

If these assumptions hold true, then once combined they have very important implications for the likely path taken by a given individual located in these areas. The most important of these implications is that they were more likely to have forgone the opportunity to in-

vest heavily in their education. This idea rest on the basic theory of opportunity cost. The adoption of technological change associated with the onset of the Industrial Revolution (Fernihough and O'Rourke, 2014) created a significant and positive shock to the demand for low-skilled employment in the industries of coal, metallurgy and textiles (Allen, 2009). Suddenly, the opportunity cost associated with staying in school widened dramatically. More relevant even, is the fact that given the relatively low wages earned in these industries, the surplus of demand for workers also widened the opportunity cost of keeping kids in school, as they too could be supplementing household income by working in these low-skilled sectors.

As a result of these implications, so long as industrial output was still relevant to the British indigenous economy and thus, a stable form of employment, decisions by workers to forgo investing in both their own and their children's education persisted. However, these seemingly rational decisions were inherently vulnerable to cyclicality. Von Tunzelman (1981, as cited in Martin, 1988) and Massey (1979) both cite the interwar years of the 20th century as a turning point for these industries. The onset of the Great Depression of the 1920s and 30s began a period of deindustrialisation in Britain, where industries such as coal mining, shipbuilding and heavy engineering went into decline. The most intense period of decline occurred in coal mining in the 1980s. Between 1981 and 2004, English and Welsh coalfields shed 222,000 jobs, or 90 per cent of all British coal industry employment (Beatty *et al.*, 2005).

Assuming the persistent forgoing of education by workers in these sectors in the decades up to deindustrialisation, this paper argues that there was no intergenerational legacy of skills in any other areas to fall back on after deindustrialisation occurred. Therefore, the divergences in economic outcomes between the north and south of Britain become more pronounced only after the interwar years, and intensify even more after the 1980's. This is reflected in the data cited at the outset of this paper. The narrative outlined here makes the argument that the origin of this divide lies firmly in the period of Industrial Revolution in Britain.

Coal, Metallurgy and Textiles-How Important?

The assumption that an individual living next to an industrial heartland was likely to have been employed in one of these three industries rests on the belief that these sectors were substantial in size, growing consistently, and important to the success of the Industrial Revolution in Britain.

Evidence for this can be found in the literature. For example, it is widely accepted that technological change was the main driver of the Industrial Revolution (Mokyr, 2009). However, Crafts (1985) argues that this technological change was a narrow phenomenon, very much localised to certain industries. Crafts believes that the upsurges in productivity

associated with the Industrial Revolution in its early stages should not be understood as widespread, but rather, centralised in textiles and metallurgy (Ibid). Productivity in all other manufacturing industries remained stagnant in pre-modern backwardness for the first half of the 19th century (Crafts, 1985). This idea is reflected in the data we see for these industries. McCloskey (1981) finds that the cotton industry contributed 18 per cent per annum to national productivity growth between 1780 and 1860. Cotton also grew from 6 per cent of all British exports to 34 per cent between 1785 and 1855 (Findlay and O'Rourke, 2007). As for metallurgy, Allen (1979) outlines how Britain was a major supplier of iron and steel to world markets around this time. He claims that midway through the 19th century, the British iron industry was the most efficient in the world.

A crucial factor underpinning the success of these industries however, was coal. Allen (2009) emphasises that the success of these industries was dependent upon the mass exploitation of cheap coal. Because of Britain's relatively high wage economy, he argues, it became cost effective to adopt new technologies which up to then had not been widely used. These new technologies involved capital intensive machinery, which were powered by coal (e.g. the steam engine). As Coal was cheap and labour relatively expensive these machines were increasingly substituted for labour (Allen, 2009).

On top of this, given the British Empire's continued expansion overseas, new export markets were consistently being created. This justified the further expansion in the output of exported goods, namely; cotton and iron (Allen 2009, 1979). Since these industries were fuel intensive, this expansion in output spurred demand for coal, since coal powered the new machinery they were increasingly employing. Overall therefore, we can begin to understand why the industries of coal, metal and textiles were central to the story of Britain's Industrial Revolution. Britain's expanding international dominance, coupled with the adoption of productive new technologies facilitated the growth of the cotton and iron industries, which, in turn facilitated the growth of the coal mining industry.

Locational Factors

The first assumption of this model is underpinned by the belief that coal, metal and textile industries were all clustered around one another. Upon examining the literature, we can see there is sufficient evidence to suggest that this was the case.

Firstly, coal was bulky and heavy, and thus costly to transport. Therefore, in an era before the transport revolution of the late 19th century, the logistics of coal transportation prevented any heavy industry which was reliant upon coal from locating in places where coal wasn't readily available (Matthias, 1983, as cited in Fernihough and O'Rourke, 2014). Secondly, where coal was used up in the production process there were substantial cost savings to being located close to where coal was mined (Wrigley, 1961).

To conclude, Fernihough and O'Rourke (2014) find that the availability of coal mattered for population growth, and thus, economic activity in general across Europe from 1800 onwards. Given what we know about the importance of textiles and metallurgy to economic activity over this period in Britain, a convincing picture therefore begins to emerge that to be close to coal is to be close to all three of these industries. As Pollard (1981) puts it: 'the map of the British Industrial Revolution, it is well known, is simply the map of the coalfields' (Pollard 1981, as cited in Fernihough and O'Rourke, 2014). This naturally increases the likelihood of employment in one of these sectors, which is a central assumption to this research.

Child Labour and the Industrial Revolution

Child Labour encompasses the darker aspects of Britain's Industrial Revolution. This is captured by Charles Dickens' description of the factories which employed children as "dark satanic mills." Child labour is a harsh reality associated with the time, and for the purposes of our second assumption, there is plenty of literature suggesting that it was focused in the industries we have mentioned throughout.

Tuttle (2001) uses British Parliamentary Papers to outline the extent of the phenomenon throughout the Industrial Revolution. Importantly, she claims that child labour was not a national market. Instead, it was a regional problem, where high instances of child labour were found most frequently in manufacturing districts. For example, both Nardinelli (1980) and Tuttle (2001) argue that child labour formed a significant portion of the labour force in textile mills. In 1833, children under the age of 13 comprised 10 to 20 per cent of the textile workforce, and this number rises as high as 57 per cent when children between the ages of 13 and 18 are included (Tuttle, 2001). The figures are just as stark for coal mining. In 1842, children formed between 19 per cent and 40 per cent of the overall labour force in British coal mines (ibid).

An important characteristic of employment in factories and coal mining is that it was very often hereditary. Humphries (2013) shows that for boys born between 1821 and 1850 whose father was engaged in either mining or factory work, the mean age for them to start work was 8 years old, the lowest of any job in their study (excluding casual labour). Humphries (2013) also shows that for this same cohort, almost 40 per cent of children working in mining or factory jobs were following in the footsteps of their fathers. Both Humphries (2013) and Tuttle (2001) claim poverty to be a significant factor driving child labour, with parents sending kids to work in search of much needed income.

Opportunity Cost

The literature up to now has outlined some very important aspects of the British Industrial Revolution. Firstly, the industries of coal, textiles and metallurgy were central to its suc

cess, and were all likely to cluster around one another. Secondly, child labour tended to be focused in these sectors, and this tended to be driven by poverty as well as hereditary factors. As outlined previously, if these facts hold true, then they have one very important implication for an individual living in a region close to a coal field/industrial centre, which is that they were likely to forgo the opportunity to invest heavily in education. It is therefore important to understand the mechanisms at work here, which made people who faced these realities forgo the opportunity to educate themselves and their children.

The theory of opportunity cost is essential here. The onset of the Industrial Revolution would have constituted a positive shock to the demand for unskilled labour. Atkin (2015) and Black *et al.* (2005) provide examples of positive shocks to labour market opportunities for the unskilled, and how it serves to widen the opportunity cost of education. Black et al (2005) notes how the Appalachian coal boom of the 1970's raised the earnings of high school dropouts relative to graduates. The authors estimate that a 10 per cent rise in the wages of dropouts resulted in a 5 to 7 per cent reduction in high school enrolments. Atkin (2015) outlines how a period of major trade reforms in Mexico altered educational outcomes via the local expansion in export manufacturing employment for high school dropouts. For every 25 jobs created it was found that one pupil dropped out at grade nine, 3 years before graduation (Atkin, 2015).

It is fair to suggest then, that the consistently positive growth in the industries of coal, metal and textiles during the Industrial Revolution (2 to 3 per cent per annum in coal and iron; 7 per cent per annum in cotton; Findlay and O'Rourke, 2009), as well as the continued expansion of international dominance by the British Empire (Massey, 1979) would only ever have impacted negatively on workers' perceptions of the opportunity cost of education.

Thus, the decision not to invest in education persisted so long as the decision to work rather than study appeared a rational one. So long as the momentum of the Industrial Revolution kept on growing, so too did the numbers choosing to follow in the footsteps of previous generations in these northern industrial areas by starting work young. A pattern begins to emerge, made up of low wages, consistently low educational outcomes, and inherent vulnerability to the trade cycle. This pattern unravels once the period of deindustrialisation sets in, and it becomes clear that certain groups in British society have been victims of region. Such is the argument of this essay, which the literature outlined above has shaped.

Conclusion

This essay has put forward the idea that the increasing economic divide between northern and southern Britain has its roots within the British Industrial Revolution. It hypothesises

that the surge in industrial output during that period set in motion a perpetual cycle of underinvestment in the education of those whom it employed. This created a generation born into a region that was utterly one-dimensional in skills set. As a result, the economic prospects of this cohort were inherently vulnerable to trade cycles. Post deindustrialisation therefore, this dichotomy unravelled.

The 'Metropolitan South', with its experience in commerce, banking, finance and government constituted as fertile soil for the modern economy, infinitely more dynamic and better suited to the way in which complex economic, social and governmental issues overlap today (Martin, 1988). Conversely, the 'Industrial North' was to experience persistent economic decay. If this is indeed the case it provides major justification for policies aimed at equal access to education, which seek to eradicate the possibility of being a victim of region in Britain. However, until these issues are addressed it remains the true in Britain today, as it was during the Industrial Revolution, that:

> *'The burden fell most heavily, both then and subsequently, on those regions which created her prosperity' (Southall, 1983:400).*

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IS BEER CONSUMPTION IN IRELAND ACYCLICAL?

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Senior Sophister

In this econometric investigation, Gearóid Gibbs examines beer consumption in Ireland and its relation to the business cycle. Citing psychological studies on increased alcohol consumption during recessions, he hypothesises that this relationship may be an acyclical one, while also emphasising evidence for procyclical consumption from economic literature. While the results of the time-series regression analysis were inconclusive, the scope for further research in this area is emphasised.

Introduction

Ireland's reputation as a nation of prolific drinkers is well established. Of all alcoholic drinks, beer continuously tops the list and accounted for 48 per cent of total alcohol consumption in Ireland in 2010, equating to approximately 98 litres of beer or over 200 pints per person (WHO, 2010). In light of these statistics, this paper seeks to examine the nature of the consumption of beer in Ireland.

Traditionally, investors have viewed alcoholic beverages, particularly beer, as products which are relatively unaffected by trends in the business cycle. Indeed, some identify drink manufacturers' stocks as being 'defensive' against downturns. Empirical research shows the returns on the common stocks of big beer firms are about 50 per cent less volatile than the market average (Freeman, 2001).

This phenomenon raises questions regarding the economic nature of beer. Is beer a normal good, with demand increasing as income increases? Or is beer an inferior good, resulting in decreased demand as income increases? Psychology also has relevant inputs with some theories indicating that alcohol may help to alleviate economic anxieties. This suggests an acyclical relationship between alcohol consumption and the business cycle. Given beer is a relatively cheap beverage, as compared to wine or spirits, individuals may substitute more expensive drinks for beer. In this case, there is a two-fold force behind increasing beer consumption in a recession. This paper aims to investigate the cyclicality of beer consumption in Ireland, with the specific hypothesis that beer consumption is acyclical.

The paper is outlined as follows: section two reviews the background and the existing literature, sections three and four specify the empirical approach and data used

in the study, section five presents the empirical results, and section six discusses possible extensions to the research.

Background and Literature Review

The hypothesis of acyclical beer consumption is developed from several psychological studies that have shown individuals to increase their alcohol consumption during economic downturns. Brenner and Mooney (1983) contend that individuals suffering from the 'stresses of unemployment' may attempt to 'alleviate psychological distress by medication with alcohol'. The authors found that as unemployment rates rise, self-destructive activities such as alcohol abuse and drunk driving increase in prevalence.

The economic literature is more varied. The general view is that alcohol is a pro-cyclical normal good, with consumption rising in income. Tremblay and Tremblay (2005) conducted an analysis of the US Brewing Industry. In a summation of eight previous studies on beer demand, they show six results of beer being a normal good, and two findings of an inferior good. Freeman (2001) analysed beer and the business cycle in the US over the period January 1955 to December 1994. Using monthly data, his estimation results in a co-integrating relationship between beer, beer taxes and cyclical economic factors suggesting that beer is somewhat immune to economic cycles. 'Beer consumption increases with income and industrial production, but increases in unemployment also'. Consistent with this finding of beer consumption being acyclical, Blake and Nied (1997) conclude that the consumption of beer in the UK, in contrast with three other types of alcohol beverage, increases with the unemployment rate. However, they also find the long run income elasticity of beer to be 0.8 suggesting that beer consumption is still somewhat affected by cyclical economic factors.

Bor *et al.* (2013) found that during the 'Great Recession' abstinence rates from alcohol increased in the US. However, this decrease was countered by an increase in total alcohol consumption rates, as more people became 'frequent binge drinkers'. 'The rise in frequent binging was observed for both employed and unemployed respondents, suggesting that factors other than job loss were driving these changes'. The authors contend that this diverging result can be explained by the countervailing 'income-effect' hypothesis and 'provocation' hypothesis. On the one hand, lower income reduces consumption, especially amongst low-income groups; however, recession-linked insecurities may lead to greater alcohol intake as a stress alleviation mechanism.

The authors' conjecture that the downturn associated with the Great Recession was much more severe than the previous business-cycle fluctuations that have been analysed in the literature. This result of countercyclical binge drinking is confirmed by Dee (2001), who found that a five percentage point increase in the unemployment rate results in an 8 per cent increase in the probability of heavy drinking.

Empirical Approach

A time-series regression model of annual beer consumption on cyclical economic and demographic variables is estimated. The model is specified as:

$$Yi = ß0+ß1X1+ ß2X2+ ß3X3+ ß4X4+ ß5X5+ ß6X6 \quad (1)$$

where:
Yi: BEER - the annual recorded consumption of pure alcohol (corresponding to beer at 5%) in litres, per person, aged 15 years old and over.
X1: UNEMPLOYMENT - the seasonally adjusted annual average standardised unemployment rate.
X2: LOGGDPPC - the log of Gross Domestic Product per capita.
X3: EMPLOYPOP - the ratio of those in employment to the population.
X4: PROPYOUTH - the proportion of the population aged between 25-34.
X5: EXCISE - the amount of excise tax on a pint of beer in euro.
X6: VAT - the amount of VAT on a pint of beer in euro.

Data and Expectations

The data is aggregated from several sources and covers the period from 1983 to 2013. Summary statistics are presented in Table 1. The dependent variable is the annual recorded consumption of pure alcohol (corresponding to beer at 5 per cent) in litres, per person, aged 15 years old and over. This is obtained from the World Health Organisation. Figure 1 shows the development of beer consumption in Ireland over the past three decades.

On the right hand side of the regression equation several cyclical variables are included. These are the unemployment rate, the seasonally adjusted annual average standardised unemployment rates taken from the Central Statistics Office; employed/population ratio for the population aged 15 years and older; and, Gross Domestic Product per capita, obtained from the World Bank statistics database. Different variables are included to capture varying trends in the business cycle. If the hypothesis of acyclical consumption is correct, we would expect a positive relationship between beer consumption and unemployment. Increasing unemployment should increase the consumption of beer. In a recession the employed/population ratio is likely to fall, we would then expect a negative relationship between this variable and the consumption of beer. GDP per capita is a measure of individual income. We would expect beer consumption to increase as GDP decreases, but if beer is a normal good; its consumption would increase as income increases. The expected effect is ambiguous and depends on the relevant magnitude of each effect.

Given the distribution of per capita GDP is badly skewed, a non-linear relationship is created between GDP per capita and beer consumption. To control the skew GDP per capita is transformed by taking its logarithm, this action can also help to prevent het-

eroskedasticity problems.

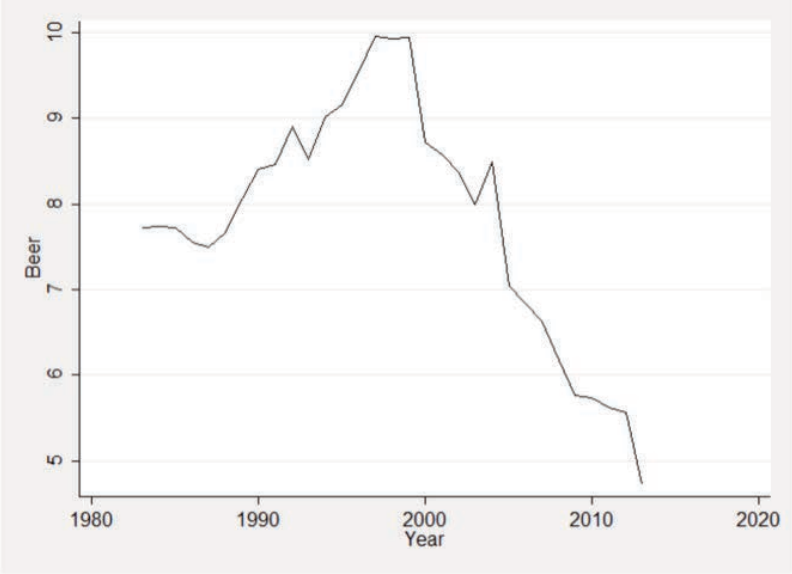

Figure 1: Beer Consumption (litres of alcohol) from 1983 to 2013

Kerr *et al.* (2004) document that different age groups have varying consumption patterns regarding types and quantities of alcoholic drinks consumed. Tremblay and Tremblay (2005) show for the US that individuals in the 25-34 year cohort have the highest consumption of beer (approximately 50 per cent in 2001). Following Freeman (2011), we control for changes in the size of this group. As this is the highest consuming age group, we would expect trends in consumption to be related to the size of this group.

Two tax variables are included. Tax on beer includes excise and VAT. Data comes from the Revenue Commissioners who provide statistics on the tax liability levied on a pint of beer. Given that beer may be addictive, government may attempt to reduce consumption by increasing the price. Price increases are generally borne by increasing the relevant excise rate. Tax may therefore have been used as a policy measure to attempt to reduce alcohol consumption and its related health and social harms. We would expect a negative relationship between tax and beer consumption.

There are several issues and assumptions about the data on beer that must be recognised. Firstly, statistics are only as accurate as data recorded. When considering alcohol consumption, it should be recognised that some consumption may not be recorded.

Alcohol that is homemade, smuggled, or intended for purposes other than consumption may go unrecorded. The World Health Organisation estimated Irish unrecorded alcohol consumption to be approximately 0.5 litres per head (for the population aged 15+ years) in 2010.

Variable	Obs	Mean	Std. Dev.	Min	Max
Beer Consumption	31	7.809	1.394	4.73	9.96
Unemployment	31	10.974	4.803	3.9	17
Log GDP per capita	31	10.195	0.389	9.557	10.659
Employment to Population	31	50.83	5.857	43.8	61
Excise	31	0.445	0.033	0.37	0.47
VAT	31	0.501	0.148	0.34	0.75
25-34 population proportion	31	0.151	0.012	0.772	1.19

Table 1: Summary Statistics for Variables

There are several issues and assumptions about the data on beer that must be recognised. Firstly, statistics are only as accurate as data recorded. When considering alcohol consumption, it should be recognised that some consumption may not be recorded. Alcohol that is homemade, smuggled, or intended for purposes other than consumption may go unrecorded. The World Health Organisation estimated Irish unrecorded alcohol consumption to be approximately 0.5 litres per head (for the population aged 15+ years) in 2010.

Secondly, given that the volume of beer consumed is based on the Revenue Commissioners clearances data, we assume that all beer available for consumption in a particular year is consumed in that year. This does not account for beer that may be imported and subsequently re-exported, beer that has been stored, or beer used in the preparation of food or discarded.

Empirical Results

The first regression model is estimated. Table 2 outlines the preliminary results from the time-series OLS regression. The R-squared of 0.9236 suggests the model explains 92.36 per cent of the variation in beer consumption. This seems rather high for a very simple model.

Unemployment, employment to population ratio, and the 25 to 35 population proportion are insignificant. Log of GDP per capita, excise, and vat are all statistically significant at 5 per cent. Before drawing inference from these results it is necessary to check the model for potential problems. Starting with heteroskedasticity, the square of the resid-

uals is plotted against the fitted values in Figure 2.

Beer	Coefficient	Std. Err.	t	p-value
Unemployment	-0.348	0.168	-0.21	0.838
Log GDP per capita	4.582	1.027	4.46	0.000
Employment to Population	-0.087	0.183	-0.48	0.637
Excise	13.527	4.576	2.96	0.007
VAT	-10.762	3.142	-3.43	0.002
25-34 population proportion	-49.743	38.989	-1.28	0.214
Constant	-27.187	13.995	-1.94	0.064

Table 2: OLS Regression Output

Unemployment, employment to population ratio, and the 25 to 35 population proportion are insignificant. Log of GDP per capita, excise, and vat are all statistically significant at 5 per cent. Before drawing inference from these results it is necessary to check the model for potential problems. Starting with heteroskedasticity, the square of the residuals is plotted against the fitted values in Figure 2.

The plot of the residuals shows a relatively even distribution across the fitted values. A more formal test for heteroskedasticity is also performed. The Breusch-Pagan/Cook Weisberg test is designed to detect linear forms of heteroskedasticity. A small chi-square value confirms that heteroskedasticity will not be an issue in this model.

Given this is time series data, it is likely that serial correlation is an issue. Serial correlation occurs when the errors associated with a given time period carry over into future time periods. The Gauss-Markov theorem requires simultaneous homoskedasticity and serially uncorrelated errors (Wooldridge, 2009). OLS will no longer be the best linear unbiased and efficient estimator in the presence of serial correlation. While serial correlation does not affect the unbiasedness or consistency of the OLS estimators, it does influence the efficiency. Positive serial correlation will cause the OLS estimates of the standard errors to be smaller than the true standard errors. In this case the standard errors and test statistics are not valid, even asymptotically (Wooldridge, 2009).

Given the size of the sample, the presence of serial correlation cannot be ignored. To identify serial correlation, a Durbin-Watson d-statistic is calculated. A value of 1.521 is returned. Calculating the upper and lower bounds, 0.998 and 1.931 are obtained respectively. As the DW statistic lies between the upper and lower bounds, the test is inconclusive. A DW value close to 2 suggests that autocorrelation may not be a problem.

Given a value of 1.5 and an inconclusive test, the data will be treated as if serial correlation is present, although formally the null hypothesis cannot be rejected.

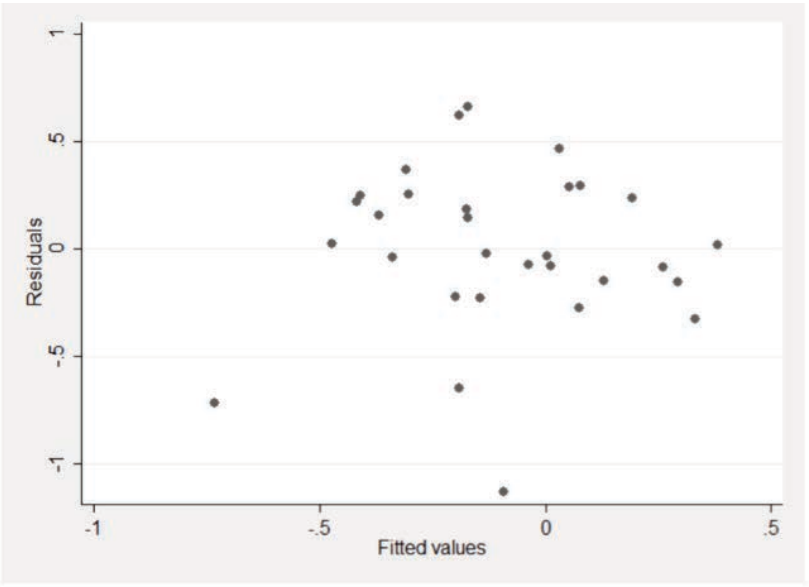

Figure 2: Residual and Fixed Value Plot

A common assumption underlying time series analysis is that the data is stationary. Many economic time series, however, are not stationary and may be highly persistent. There is reason to believe that the variables exhibit a unit root in their time series representations. A Dickey-Fuller test for unit root is conducted on the dependent and independent variables. The null hypothesis is that the variable follows a unit-root process and is therefore non-stationary. The Dickey-Fuller tests reveal that both the dependent and independent variables all exhibit unit root processes and are non-stationary.

To correct for the unit root processes, the variables are first-differenced. First differencing involves transforming the variables into a series of changes from one period to the next. First differencing can also be used to correct for the serial correlation identified earlier. The differenced data will contain one less data point than the original sample.

The regression is estimated again using the first-differenced variables as in Equation 2. Even though several variables were found to be insignificant in the first regression, they are important control variables and are retained in the revised model. Table 3 outlines the results from the regression using the first-differenced variables and robust standard

errors. A Durbin-Watson d-statistic of 2.28 is calculated. Given this is close to 2 we can conclude that the serial correlation issue has been addressed.

$$Y_i = \beta_0 + \beta_1 \Delta X_1 + \beta_2 \Delta X_2 + \beta_3 \Delta X_3 + \beta_4 \Delta X_4 + \beta_5 \Delta X_5 + \beta_6 \Delta X_6 \qquad (2)$$

From Table 3, the differences in unemployment, VAT, excise, and 25-35 population proportion are now all insignificant. The difference in the employment to population ratio is significant at the 10 per cent significance level, while the difference in log GDP per capita is significant at 5 per cent. The R-squared shows that the model is now explaining about 31.9 per cent of the difference in beer consumption, down from 92.36 per cent in the previous regression.

A negative coefficient on the employment to population ratio variable supports our hypothesis. A 1 per cent increase in the employment to population ratio will lead to an estimated decrease in litres of alcohol consumed, corresponding to beer, by about 0.43 per cent. That implies that a falling employment to population ratio, as would be expected in a recession, would lead to an increase in the consumption of beer.

A positive coefficient on the GDP variable is as expected and suggests a pro-cyclical relationship between beer and the business cycle validating the income effect. An increase of 1 in the log of GDP/capita will increase litres of alcohol in beer consumed by 8.178. Given this variable was transformed by a logarithm, we can interpret this as a percentage increase. A 1 per cent increase in GDP/capita is estimated to increase litres of alcohol consumer, corresponding to beer, by about 0.081 per cent.

Beer	Coefficient	Robust Std. Err.	t	p-value
Unemployment	-0.237	0.211	-1.13	0.272
Log GDP per capita	8.178	3.846	2.13	0.044
Employment to Population	-0.423	0.235	-1.8	0.085
Excise	0.745	3.056	0.24	0.810
VAT	2.469	4.031	0.61	0.546
25-34 population proportion	27.949	40.740	0.69	0.5
Constant	-0.362	0.178	-2.03	0.054

Table 3: OLS Regression with First Differenced Variables

Extensions

The main limitation in this study is the size of the sample. The 31 annual data points, representing 1983-2013, may not be sufficient to identify changes in demand for beer to changes in economic performance variables. Increasing the frequency of the data to allow within-year variations in alcohol consumption to be identified would be an immediate improvement. However, there are limitations to the data available and aggregated data is often the only option.

Regarding the demographic factors affecting beer consumption, the distribution of ages in the population may affect beer consumption in more nuanced ways than the single age group variable included in this study can identify. Even though we found the proportion of individuals aged 25-34 to be an insignificant variable, there may be merit in examining changes in the entire age distribution of the population. Freeman (2011) takes this approach and uses a polynomial distributed lag (PDL) model as an alternative to the single age cohort variable.

Furthermore, it would be interesting to investigate how changing economic conditions impacts the alcohol consumption of different subgroups of the population. Details on income and education could provide insights here. If lower income groups are more likely to face job losses, they may increase consumption. However, high income earners may be more exposed to other factors affected by detrimental economic performance, consider investments in property or equities. The role of gender could be examined. Bor *et al.* (2013) found single men are most likely to increase drink intake during a recession.

Finally, some literature claims that the consumption of beer rises in a recession, as consumers switch away from more expensive drinks. Further research to identify trends across alcoholic beverages could be undertaken.

Conclusion

This paper attempted to identify the cyclicality of Irish beer consumption, in particular, the hypothesis that the consumption of beer is acyclical was tested. This research was motivated by psychological work which has shown that individuals may self-medicate with alcohol and rely on it as a 'cold comfort' to alleviate the stresses of an economic downturn and associated insecurities regarding income and employment. While research has been conducted on this topic, no studies have examined the Irish experience, especially relevant giving varied business cycles across the 1980s, 1990s, and 2000s, and one of the highest beer consumption per capita statistics in the world-98.3 litres in 2012.

The findings in this paper do not lend themselves to any firm conclusions. While a negative relationship was established between beer consumption and the employment to population ratio, a positive relationship was also recorded with GDP per capita. Overall,

and following the results of the majority of the literature, it is likely that beer is a normal pro-cyclical good and that the income effect dominates any provocation effect which may increase consumption in certain circumstances.

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Saving Private Data: The Economics Of Online Privacy

Greg Mangan
Senior Sophister

Economic activity is increasingly taking place in an online setting and the security and privacy of people's personal information is increasingly called into question by whistleblowers and media outlets. In this econometric investigation, Greg Mangan uses a logistic regression model to investigate what influences people's concern about privacy. While his results do not support hypotheses about demographic differences he finds that being the victim of a cybercrime has a significant effect on fear. These results suggest that stereotypes about different demographics' attitudes to the internet may be an oversimplification, and that in reality differences in attitude are the result of different experiences.

Introduction

As internet users, should we be worried about our privacy online? Furthermore, are we worried about our online privacy? There are many causes for fear in offering our personal information online. However, from the point of view of businesses, and those concerned with the function of economic markets, it is the fear itself that should be feared.

While much of the fear is justified due to credible threats such as scams and identity theft, there is a significant portion of worry that is unfounded, which impedes the full efficiency of online markets. Understanding the motivation for this fear and the demographic breakdown could be a huge advantage to businesses in terms of how they market their products and how they invest in security measures.

This paper aims to answer the question: *who* is worried about online privacy? Beginning with a literary review of writings on the economics of privacy, a logit model is then introduced to answer this question based on a comprehensive dataset that ties attitudes and experiences of online privacy with demographic information. Through the course of the paper, 'anonymity' will refer specifically to online anonymity unless stated and will be used interchangeably with 'online privacy'.

Literary Review

A very important distinction to make in relation to online privacy is between attitudes

and behaviours. Acquisiti (2004) take a psychological approach to explaining inconsistencies in consumer behaviour, claiming that consumers cannot be expected to act rationally in the decision making process for e-commerce due to self-control problems and the preference for instant gratification. Some users may fail to behave in a way that protects their privacy, even if this conflicts with their attitude towards privacy.

Nehf (2007) furthers the debate over dichotomy between consumer actions and consumer attitudes. A case of self-imposed information asymmetry is proposed in that most web users simply fail to read online privacy policies for websites. These are often lengthy blocks of convoluted prose that effectively mask the important implications for user privacy. Also, individuals may assume that a website suitably protects their personal information from the belief that the brand name is trustworthy, due to their practices and reputations in other (not necessarily online) markets. While companies may use this signalling to their advantage, there is often no basis for this assumption on the individual's part. As such, they are in a position where they have an incentive to accumulate personal information (which can generally be used to analyse preferences and inform profit-maximising policies) with little backlash from their users, who are therefore presented with a genuine cause for concern over their information availability online.

Miyazaki and Fernandez (2001) analysed studies in the area of risk perceptions and how they affected individual's involvement in online markets from the perspective of 'internet literacy'. They found evidence in support of their hypothesis that 'internet experience is positively related to the rate of purchasing products online'.

While freedom and choice are properties that are highly valued by economists, it is argued in 'Privacy and Freedom: An Economic (Re-)Evaluation of Privacy' (van Aaken, Ostermaier and Picot, 2014) that privacy (which hasn't always been given the same weight of importance) is a type of freedom and should therefore be considered a fundamental economic concept. The authors construct an argument built around economic liberalism and the idea that 'freedom has intrinsic value'. Revocability is identified as a key requirement in terms of individuals giving up their privacy- one should be able to reclaim it. Many websites that store large amounts of personal information such as Facebook and Google fail to offer or weakly uphold this concept of revocability; the paper commends the EU's attempts to introduce a 'right to be forgotten'.

Setting aside the question of whether individuals have cause for concern, the mere fact that they have concern is detrimental to the functioning of eCommerce markets. A Federal Trade Commission report given to the US congress (FTC, 2000) noted that studies show 'privacy concerns may have resulted in as much as $2.8 billion in lost online retail sales in 1999, while another suggests potential losses of up to $18 billion by 2002'. Unjustified worry may be considered a market imperfection, a failure to 'sustain desirable activity' (Bator, 1958). 'Desirable activity' in this context is the highly eff-

icient online market for goods. Understanding worry over privacy issues, whether justified or unjustified, is therefore essential for all firms engaged in this economic activity.

Empirical Approach

Data

To conduct an empirical investigation into the determinants of concerns over online personal information, a cross-sectional data set from the Pew Research Institute was selected. The data was collected from a survey on anonymity, privacy and security online (Pew Research Institute, 2013). The majority of the questions were only asked of respondents who initially answered yes to either being an internet user or a smartphone user, and so the empirical analysis has been restricted to this subset of individuals. Most of the variables are binary dummy variables, derived from questions with 'yes' or 'no' answers.

The important variable that we seek to explain is that of whether an individual is worried about their information being online or not. Standard personal information such as age and sex is included for each respondent. Respondents are also asked if they are a parent of a child 18 or younger. Other explanatory variables can be gathered from the survey such as views on the possibility of anonymity, views on the right to anonymity and attempts at anonymity. The final data we will draw from the survey comes from a set of questions about negative online experiences, for which we will consider a new binary dummy variable that represents whether or not an individual has been a victim of one or more of the listed abuses.

Model

The variables to be used in the model are:

Yi = WORRIED-A binary dummy variable that takes the value of 1 if the respondent answers yes to *'Do you ever worry about how much information is available about you on the internet…?'*

X1 = PARENT-A binary dummy variable that takes the value of 1 if the respondent is a parent or guardian to a child under 18

X2 = AGE-The age of the respondent in years

X3 = SEX-A binary dummy variable that takes the value of 1 if the respondent is male and 0 if female

X4 = ANON_RIGHT-A binary dummy variable that takes the value of 1 if the respondent answers yes to *'Do you think that people should have the ability to use the internet completely anonymously for certain kinds of online activities?'*

X5 = ANON_POS-A binary dummy variable that takes the value of 1 if the respondent answers yes to *'…do you think it is possible for someone to use the internet completely anonymously…?'*

X6 = ANON_TRIED-A binary dummy variable that takes the value of 1 if the respondent answers yes to *'Have you ever tried to use the internet in a way that hides or masks your identity…?'*

X7 = VICTIM-A binary dummy variable that takes the value of 1 if the respondent answers yes to at least one of eight questions about being the victim of a mishap due to online activity (stolen data, account compromisation, scam, harassment, loss of job/education opportunity, relationship trouble, reputation damage and physical danger)

To estimate the effects of the variables on individuals' worries we define the following logistic model:

$$P(Y_i = 1) = exp(Z_i)/[1 + exp(Z_i)] \qquad for\ Zi = \sum_{k=0}^{j} \beta_k X_{k,i} \ (X_{0,i}=1 \forall i)$$

The model was run firstly for j=6 and secondly for j=7.

Choice of Statistical Model

The most important point to note from the variable specification above is that the dependent variable is binary. Therefore, the aim is to build a model that predicts P(Yi=1), the probability of a yes for WORRIED. The linear probability model is one method for achieving this, which follows a standard OLS regression approach. However this gives rise to two notable issues: the predicted values may fall outside of the range of the closed set [0,1] (meaning an undefined probabilistic interpretation) and the marginal effect of changes in explanatory variables is assumed to be constant (Wooldridge, 2012). Instead, the logit model is used as an alternative.

The logit model is built around a cumulative distribution function (CDF), as this necessarily maps onto [0,1], solving the first issue above. The probit model is also built around a CDF of the normal distribution. The probit would give similar results, especially given the large sample size (n=770). Seeing as the CDF used is a function of exponentials,

the marginal effects are no longer simple constants, as was the case with linear models. For the logit model 'the magnitude of the effect varies with the values of the exogenous variables' (Aldrich and Nelson, 1984), which solves the second issue above of the unrealistic assumption of a constant effect.

Expectations

Firstly, the data may be summarised as below:

Variable	Obs	Mean	Std. Dev.	Min	Max
WORRIED	770	.4844156	.5000819	0	1
PARENT	770	.2779221	.4482659	0	1
AGE	770	48.57143	17.52073	18	93
SEX	770	.5064935	.5002828	0	1
ANON_RIGHT	770	.5909091	.4919857	0	1
ANON_POS	770	.3506494	.4774835	0	1
ANON_TRIED	770	.1584416	.3653919	0	1
VICTIM	770	.3584416	.4798544	0	1

Table 1: Data Summary

Two groups that could be assumed to be sceptical of online safety would be parents and the elderly. Parents may be more actively concerned, as concern for their child's online safety may force them to more strongly consider the dangerous of their own information being online. Due to the rapid pace of technological change, the elderly are more likely to be unfamiliar with new technologies and therefore possibly more sceptical of them. Therefore, it is expected that the results will show-positive relationships with WORRIED for both PARENT and AGE. SEX is included as a control variable, aiming to reduce omitted variable bias. It is not expected that it would have any important effect on WORRIED.

It is expected that an individual who has tried to mask their online activity at some point would naturally be more likely to have concerns about online anonymity. As such, a significant positive impact on WORRIED is expected of the ANON_TRIED variable. The two other dummy variables related to questions posed about anonymity are less clear-cut. The effects of the variables ANON_RIGHT and ANON_POS are therefore ambiguous.

A stereotype of an individual who is worried about their information being available online may have historically leaned towards an image of paranoia. However, given the rise of cybercrime in recent years (RTÉ, 2015) there is much more justifiable cause for concern. As such, it is expected that VICTIM will have a significant positive impact on

WORRIED.

Results

Logit Interpretations

Interpretation of coefficients in the logit model is different to that of standard OLS regression due to the non-linear relationship between dependent and independent variables. The interpretation is 'less straightforward' (Aldrich and Nelson, 1984). However we can still say that the sign of the coefficient determines the direction of the effect and that greater magnitudes correspond to larger effects. The main difference is that we cannot state the effect on the dependent variable of a per unit change in an explanatory variable, we can only give statements such as: 'an individual who answered yes for Xi, is more/less likely to be worried'. Significance is discussed in relation to the 5 per cent level.

Interpreting the Results

The logit test was run first for the case of j=6 (i.e. just using the first six explanatory variables listed in the model section), giving the following output:

```
Logistic regression                               Number of obs   =        770
                                                  LR chi2(6)      =      21.12
                                                  Prob > chi2     =     0.0017
Log likelihood = -522.78899                       Pseudo R2       =     0.0198
```

WORRIED	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PARENT	.0709351	.1715258	0.41	0.679	-.2652493	.4071196
AGE	-.0010371	.0045066	-0.23	0.818	-.0098699	.0077957
SEX	-.2610505	.1493497	-1.75	0.080	-.5537705	.0316694
ANON_RIGHT	.2606078	.1539064	1.69	0.090	-.0410432	.5622588
ANON_POS	-.2474577	.1549434	-1.60	0.110	-.5511413	.0562259
ANON_TRIED	.6701472	.2083145	3.22	0.001	.2618583	1.078436
_cons	-.0720176	.2962919	-0.24	0.808	-.6527392	.5087039

Table 2: Logistic Output for j=6

The first point to note is that the likelihood ratio chi-squared and its associated p-value of 0.0017 mean that the model is significantly better than a model with no predictors. As expected the ANON_TRIED variable has a strong positive impact. The p-value of 0.001 suggests that it is highly significant. This would seem to go against the idea of Acquisiti (2014) that there exists a dichotomy between beliefs and behaviour as regards online anonymity.

ANON_RIGHT is not statistically significant for a one-tailed test, but using a one-tailed test gives a p-value of 0.090/2=.045, which is statistically significant. An ar

gument for this would be that it would seem illogical for an individual who does not believe in a right to anonymity to then be worried about their personal information being online. ANON_POS does not appear to be significant.

Surprisingly, PARENT and AGE seem to have very little statistical significance, which would challenge the perception of parental and elderly scepticism of technology. Even more surprising is that SEX, while not statistically significant, is not too far off with a p-value of 0.08. If significant, the coefficient would suggest that females tend to be more worried. It would be interesting to see if a test on a larger sample would give a statistically significant result.

Secondly the model was run for j=7 (the same model as above but this time including the VICTIM term), giving the following output:

```
Logistic regression                             Number of obs   =        770
                                                LR chi2(7)      =      27.03
                                                Prob > chi2     =     0.0003
Log likelihood = -519.83417                     Pseudo R2       =     0.0253
```

WORRIED	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
PARENT	.0516411	.1724416	0.30	0.765	-.2863382	.3896204
AGE	.0010332	.004605	0.22	0.822	-.0079925	.0100589
SEX	-.2558089	.1499272	-1.71	0.088	-.5496608	.0380429
ANON_RIGHT	.272266	.1545852	1.76	0.078	-.0307155	.5752474
ANON_POS	-.2724322	.155989	-1.75	0.081	-.578165	.0333006
ANON_TRIED	.6440991	.2092815	3.08	0.002	.233915	1.054283
VICTIM	.3822288	.1575726	2.43	0.015	.0733921	.6910655
_cons	-.3011752	.3122359	-0.96	0.335	-.9131463	.3107958

Table 3: Logit Model for j=7

Similar interpretations are possible given this test. PARENT and AGE are not statistically significant. AGE has a higher p-value of 0.088 this time, suggesting that in the previous model it was capturing some of the explanatory power of the VICTIM variable. Our pseudo R-squared of 2.53 per cent suggests that it is a relatively small proportion of differences that is being explained by the model; nonetheless some of the variables are statistically significant.

The main outcome from this test is that VICTIM is quite statistically significant factor, due to the p-value of 0.015. The positive effect of this binary variable is as expected, demonstrating that individuals who have been victims of online wrong-doings are more likely to be worried. Paranoia could be interpreted as VICTIM not having a significant impact on WORRIED, and so there does not appear to be an indication of this.

Issues with the Model

One issue with the above question of paranoia is the direction of causality. The most logical statement for paranoia would be a low P(VICTIM | WORRIED), as this looks at the probability that an individual has been a victim given that there are worried. The problem is that our model is structured the other way around and so while our interpretation above could possibly be true, in that paranoia could be indicated by a low significant impact of VICTIM on WORRIED, it is probably safer to say that the model is inconclusive about the existence or paranoia (rather than confirming its absence).

The strongest issue to highlight is in relation to the survey answers being interpreted as 'Yes' or 'No' values. In determining values for WORRIED, ANON_RIGHT, ANON_POS, ANON_TRIED and VICTIM, the 'No' interpretation (the zero binary value) also incorporates those respondents that answered 'Don't know' or those that refused to answer. Therefore the most explicit interpretation would not actually be 'Yes' and 'No', but rather 'Responded Yes' and 'Did not respond Yes'. The two human factors that may distort the results in this case are honesty and willingness to disclose information. In particular the VICTIM variable may be prone to bias in that respondents who were in fact victims of the listed online attacks may, for reasons of shame or denial, answer 'No' or refuse to answer, which would give rise to a significant bias.

Another issue is that our dependent variable is binary, though worry may not be a binary concept. We are assuming that individuals are either worried or not worried. It may be that there are different degrees of worry, even different types of worry, that should be investigated.

Possible Extensions

With the worry issue in mind, one possible extension would be to gather categorical data for worry. To look at the issue from the attitude versus actions perspective of Acquisiti (2014) and the FTC (2002) report, the WORRIED variable could take on distinct values for responses such as 'Yes I am worried but No it doesn't negatively affect my eCommerce activity' and 'Yes I am worried and Yes it does negatively affect my eCommerce activity'.

To further analyse the interaction of the variables in this model, it would be interesting to incorporate questions regarding actual eCommerce engagement. A measure of spending on online purchases could be introduced, for example an individual's estimation of their annual spending in such markets. This could help to paint a clearer image of the type of consumer that is worried about online privacy. Further questions could be included about internet literacy, which Miyazaki and Fernandez (2001) would seem to suggest is an important factor.

A final extension would be a panel data analysis, introducing a time series by repeated surveying of the fixed sample of individuals. It would be very interesting to analyse

the change in worries over time, and to single out the effects of large scale privacy scares such as the Edward Snowden NSA whistleblowing incident (Brown, 2014).

Conclusion

Though the paper has not managed to identify key demographics that are most prone to worry over piracy, this in itself could be a lesson to businesses. There is no singular face of online fear, and so efforts to address privacy concerns should not depend on the demographic of a firm's customer base.

The strongest result from the empirical analysis confirms that victims of online attacks are more likely to be worried about their privacy, and also that there seems to be evidence that individuals attitudes regarding privacy concerns are in fact aligned with their behaviours.

Finally, issues that could cause bias in the results are raised, giving rise to a discussion of an extended survey that would incorporate factors such as a non-binary view of worry and an inter-temporal element, which would potentially give clearer results to the question of who is worried about online privacy.

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WHAT LABOUR FORCE CHARACTERISTICS HAVE THE GREATEST IMPACT ON PRODUCTIVITY ACROSS OECD COUNTRIES?

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In the aftermath of the financial crisis many countries sought recovery through improved labour force productivity. In this econometric investigation, Daniel Fallen Bailey examines the factors affecting labour productivity across countries. His results question the overarching emphasis sometimes placed on labour market efficiency, highlighting the importance of more worker-friendly measure like real wage and employment protection.

Introduction

This research paper aims to answer the question of what characteristic of a country's labour force has the greatest impact on productivity levels. The idea for such a topic stems from the fact that economists are at the intriguing but often perplexing stage of emergence from a great recession, where can begin the analysis of the shape of recoveries of various countries. Taking from simple Cobb-Douglas production theory, we understand Total Factor Productivity (of which labour productivity is a fundamental element) to unambiguously increase a country's level of economic growth (Sorenson and Whitta-Jacobsen, 2010). Thus, after the systemic global shock of 2008, many countries have naturally sought improvements in labour productivity as a pathway to recovery.

The paper, motivated by research on various countries' attempts at such a recovery, aims to account for differences in productivity levels seen across OECD countries, and will attempt to discover what defining feature(s) or characteristic(s) of a country's labour force have the greatest effect on overall outcomes of productivity levels.

Motivation and Literary Review

This paper was motivated by research of various economies' attempts at productive recoveries from the crisis. One finds that many new theories and discussions have been put

forward to explain the overall factors affecting differentials in outcomes across these regions.

One such theory is presented by The Economist (2014b), who stipulate that Britain has experienced a 'productivity puzzle' since the crisis. This is due to soaring employment levels, coupled with stagnant levels of economic growth. The Economist (2014b) puts the absence of improvements in TFP down to inflation; relatively high inflation in the region has lowered the real wage level, allowing employers to hire more workers and use them less intensively which has created a productivity lag.

In the US by contrast, relatively low inflation throughout the recovery has kept real wages high. As a result of the costly nature of hiring new workers, unemployment has remained high, only falling 2.1 per cent from a high of 7.8 per cent in January 2009 (Bureau of Labour Statistics (BLS), 2015). But employers appear to have been successful in wringing more work from the existing workforce, and the outcome has seen gains to productivity. Evidence that supports this is seen in the data for productivity levels in the US, which have averaged an annual increase of 1.55 per cent from 2009-2014 (BLS, 2015). The Economist (2014b) magazines theory links real wage levels directly to growth in productivity. However, other articles have emphasised the more idiosyncratic factors behind productivity that are specific to each region.

In 2015, The Economist (2015a; 2015b) put forward a discussion on certain characteristics of the US economy which may reflect its strong performance in productivity and output since the crisis [the US managed to average 2 per cent annual growth in GDP per capita since 2010, impressive considering global growth was only 2.5 per cent in 2014 (World Bank, 2015)]. They highlight that the flexibility of the US labour force combined with the fact that US is at the frontier of global innovation and technology, has created what they label the 'On-Demand' economy (The Economist, 2015b). This is an economy which puts 'job-starved workers in contact with time-starved urban professionals', tapping into the underused resources within society. Characteristics of this economy include a lack of full-time employees or a need for offices, and the resourcefulness to use 'spare cognitive capacity' all across the world (The Economist, 2015a).

Importantly, this has created a rise in the freelance worker. 53 million Americans now work as freelancers, and as many as 1 in 3 people do some sort of freelance work. Small app-based companies are consolidating these workers into a catalogue of on-demand professionals, ready to be contracted only as they're needed. This means companies can solve transient business problems quicker, and more efficiently. This idea is reflective of work by Acemoglu *et al.* (2012), who argue that the USA is at the frontier of world growth with regard to innovation and technology, and that this is facilitated by "unfettered competition and risk taking" which they label 'cut-throat capitalism.'

Overall, this second theory put forward by The Economist (2015a; 2015b) sug

gests that flexibility in the labour force combined with emphasis on research and development are the key to improving productivity, and this accounts for the US' strong performance of growth since the financial crisis.

The combination of these two theories which outline the factors affecting productivity (i.e. firstly the real wage level and second, labour market flexibility combined with innovative research and development) could account for the stagnated recovery of the EU from the downturn. Productivity in the region is sluggish and therefore, stagnant growth figures of less than 2 per cent are forecast for Germany, France and Italy in 2015. EU-wide unemployment is consistently high also, standing at 11.5 per cent in November 2014. As well as this, the threat of deflation in 2014 has prompted the ECB to engage in a program of quantitative easing in the hope of stimulating the economy (Eurostat, 2015; Shellock, 2015).

One reason for this slow recovery of productivity levels however, could be due to the fact that since the crisis, the EU has fallen further from meeting the criteria necessary for an optimal currency area (OCA). These criteria, set out by Mundell (1961) and Mckinnon (1963), are deemed essential if a monetary union is to be feasible for all countries involved. At the heart of such criteria is labour market flexibility, which facilitates the adjustment to asymmetric shocks (McKinnon 1963; Mundell, 1969; Jager and Hafner, 2013). It is arguable that relatively inflexible labour markets, and in particular, relatively strict employment protection legislation is characteristic of the EU, as exemplified by such things as:

1. The high degree of specialisation in the EU since the introduction of the Euro (Jager and Hafner, 2013)
2. Resistance from Germany to the finalising of the Transatlantic Trade and Investment Partnership with the US. Most Germans take issue with the 'harmonisation of regulatory standards and removing barriers to investment' which could result in social dumping (Barysch, 2014)
3. Resistance in France to the Macron Bill in 2014, aimed at addressing the 35-hour week, reducing payroll taxes on companies and loosening Sunday-trading rules. As The Economist (2014a) points out; 'For some Socialists, rest on Sundays is a historic achievement of the labour movement; any attempt to revoke this right is an assault on the very concept of progress.'

Overall therefore, previous research points to a number of factors which could be explaining the variation in productivity levels across major regions of the world economy. This paper will focus on factors to do with inflation (real minimum wage), innovation (R+D expenditure) and labour market characteristics such as the level of temporary em-

ployment contracts, trade union density and the strictness of employment protection legislation. It will also look at Adult education levels to see if this is affecting a countries productivity performance level.

Empirical Approach

In order to hypothesise the determinants which have been outlined above, this essay proposes the following regression:

$$Yi = ß0+ß1X1+ ß2X2+ ß3X3+ ß4X4+ ß5X5+ ß6X6 \quad (1)$$

where:

Yi: PRODUCTIVITYLEV - A measure of labour productivity. It represents GDP per hour worked for the 5 years used in the study, in dollars adjusted for PPP.

X1: TEMPCONTRACTS - The number of contracts of limited duration (temporary employment contracts) expressed as a percentage of total employment.

X2: REALMINWAGE - Real minimum wage, in dollars adjusted for PPP.

X3: TRUNIONDENSITY - This represents the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. Density is calculated using survey and administrative data, adjusted for those who are self-employed or non-active.

X4: ADULTEDUC - Adult Education Levels. This represents the percentage of 25-64 year olds with tertiary level education achieved.

X5: R+DEXPEND - Spending on Research and Development as a % of GDP.

X6: STREMPPRO - This represents indicators for the strictness of employment protection legislation. They are synthetic indicators of the strictness of regulation on dismissals. For each year, indicators refer to regulation in force on the 1st of January (OECD, 2013).

Data

All data present in this paper is taken from OECD publications. 21 OECD countries are used in a cross-sectional study across five different years; 2000, 2005, 2009, 2010 and 2012. Data is sourced for each individual variable, for each country from each of the 5 years, and then averaged out. This gives 105 data points for each of the 7 variables used. Table 1 provides a summary of the data. Table 2 gives the 21 countries used. These countries were chosen partly due to data availability and partly due to the fact they provide a good variation of socioeconomic environment.

VARIABLE	OBS	MEAN	STD. DEV	MIN	MAX
PRODUCTIVITYLEV	21	35.55	13.79	15.00	65.94
TEMPCONTRACTS	21	21.11	4.91	12.00	31.05
REAL MIN WAGE	21	13212.15	5801.30	1732.00	21465.60
TR UNION DENSITY	21	21.23	10.88	6.87	54.71
ADULT EDUC	21	27.99	10.32	11.94	47.74
R+DEXPEND	21	1.76	0.82	0.59	3.23
STREMPPRO	21	3.05	1.00	0.00	5.13

Table 1: Data Summary

Australia	Luxembourg
Belgium	Mexico
Canada	Netherlands
Czech Republic	New Zealand
France	Poland
Greece	Portugal
Hungary	Slovak Republic
Ireland	Spain
Japan	Turkey
Korea	United Kingdom
United States	

Table 2: OECD Countries Used

Results

The overall results of the regression can be found in Table 3. The results mean that the original equation (1), posited in the Empirical Approach, can now be written as:

$$PRODUCTIVITYLEV_i = -0.5426 - 0.2474ß1 + 0.0021ß2 - 0.0906ß3 + 0.1817ß4 - 0.4511ß5 + 3.7350ß6$$

PRODUCTIVITYLEV	COEF	SE	T	P-VALUE
TEMPCONTRACTS	-0.2474	0.33	-0.76	0.46
REAL MIN WAGE	0.0021	0.00	6.57	0.00
TR UNION DENSITY	-0.0906	0.18	-0.49	0.63
ADULT EDUC	0.1817	0.18	0.99	0.34
R+DEXPEND	-0.4511	1.89	-0.24	0.82
STREMPPRO	3.7350	1.25	2.98	0.01
_CONS	-0.5426	8.21	-0.07	0.95

Table 3: Regression Output

Interpreting the Results

Overall, when tested against the null hypothesis of $\beta n = 0$, only 2 variables are found to be statistically significant when using a t-test at the 5% significance level; REALMINWAGE and STREMPPRO. The p-values for these coefficients are lower than 0.05 in both cases, meaning we can reject the null hypothesis that $\beta n = 0$. The lack of other significant variables may be due to the manner in which the data was collected.

However, the R2 for the model is 0.8475, which tells us that 84.75 per cent of the variation in labour productivity is explained by the model -a good result. As well as this, the F statistic for the regression is 15.75, which means the p-value is 0. This implies that the model is statistically significant at predicting labour productivity levels. To show this evidence of linearity, the predicted values of PRODUCTIVITYLEV were generated and shown in a scatter plot alongside the observed data. A 45 degree pattern is expected in order to show linearity in the model. The model does a good job in predicting PRODUCTIVITYLEV.

It is interesting to interpret the signs on the independent variables. Based on the first theory put forward by The Economist in (2014b), we would have expected to see a positive relationship between PRODUCTIVITYLEV and REALMINWAGE. This is due to the implication that when real wage rises, it becomes more costly for employers to take on work, which means that in order to meet given demand, employers need to wring more work from a smaller workforce. Conversely, when real wage falls, the incentive to economise on labour is wiped out and productivity suffers as a result. Employers hire more workers and use them less intensively, forgoing opportunities to innovate.

This intuition is reflected in the positive result seen in the regression. The results

estimate that a one unit increase in real minimum wage will result in a 0.21 increase in labour productivity score. Based on the second theory put forward by The Economist (2015a; 2015b), as well as the work of Acemoglu *et al.* (2012), we would have expected to see a positive relationship between PRODUCTIVITYLEV and TEMPCONTRACTS, as well as PRODUCTIVITYLEV and R+DEXPEND. This is due to the implication that firstly, the more possible it is to hire workers on contracts of limited duration or fixed-term contracts, the more employers can hire solely to solve transient business problems efficiently and quickly, without the added cost of payroll taxes or payroll insurance associated with permanent contracts. Also implied by this theory is the idea that emphasis on research and development, accompanied by such flexibility in the labour force, should have a positive effect on labour productivity.

However, the regression results show an insignificant, but negative result between both PRODUCTIVITYLEV and TEMPCONTRACTS (-0.2474), as well as PRODUCTIVITYLEV and R+DEXPEND (-0.4511). With regard to TEMPCONTRACTS, the negative relationship may be due to workers not being comfortable with the lack of stability associated with short-term contracts, and thus not achieving their full productive potential. The negative relationship with R+DEXPEND suggests that possibly labour productivity is related more to R+D expenditure per worker as opposed to the percentage of GDP.

And based on the third theory which is extrapolated from the work of McKinnon (1963), Mundell (1969) and Jager and Hafner (2013), as well as data from Eurostat (2015), we would expect a negative relationship between PRODUCTIVITYLEV and TRUNIONDENSITY, and PRODUCTIVITYLEV and STREMPPRO. The implication here is that labour market inflexibilities brought about by a strong trade union presence and strict implementation of employment protection legislation, should have a negative effect on labour productivity.

However, although we see an insignificant and negative relationship between PRODUCTIVITYLEV and TRUNIONDENSITY, we see a positive and statistically significant relationship between PRODUCTIVITYLEV and STREMPPRO. This implies that the more stringently employment protection legislation is carried out, the more productive workers become. It implies that a 1 unit increase in the strictness of STREMPPRO results in an increase in the labour productivity score of 3.74, which is a very strong correlation. This outcome reflects the negative result attained for TEMPCONTRACTS, which implied that workers are less productive in an unpredictable environment.

Issues with the Model

Firstly, tests were carried out to uncover if the model suffered from omitted variable bias. This was tested for by running a Ramsey RESET test. The results in Table 4 suggest that

there is no omitted variable bias in the model. If there were, the omitted variable would not be observed and would end up within the error term, which creates a bias (Wooldridge, 2014).

Ho:	model has no omitted variables
F Statistic	0.70
p-value	0.57

Table 4: Ramsey RESET Test

Secondly, tests were carried out for the presence of heteroskedasticity in the model. This occurs when the variance of the unobservable error term (εi), conditional on the explanatory variables in the model (Xi), is non-constant given the variables observed. Furthermore, if omitted variables were actually included in the error term, they would be non-constant. In this scenario, there would be difficulties in testing the significance of the model as the OLS t-statistics would not be t-distributed and the F-statistics not F-distributed.

In order to test for this, the residuals were plotted against the predicted values. The result should show no pattern at all (implying homoscedasticity), but if a pattern is present, then the model suffers from heteroskedasticity. Looking at the results in Figure 1, we see a clear pattern in the residuals, implying the presence of heteroskedasticity.

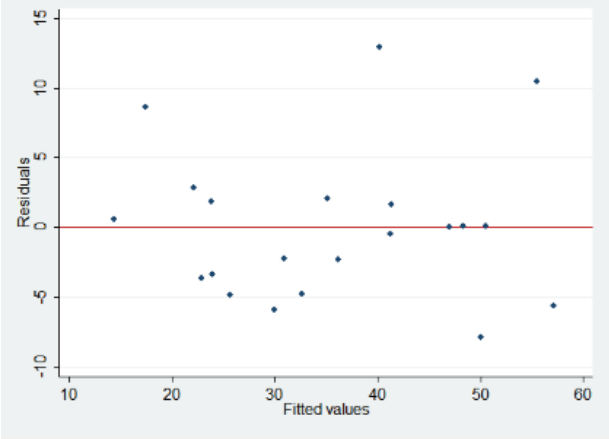

Figure 1: Residuals vs Predicted Values

The problem with this is that the standard errors for each coefficient may be wrong as a result. In order to adjust for the issue, we use the heteroskedasticity-robust standard errors, which is obtained by placing 'robust' after the 'regress' command. The regression results in Table 3 have thus been adjusted for this.

Possible Extensions

Firstly, it would be intriguing to see the relationship between R+D expenditure per worker and labour productivity, rather than R+D as a percentage of GDP, as outlined earlier. Secondly, more variables could be included in any future extensions to the model in order to uncover more factors affecting variation in labour productivity. These could include the level of capital employed or the level of infrastructure (particularly broadband levels and quality) in an economy, both of which add to the productive capacity of the labour force. It would also be interesting to further explore the impact of employment protection legislation on labour productivity, which was significant in this model.

Conclusion

The aim of this investigation was to explore what characteristics of the labour force have the greatest impact on labour productivity levels. In conclusion, the results shown in the regression are surprising, given that they have very different implications to the theories which motivated the research question initially. They imply greater importance for workers' real wage and employment protection in harnessing improvements in labour productivity, rather than for the more competitive and aggressive aspects of attempts to economise on labour through temporary contracts and R+D. This is reflective of Acemoglu *et al.* (2012)'s suggestion that many economies range between 'cut-throat' and 'cuddly' capitalism.

The results shown here advocate a move more towards cuddly capitalism, which is reflective of the sort of social democracy found in Western Europe and the Nordic countries (Acemoglu *et al.*, 2012). However, Dolenc and Laporsek's (2013) explanation of the concept of Flexicurity becomes relevant here. They describe this as the balance between flexible employment arrangements (such as temporary contracts) as well as the security and protection of workers in the labour market. Importantly, they show that the right mix of the two policies can be beneficial for labour productivity growth. Despite the results here favouring the side of social protection, this paper would emphasise their balanced view with regard to future policy implications.

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A Comparison Of Financial Crisis Policy Responses By Ireland And Iceland

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In this paper, James Green, John Kavanagh and Conor Leen focus on the recent economic crises experienced by Ireland and Iceland. They provide background for these crises and explore the different responses of the two. They emphasise Ireland's comparatively limited monetary powers and question whether this was an advantage or disadvantage in the path to recovery in the long run.

Abstract

This paper compares the effectiveness of the policies implemented by Iceland and Ireland in returning growth and stability to their respective economies. It begins by drawing parallels of the laxed management of their respective financial sectors and moves on to argue that Iceland's initial responses vis-à-vis capital controls and its currency depreciation allowed it to realise short term gains and benefits thus returning to moderate growth very quickly. Conversely, the paper argues that the policies implemented in Ireland were a lot more forward looking and the benefits had a longer time horizon. Whereas today Ireland has a stronger business environment and much higher investment levels, Iceland is finally coming out the other side and we see it now reverse some of the policies it implemented.

Introduction

A letter is not the only difference between Ireland and Iceland; this adage holds true no more so than when looking through the lens of the financial crisis. For the most part, there were stark differences in the genesis of the two crises. This paper looks at the respective causes of the each country's crisis and draws conclusions on the similarities between the evolutions of both crises, whether it be the faults and foibles of Ireland's property boom or Iceland's chronic mismanagement of its banks. The paper discusses both policy responses, be it bailout or default and discusses the immediate implications of both. Iceland's banks defaulted on their foreign obligations so the economy could stay afloat, while the Irish bailout was characterised by the recapitalization of Irish banks through

cash injections and the guaranteeing of banks liabilities. Fast forwarding to the present day, the paper analyses the effectiveness of both policy responses in restoring both financial and economic stability to their respective countries.

Background to Both Crises

Starting around the turn of the century, the Irish economy underwent a paradigm shift from export-led growth and became fuelled by rising property prices and a construction bubble (Honohan, 2009). At the same time, in a country of similar size but with less than a tenth of the population further north, banks were privatized for the first time, bringing about their rapid growth (Benediktsdottir *et al.*, 2011).

The boom in Ireland stemmed from a demand for houses, championed by membership of the EU and EMU, which increased net immigration and decreased interest rates (Honohan, 2009). The EMU made over borrowing quasi-safe by veiling the penalty of an interest rate increase if it occurred, which was amplified by the removal of currency risk and thus enabled foreign borrowing. The change in Iceland came from the view that banks should be separated from the government to avoid crony capitalism (Special Investigation Commission, 2010). This ultimately did not happen and the mismanagement of both countries' banks would prove to be a constant in what is otherwise two very different tales.

It would be idealist to say that fiscal policy had not been mismanaged in Ireland. The restructuring of the tax base reduced income tax while increasing the 'windfall revenues' of corporation tax, stamp duties and capital gains tax (Honohan, 2009). This was a fair weather policy that did not consider a downturn. The boom masked the volatility of such sources of revenue which was only revealed when it was too late to prevent what could only be called a fiscal crisis in Ireland. Looking at mismanagement in Iceland's case, IceSave accounts yielding high interest rates were used to attract foreign depositors, proceeds here were put into risky loans (Benediktsdottir *et al.*, 2011). Iceland's banks became key international financial intermediaries and the bank's foreign denominated debt grew to 8 times the size of Iceland's GDP (Brogger and Kristin Einarsdotti, 2008). Ireland's foreign borrowings from the boom, while still large in absolute terms at 60 per cent of GDP, were only a microcosm of Iceland's, showing the degree of mismanagement that manifested itself in the Nordic state.

Delving into the minutia of the Irish property boom, the threefold increase in average house prices from 1994 to 2006 should have been a warning signal to banks. Anglo-Irish Bank's reckless expansion put pressure on others to throw caution to the wind to maintain market share (Mody and Sandri, 2012). The bank's role in fuelling the boom exposed them to solvency and funding pressures. Credit risk was ignored, and bank regulators were complacent in letting lending standards relax (Mody and Sandri, 2012).

Looking at Pillar One and Two of the Basel framework, too much attention was paid to the latter while the former was ignored (Whelan, 2014). This mismanagement set the scene for Anglo-Irish to fail after the Lehman Brothers collapse, and put further pressure on secondary market yields of Irish government securities (Mody and Sandri, 2012). With this, Ireland had unwittingly plunged itself into a financial crisis.

A saving grace for Ireland became a problem for Iceland: membership of the euro (or lack thereof). The Krona already had carry trade problems due to its overvaluation and Iceland broke the Giudotti-Greenspan rule in 2006 leading to an attack on the Krona by speculators (Gylfason *et al.*, 2010). Currency problems meant banks were unable to renew maturing short term obligations. The Central Bank couldn't fulfil its lender of last resort duties as Iceland's foreign debt was too large (Benediktsdottir *et al.*, 2011). The currency crisis made matters worse, foreign denominated debt meant the depreciation increased Iceland's debt burden. Banks tried to draw money from overseas subsidiaries but the UK froze Icelandic assets to protect Briton's Icesave account deposits (Special Investigation Commission, 2010). With credit markets dried up, the banks capitulated, they proved too big to save.

On 29 September 2008, the Irish banks made an overnight decision to guarantee the banking system, borrowing a total of €440 billion (Kauppinen, 2012). On the same day in Iceland, the government announced plans to nationalise Glitnir, the third largest bank (Benediktsdottir *et al.*, 2011). This set in motion the chain of events that would see Iceland default on its foreign debt, and become the first industrialised country in 30 years to get a loan from the IMF (Danielsson, 2011). With this, two crises were well and truly under way.

The Icelandic Default

Iceland adopted a heterodox policy when responding to the collapse of their banks, the inability to use a more orthodox policy cast a die for their future as we will see in the conclusions. They allowed the 3 largest banks, Kaupthing, Glitner and Lansbanki to capitulate, and founded new banks in their stead to take over the domestic operations of these banks. The new banks were bereft of foreign operations, which accounted for two-thirds of the old banks' liabilities, much to the detriment of shareholders and foreign creditors (Special Investigation Commission, 2010). This was by no means a silver bullet solution, but along with strict capital controls, which stabilised the value of the Krona and stopped creditors leaving in tandem with some of the country's GDP, and a debt package to finance the budget deficit, steps were taken in the right direction (Gylfason *et al.*, 2010).

Regarding the logistics of the default, Iceland claimed that since they did not offer a guarantee to foreign debtors, that it should not be them who bore the cost of its

fulfilment, which was a colossal 45 per cent of Iceland's GDP. This would have caused the economy to spiral out of control. Here Iceland's brinkmanship worked as they were not held fully liable where perhaps they would have been under a different system. To cushion the economy's freefall and keep their currency from crashing any more than it already had, Iceland got a loan of $4.6 billion in total (Brogger and Kristin Einarsdotti, 2008). Essentially, Iceland let their banks fail for foreigners, while shielding its people from the brunt of the crisis. Iceland's initial reason for not honouring the guarantee was due to insolvency arising from the credit markets drying up, further down the line when they had the means to repay debts, the people of Iceland voted against doing so in two referenda (Gylfason *et al.*, 2010).

Irish Bailout

With the fall of Lehman Brothers in mid-September 2008, huge pressure was exerted on the wholesale funding of banks, this included Ireland (Mody and Sandri, 2012) As a result, two weeks later, the Irish government introduced the blanket guarantee scheme covering almost all Irish bank liabilities.

This guarantee scheme was expected to cover liquidity problems at banks however it sharply contrasted with the majority of other European countries and the US where they only provide guarantees for new borrowings (Schoenmaker, 2015). However, due to maturing bank paper and non-renewal of deposits, ELA had to be introduced by the Central Bank of Ireland. Therefore the backing up of Irish banks changed hands from the government to the Central Bank. The increasing ELA and the dependence of banks on Eurosystem funding could not be sustained and the guarantee eventually expired (Schoenmaker, 2015).

The recapitalization of Irish banks took place in 2 phases. Both the Bank of Ireland and AIB received €3.5 billion of injections as part of phase one, in the meantime Anglo-Irish was nationalized in early 2009 and received an injection of €4 billion (Schoenmaker, 2015). Phase 2 witnessed the establishment of NAMA, to look after the large loans taken out by property developers. As a result of these large property loans being bought at 'long-term economic value', banks had to incur prospective losses. The Prudential Capital Adequacy Review estimate for the losses on these NAMA and non-NAMA loans of the Irish banks amount to €32 billion (Schoenmaker, 2015).

Policy Implications and Today's Environment

Fast forwarding to today, we are in a very different economic climate to the one witnessed at the time of the crisis. Both policies, either default or bailout, had considerably different effects on their respective countries. This paper now looks at some immediate and lasting effects of the policy responses, comparing how both countries have recovered and what

sort of condition both their financial sectors and economies are in today. It shows how the countries have performed relative to each other and if any lasting effects of the policies are still visible through looking at various figures, while drawing conclusions.

Currency Effects

Iceland's ability to depreciate their currency allowed them to return to moderate growth quite quickly in the form of a boost to exports (Howden, 2013). But this initial growth never developed into sustained long term growth (Howden, 2013). The paper will compare this to Ireland's situation where it was initially worse because of the euro but subsequently developed long term policies to help sustained growth into the future.

As a knock-on effect from the default in Iceland, the sale of domestic assets to fund foreign liabilities led to a huge depreciation in the value of the Krona which saw it surrender roughly half of its value to both the Euro and the Dollar (Howden, 2013). This rapid depreciation led to huge inflation in Iceland and it reached highs of 20 per cent in 2009 (Trading Economics, 2015). This depreciation allowed Iceland to inflate away some of their debts. Ireland on the other hand had to bear the brunt of their debts via the taxpayer as it lacks control over its own exchange rate (Whelan, 2014). Today, Ireland's Debt/GDP levels currently stand at 110 per cent and Iceland's at 86 per cent (Trading Economics, 2015). This points to the extra tax burden which was put on the Irish taxpayer because of the IMF bailout. For Ireland currency depreciation was not an option as it was a member of the EU and the EMU. This paper argues that while it initially hindered Ireland's recovery and proved to be an obstacle, it provided long term benefits for the economy as a whole.

Iceland's depreciation aided some groups, mainly exporters, but did not help domestic producers and consumers. (Howden, 2013) This drastic fall in prices helped them regain international competitiveness and their exports boomed. This also meant that imports became very expensive which, as a small isolated island, the Icelandic consumer relies on. There was a drastic shift of Iceland's balance of trade in 2008 with its increased exports. But it never managed to capitalise on this initial growth and its balance of trade has since been declining. (Trading Economics, 2015) A conclusion from this is that while beneficial in the short run, this depreciation harmed the long term sustained growth prospects of Iceland.

Today we see inflation levels of 2.5 per cent in Iceland which are definitely a lasting effect of crisis (Trading Economics, 2015). In a recent attempt to keep a lid on inflation rates, we have seen the Icelandic government raise interest rates (Hafstad, 2015). Recent developments in wage contracts have led to an increase in expected inflation rates and also indicators have pointed to large increases in household spending (Hafstad, 2015). This shows definite signs of an improving economy but with inflation set to reach 4 per

cent in 2016, the Central Bank of Iceland are taking necessary corrective measures.

Comparing the Irish situation to the depreciation which occurred in Iceland, Ireland witnessed a natural price deflation that allowed relative prices to realign themselves, pointing entrepreneurs in the direction of the profitable areas of the economy (Howden, 2013). Between 2008 and 2010 Ireland suffered deflationary pressures relative to other EU members. This change was a gradual process but there is evidence to suggest that long term benefits of deflation outweigh the short term benefit of a nominal depreciation.

Investment levels today in Ireland are much higher than Iceland's and an analysis of the countries respective current accounts points towards higher investment in Ireland (Trading Economics, 2015). The current account level is a very good indicator regarding the health of an economy (Chen *et al.*, 2013). Ireland's inflation rate, which was around the 4% mark pre crisis, drastically decreased and deflation of 6 per cent occurred in 2009. Today there are inflation levels of 2.5 per cent in Iceland while Ireland's is at a -0.2 per cent level (Trading Economics, 2015). While Ireland initially suffered a lot worse as it couldn't depreciate its currency, it has since surpassed Iceland in growth levels and is seeing the long term benefits of natural price realignment (Gylfason *et al.*, 2010). This return to competitiveness has seen Ireland's annual GDP growth rate be above 4 per cent since January 2014 (Trading Economics, 2015). This year it is set to reach 7 per cent, which is over three times above EU average and 2 per cent bigger than Iceland's. Ireland's policies were for the long term and this is where it reaped the benefits. Iceland performed better in the short run but the effectiveness of the Irish policy response surpassed Iceland's in the long run.

Effects of Capital Controls and the Bank Guarantee

As another impact of the default, the IMF implemented strict capital controls on Iceland (Howden, 2013). The aims of these capital controls focused on three mains areas including limiting foreign currency outflows, putting a stop to the Krona depreciating any further and finally maintaining a desirable level of foreign currency for vital transactions (Howden, 2013). This paper finds that these controls greatly affected Iceland and the lasting effects of these can still be seen today through low levels of foreign direct investment, capital flows, trade balances and the damage done to the legitimacy of its business environment.

The effect of capital controls imposed by the IMF on Iceland have drastically harmed its FDI and have greatly inhibited recovery (Danielsson, 2011). Under the capital controls, entrepreneurs were forced to seek permission from the Central Bank of Iceland to procure foreign funds to invest abroad which made it very difficult for organic growth post crisis. Emigration was also limited as individuals had no guarantee that they could bring their financial capital with them (Howden, 2013). However, more detrimental is the fact that the controls have reduced foreign confidence in the economy and harmed

the nature of their business environment. By blocking investment in projects funded by incoming FDI, Iceland's Central Bank has created a clear disincentive for foreigners to invest in Iceland, effectively reducing its level of openness as an economy (Danielsson, 2011).

Looking at the current figures we see that Iceland's FDI went from extreme highs of 200 billion ISK in 2007 to negative levels in the depths of the crisis (Trading Economics, 2015). Capital controls also meant a lack of access to foreign capital and loans. Investors have had to borrow at the Icelandic interest rate which for the last 3 years has been at highs of 6 per cent. This has made any sort of borrowing very expensive in Iceland and inhibited recovery and real economic growth. In a recent announcement, these capital controls are not set to last much longer as the Icelandic government plans to remove them in January 2016 (The Economist, 2015). It has now reached a stage where the government is in a strong enough financial and economic position to remove these capital controls. Since announcement of this in June 2015, capital flows have skyrocketed and are double what they were at the start of 2015 now (Trading Economics, 2015). Iceland must be cautious in exiting these controls however as it could lead to a huge outflow of assets, thereby destabilising its currency.

In contrast to the harming effect of capital controls on the business environment of Iceland, the Irish bank guarantee gave a boost of confidence to foreign investors as Ireland solidified the stability and longevity of its financial sector (Schoenmaker, 2015). It solidified the government's commitment to an open economy and today we see levels of foreign direct investment have only been increasing in Ireland (Trading Economics, 2015). Unlike Iceland, Ireland's balance of trade has only increased and this is generally due to its export led nature. Due to the free movement of capital, Ireland had access to financing options all over Europe. It has been able to benefit from extremely low interest rates of late and this has greatly aided the economic recovery through cheap loans and increased investment. The figures show that Ireland has had interest rates of approximately 1 per cent since 2010. Compare this to Iceland's current level of 5.6 per cent and it's easy to see why Ireland has recovered so well compared to Iceland.

Conclusion

Bond yields in both countries spiked hugely around the time of the crisis with both Ireland and Iceland's reaching record levels. These are key signs of the stability of a country's financial sector and with banks being so closely linked to the sovereign before the crisis, it points to quite a high level of systemic risk (Battistini *et al.*, 2014). Looking at bond yields today, we have seen Ireland's return from a 12 per cent high in 2009 to a healthy 1 per cent on ten-year sovereign bonds (Trading Economics, 2015). Similarly Iceland's ten-year sovereign reached highs in 2009 of 12.5 per cent (Trading Economics, 2015). We have

since seen Iceland's lower to 6 per cent but this is still quite high for a developed nation. This can be argued to point to an overall better recovery in Ireland because ,as mentioned, bond yields are an indicator of financial and economic stability (Battistini *et al.*, 2014).

The paper set out to compare the performance of each country's economy in response to the implemented policy, be it bailout or default. From both researching the extensive literature and gathering indicators, we were able to draw conclusions on the effectiveness of both respective policies. The paper found that while Iceland initially returned to moderate growth, the lasting effects of the default proved to be detrimental for long term sustained growth. We are finally seeing Iceland come out the other side as it lifts its capital controls. Ireland, on the other hand, implemented long term policies and has reaped the benefits of enduring an initially tougher policy stance.

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Cheese, Chocolate And Cuckoo Clocks: The Swiss Model For The United Kingdom

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With David Cameron's in-out referendum due to be held in June 2016 much attention has been devoted to what Britain's relationship with the Eu might resemble in the event of a Brexit. In this essay, Elisabeth O'Higgins describes the Swiss model; that of a non-member which enjoys an elevated relationship with the EU, and evaluates its potential as an option for the UK.

Introduction

The United Kingdom (UK, hereafter) joined the European Economic Community in 1973. The UK's place in Europe has become an increasingly polarising issue since 2013, when the British Prime Minister David Cameron announced that he would hold a referendum on whether or not the UK should stay in the European Union (EU, hereafter) before the end of 2017. At present there are many questions left unanswered concerning the ramifications if one of the EU's founding members chooses to leave, i.e. if a 'Brexit' occurs. The political and economic consequences of the UK leaving the Union are much debated. It is generally accepted that if the EU's third largest state decides to leave, the landscape of the EU will be changed forever. The UK would have to renegotiate a relationship with the EU; the form this relationship would take depends on a number of factors. The model put forward as the best option for the UK by most Eurosceptics is the Swiss Model. This essay will briefly discuss the options should the UK decide to leave the EU, followed by an in-depth analysis of the advantages and disadvantages of the Swiss model for the UK and indeed for the EU and will conclude with an overview of the best option for the UK.

At present, with a population of over 64 million people, the UK is the third largest country in the Union. As a founding member and an economic powerhouse the UK is an integral part of the EU. Over the last few years a proportion of the British electorate and many politicians have become increasingly frustrated with the UK's position within the EU. The British Prime Minister David Cameron has promised the British public that he will hold an 'in-out' referendum. The outcome of this referendum is contentious

and will be closely scrutinised. If the British people decide to leave the EU the UK has a number of options to restructure its relationship with Europe.

The Options for the United Kingdom

The UK Remains in the European Economic Area

The first model the UK could adopt is a model similar to that of Norway. This means that the UK would negotiate a deal so that it could remain a member of the European Economic Area retaining their access to the single market. At first glance, this seems like a good alternative for the UK. If the UK adopted this model they would benefit from access to the single market but they would not have to adhere to European policies, such as the Common Agricultural Policy.

The big anomaly with this model is the fact that countries that have adopted this model, such as Norway, are often forced to apply European laws over which they have no input and still contribute towards the European budget (Hannon, 2012). Norway adopts a large majority of EU laws and aligns itself closely with the European Union on a number of issues, while not having a seat at the table when crucial decisions are made (Haugevik in Sanschneider, 2014). It seems counter productive to leave the European Union, where the UK has the ability to influence laws and policies, and then choose to stay in the European Economic Area where you have to apply European laws without any negotiating powers that were previously available as a member of the EU. Ultimately, the vast majority of the most burdensome EU regulations for businesses, including The Working Time Directive, would still be applied to the UK (Miller, 2013). Thus, adoption of the Norwegian Model appears to hold more disadvantages than advantages for the UK.

The UK Negotiates Individual Agreements

The second model that could be implemented is a model whereby the UK has no official ties with the EU and makes individual bilateral agreements with countries regarding trade. The UK would have to rely heavily on the World Trade Organisation as a means of negotiating trade deals and would have to negotiate deals with other countries on it's own. However, many countries have clearly indicated that they would much prefer to deal with the UK as a member of the EU rather than just dealing singly with the UK. Michael Froman, the US trade representative, has stated that Washington would not be eager to sign an Angloshperic bilateral deal. He has stated that the UK would have a bigger voice in trade talks if they stayed in the EU (Froman in the Financial Times, 2015). Deals on bilateral trade agreements would be incredibly burdensome on the UK's government resources. As well as this, the UK would no longer have the leverage of the combined power of the EU to reach these trade agreements. The UK would have to make it's own deals not just with other European countries but with other economic powers such as the

United States and China. This does not seem to be an ideal arrangement for the UK, as it would have much more influence and power in negotiating deals, both politically and economically, if it stayed in the EU.

The UK Adopts the Swiss Model

The third and most realistic option for the UK is the Swiss model. Switzerland, unlike Norway, is not a member of the European Economic Area (they rejected membership in 1992), it is however, a member of the European Free Trade Area (EFTA, hereafter). This arrangement means that Switzerland and the European Union cooperate by way of bilateral agreements managed through joint committees. The EFTA operates a free trade area which means Switzerland can reach independent free trade agreements with other European countries rather than being a member of a customs union where they cannot make deals with other countries on an individual basis. Switzerland has arranged around 120 sector specific bilateral agreements with the EU (Clements, 2014). The Swiss relationship with the European Union is a unique one with both advantages and disadvantages.

The Advantages of the Swiss Model for the UK

Most Eurosceptics in the UK have put forward the Swiss model as the UK's best alternative should it choose to leave the Union. Undoubtedly, there are benefits to adopting this model. Hannon has stated that Switzerland through membership of the EFTA has all the benefits of full membership of the EU but few of the costs. It has all four freedoms of the single market; free movement of goods, services, people and capital but no regulatory burdens from Brussels (Hannon, 2012). Switzerland frees itself from many regulatory burdens and rules by not being a member of the EU or the EEA.

Switzerland also contributes significantly less to the European budget. It is estimated that if the UK adopted the Swiss model its budgetary contributions would fall by around sixty percent (Miller, 2013). Reduced regulation from the EU would mean that businesses in the UK would not be burdened with rules and regulations from Brussels, which Eurosceptics argue could reduce costs and increase competitiveness. The UK would also be free to negotiate free trade agreements with diverse sets of countries outside the Union and on it's own without having to gain consensus at a European level. At face value the Swiss model seems ideal, the UK could still trade freely with the EU but without the burden of regulatory rules from Brussels. However, if you look a little closer a number of flaws emerge.

The Disadvantages of the Swiss Model for the UK

There are disadvantages to the UK adopting the Swiss model. Firstly, it is not guaranteed

that the EU will allow for such an arrangement to occur. Negotiating a deal between the UK and the EU would be long, laborious and complex and it is unlikely an exact replica of the Swiss model would be the outcome of these negotiations.

Secondly, it is also not certain whether the UK could secure membership of EFTA. Becoming a member of the EFTA would be a lengthy process, which could be vetoed by members of the EFTA at anytime. It is not inconceivable that the dynamics of the UK as a country intending to join the EFTA do not adequately correspond with the members of the EFTA (Clements, 2014). This is a risk the UK would have to be willing to take if they choose to go this route.

Nevertheless, if the UK secured a deal similar to Switzerland they would lose their direct influence over EU decision-making. While they would still have access to the market they would still have to accept all EU standards when selling to this market even though they do not have any say in establishing these standards.

The UK could lose out greatly should it choose to leave the EU and adopt a model like Switzerland. While the UK would have to contribute significantly less to the European budget it has been estimated that in a worst case scenario leaving the EU could reduce U.K incomes by about 3.1 per cent (£50 billion per annum). This is due to the fact there would inevitably be some increases in trade costs through non tariff barriers and economic losses from missing out on any further market integration within the EU (Dhingra *et al.*, 2015). The loss to the UK economy of leaving the EU is substantial and far outweighs the reduced contributions to the European budget.

The UK would also be disadvantaged as it would lose out on any future trade deals between the EU and other countries. For example, the UK would have to renegotiate on the Transatlantic Trade and Investment Partnership deal between the United States and the EU. It is likely that they would simply have to accept the same deal as Europe, as the U.S are unlikely to partake in more lengthy negotiations or not take part in the deal which would incur significant losses to the British economy. The UK would miss out on any future trade deals between the European Union and other big economies such as emerging Asian economies like China and would have to make their own bilateral arrangements. Although it is possible for these bilateral arrangements to be reached, as Switzerland has proved, it seems intuitive that Britain could have more influence, leverage and power as part of a group of twenty-eight countries rather than acting on its own.

One of the main arguments put forward in favour of the UK leaving the EU is the UK's concern and belief that they risk losing sovereignty if they remain in the Union. However, Switzerland is losing sovereignty due to globalisation. Like the UK, Switzerland is a nation with an open economy that has to increasingly play by global rules (De Grutyer, 2015). For example, the Swiss have de facto given up their banking secrecy, which is enshrined in their constitution due to pressure from the United States tax authorities (De

Grutyer, 2015). Switzerland, outside of the European Union, still struggles to maintain its sovereignty in an ever increasing globalised world. If it is sovereignty that the British are worried about they may in fact be better off staying within the European Union were they arguably have more bargaining power to retain some sovereignty with the rest of the world.

Officially Switzerland can make their own laws surrounding trade without any input from the European Union. However, in reality Swiss laws are heavily influenced by EU rules, otherwise their companies would not be able to trade with EU companies who are their major partners (McFadden and Tarrant, 2015). Hence, Swiss legislation must be made compatible with EU rules, in practice this means that Switzerland is similar to Norway in that they have no say in rule making but end up having to abide by them anyway. Dr Jonsdottir a policy officer at the EFTA has stated that 'being in with the outs' while trading freely in Europe comes at a price. It means paying to administer and police the single market while the 'in-crowd' makes the important decisions about how it works (Jonsdottir in Miller, 2013). Britain is currently part of the 'in-crowd' with the potential to change and influence regulation and policy. Losing their place at the decision table does not seem like an attractive prospect for the UK who currently maintain influence over these rules: giving up this influence has the potential to raise more problems that it solves.

While it appears that Switzerland gains from the EU by not having to comply with their regulations and policies, in reality however, when Swiss companies trade with the EU on any level it has to adhere to European standards. As Europe is Switzerland's biggest exporting market this has lead to Switzerland adopting most European laws themselves even though they have had no say in them. It is likely that if the UK adopted this model it would end up adopting new EU laws and standards as Switzerland has done.

The Consequences for Europe

One of the European Union's founding members leaving will undoubtedly have a huge impact on the rest of Europe both politically and economically. If the UK decides to leave it would change the landscape of the EU forever.

Firstly, the process of the UK exiting the EU would be burdensome on both the EU's and UK's administrative systems while also taking up a lot of political time and energy. Secondly, a Brexit would have ramifications for Ireland and the Irish economy. Any barriers, even non-tariff barriers, which could arise between the UK and Ireland due to an exit has the potential to put strain on Northern Ireland's already fragile economy and has the potential to impact on the peace process. Irish government representatives have expressed deep concern should the UK adopt a Swiss style relationship with the EU particularly around the implications this could have on Irish-British bilateral relations (Kilcourse in Sanschneider, 2014). It is difficult to know the full extent that a Brexit would

have on Irish-British relations; it seems in both countries interests that their relationship remains the way it stands with both countries members of the European Union.

Finally, even though the United Kingdom has at times been a reluctant member of the EU it has played a major role in forming regulation and policies over the years. It has impacted on European integration for over forty years and was instrumental in pushing forward the free market. There is no doubt that at times the UK-EU relationship has been strained, however, the EU would face a deficit if the UK left the decision making table. There may be less pressure to increase efficiency or reform traditional areas of spending, net payers like Germany would lose significantly in these areas (Zuleeg in Sanschneider, 2014:60). Also, spending on regional funds and agriculture could decline as the United Kingdom contributes large amounts to these funds.

There do not appear to be any benefits for Europe if Britain should decide to leave the EU, however there would be significant losses. It is in the EU's interest to try and persuade the UK to remain as an integral part of the Union and not as a member of the EFTA as its leaving could really throw the whole European project off course.

Conclusion

Although on the surface there are benefits to the UK adopting a Swiss like relationship with the European Union the disadvantages of leaving far outweigh these benefits. Cherry-picking a relationship like the Swiss has it's limits and the idea that bilateralism is a panacea for a prosperous economic future outside the EU is greatly exaggerated (Nünlist in Sanschneider, 2014, p. 66). Both the EU and the UK can gain far more by working together. Herman Van Rompuy perhaps best summarises a Brexit stating that the UK leaving the EU would be like 'a divorce after forty years of marriage … Leaving is an act of free will, and perfectly legitimate, but it doesn't come for free' (Herman Van Rompuy in Miller, 2013). Although the outcome of the referendum is unknown, it is certain that it will have a significant impact on EU. If the UK decides to stay in the EU it shows that the British people have confidence and hope in the EU. On the other hand, if the UK decides to leave the EU the outcome will be complicated and come with many challenges and changes.

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COMPETING AGAINST GERMANY: UNIT LABOUR COSTS IN THE EUROPEAN MONETARY UNION

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In this essay, Jonas Peisker asserts the importance of Unit Labour Costs (ULC) in accomplishing the Jean Monnet's convergence objective. Examining the causes of divergent trends in ULC among Euro member states, most notably Germany's perfectly rational drive for competitive advantage, he concludes that implementation of common wage coordination in the spirit of 'ever closer union' is needed to achieve balance and stability going forward.

Introduction

'Ever closer union'-these iconic words constitute the first paragraph of the Treaty of Rome, forged by Jean Monnet, the intellectual father of the EU. His legacy is the so-called convergence objective that guides the actions of the European Commission to the present day. As a way to facilitate economic cooperation and convergence the third stage of the Economic and Monetary Union (EMU), the common currency, was introduced to 11 countries in 1999. The EMU now faces a prolonged crisis; a north-south divide characterises the economic conditions. Unilateral austerity measures have – unsuccessfully – been employed to mitigate the crisis. Every year it continues the crisis will become harder to solve, as workers, particularly skilled young people, are forced to emigrate in the face of over 50 per cent youth unemployment in Spain and Greece and over 40 per cent in Italy in 2014 (Eurostat, 2015). These are strikingly high figures compared to only 8 per cent of Germans under 25 who face the same predicament. 17 years after its introduction, it seems blatantly clear that the EMU has so far failed to achieve Jean Monnet's vision of a united Europe.

This essay draws an empirical sketch of the developments since the introduction of the euro in 1999. In all calculations 'euro area' refers to the initial 11 euro members plus Greece. First, the institutional framework of the EMU is examined. In order to investigate the effect of diverging unit labour costs (ULC) on price level and its consequences for monetary policy in the euro area, the essay then examines contrasts between Germany, France, and Italy, representative of the broad trends within the EMU. Italy,

somewhat arbitrarily, accounts for the southern European countries as it exhibits a similar trend to Spain, Greece and Portugal. Special consideration is then given to Germany's export strength and labour market policies that are suggested to be the cause of imbalances in the euro area. Finally, the implications for macroeconomic policy in the euro area are derived. It is argued that the trends of the countries in the euro area are divergent, and that only a thorough redesign of the EMU institutions that strengthens supra-national elements can accomplish the convergence objective of the EC.

The Institutional Framework of the EMU

The Eurozone rests on three interdependent institutions (Cesaratto, 2010). Firstly, the Eurozone is an agreement on a common target inflation rate and currency which results in a nominally fixed exchange rate. The euro members therefore forego any independent monetary policy. Secondly, European fiscal policy only exists as a constraint, as a negative concept outlined in the treaties of Maastricht and Amsterdam where, for instance, limits to sovereign debt and price volatility are specified. However, since these provisions are commonly violated they have been degraded to rather vague guidelines. At the same time, growth and national competitiveness is explicitly left to the national and regional level (European Commission, 2014). The ongoing divergence indicates that pursuing national competitiveness strategies without considering the development relative to the other members within a common monetary policy is inherently contradictory.

In systems with flexible exchange rates, external imbalances are buffered by exchange rate adjustments. Countries with trade deficits would depreciate their currency in order to gain competitiveness, while currencies of countries with surpluses appreciate theirs, which makes their goods more expensive to purchase abroad. This, however, is not possible in the euro area due to the fixed nominal exchange rate. Therefore, deflationary policies must lead to an internal devaluation by which the country gains competitive advantage over the rest of the monetary union. The devaluing country is gaining at the cost of other countries who abide by the inflation agreement and thus pursues a beggar-thy-neighbour policy, a nail in the coffin of the common currency. In order to prevent such policies in the euro area additional macroeconomic coordination, particularly regarding the wage levels, is imperative.

Tendency of Divergence

The price level of goods is influenced by the cost of labour as well as capital input. While the free movement of capital eliminates differences in the costs of capital for entrepreneurs across Europe, wages are still determined on national level within the EMU. As a result ULC are the most important determinant of national price levels on the supply side. The ULC measures the nominal cost of labour relative to its productivity per hour.

The national level of competitiveness is then determined by ULC on the supply side in conjunction with exchange rate adjustments on the demand side. Since the latter has has been removed in the monetary union, the ULC has even more importance for the competitive position of countries in the EMU (Bibow, 2013). The divergence in ULC within the euro area is enormous, as annual differences in growth rates accumulate. Since the introduction of the euro the ULC in Germany have increased 37.6 per cent less than in Italy and 13.3 per cent less than in France, a country that is in line with the Eurozone. Indeed, this gap empirically has an effect on the national price development. While France moved along with the average of the Eurozone, Germany undercuts the inflation target clearly and Italy exceeds it, resulting a inflation gap of 14.7 per cent between Germany and Italy.

Germany's Role in the EMU

The policy of wage deflation-more precisely disinflation-in the largest economy of the Eurozone and its according internal devaluation has succeeded in creating competitive advantages on international markets. While France and Italy alternate between periods of trade deficits and surpluses, Germany has accumulated a huge trade surplus since the introduction of the euro. Net exports accounted for 7 per cent of German GDP in 2015, in contrast to 3 per cent in Italy and –1.5 per cent in France.

Additionally, Germany's fiscal prudence contributes to its high current account since, a constitutional debt limit suppresses domestic demand. Germany has exceeded the intra-EU exports of the other member states only since 1999. The German goods, subsidised by low wages, greatly affect the other euro members. The EU imported 6.5 per cent more from Germany than from France before the onset of the crisis in 2008, underscoring the competitive dominance of Germany on the EMU-internal market. Germany's deflationary policy-just as much as unchecked inflation in the southern European countries-has created the immense external imbalances that are at the core of the euro crisis.

Both productivity increases and wage deflation have pushed down ULC in Germany. With the onset of the single currency Germany adopted the latter as a new strategy to tackle its persistently high unemployment. The 'Hartz reforms' re-organised the labour market in 2002 and increased the pressure on workers and wages by imposing sanctions on the unemployed if they turn down job offers, no matter whether those are suitable or not. The threat of sanctions has greatly increased temporary and precarious employment in Germany. 1.3 million German employees depended on unemployment benefits in 2014 because their wage did not even cover their subsistence minimum (Bundesagentur für Arbeit, 2015). The number of employees of subcontractors has increased by 170 per cent to 856,000 from 2002 to 2014 (Bundesagentur für Arbeit, 2015). The upsurge of temporary

and low-wage employment created a labour force that is not able to unionise in order to represent their interest, namely a wage increase in line with productivity and target inflation. As a consequence, both labour costs and inflation stayed low in Germany. Therefore, Germany does not commit itself to the common inflation rate that is so crucial for the monetary union. This is ironic since the ECB was modelled after the Bundesbank.

Implications for the European Monetary Union

The core contribution of this essay to the public debate surrounding the euro crisis is that examining the trends in ULC are essential to understand its roots and possible solutions. What follows is that any strategy that credibly attempts to solve the euro crisis must be fundamentally multilateral in its approach. The implementation of common wage coordination or bargaining is of utmost importance in order to prevent asymmetric demand shocks and external imbalances in the euro area. Flassbeck and Spiecker (2011) suggest that the development of ULC should gradually converge, i.e. ULC growth of 3 per cent annually in Germany and of 1 per cent in the southern euro members while the Eurozone average remains just below 2 per cent, the inflation target of the ECB, like in France. A 'European wage standard' is conceivable to bring Europe back on the path of convergence (Brancaccio, 2012). This standard would induce nominal wage growth to be at least in line with national productivity increases, consider the trade balance, and establish an institution that can credibly enforce compliance. So far very little consideration has been given to the possible implementation of such an institution since this almost certainly incorporates relinquishing national sovereignty to a supra-national body of the EMU.

Two steps could contribute to a sustainable solution to the euro crisis and an ending of competitive deflation. First, the ECB's mandate, closely defined as targeting a 2 per cent inflation rate, must be extended so that it can consider employment and stability besides price stability, because the transition phase suggested by Flassbeck and Spiecker will probably lead to temporarily higher inflation. Secondly, the Eurogroup, the meeting of the ministers of finance and the governor of the ECB, should be institutionalised in order to create a political body that can coordinate macroeconomic policy across Europe. Doubtless, those are the first steps towards a federal Europe since such reforms would have far-reaching implications for wage bargaining and social policy, and these are some of the last policy domains largely untouched by EU law.

Conclusion

There is still an immense scope for literature that examines how such a transition from national to supra-national institutions can be implemented most efficiently as well as how such an endeavour can be communicated within the political process, considering eurosceptics gaining ground in virtually all euro member states. First and foremost, in order

to equip decision-makers with practical advice, the data employed here needs to be disaggregated to differentiate between different sectors within economies, to give indication of the scope and naturof a possible wage standard.

When Jean Monnet advocated 'ever closer union' it was his emphatic narrative that brought Europe together, not strict rational necessity. Indeed, this exceptional project of supra-nationality succeeded in the early years because it was the former and not the latter. It is vitally important for the EMU to find a sustainable solution to its crisis, and the common overarching objective of a united Europe can only be achieved if national developments are balanced. A spirit of 'ever closer union' is what Europe needs once again, because Germany clearly has no incentive to give up its entrenched position of competitiveness out of rational self-interest.

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BEYOND PARANOIA: THE ECONOMICS OF NON-EU IMMIGRATION

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The refugee crisis has received extensive attention this year. In this essay, Kilian Mueller examines some of the common claims about the economic impacts of immigration using a number of theoretical frameworks and previous empirical findings. He follows this theoretical analysis with a discussion of the likely effects of the refugee crisis on Europe going forward.

Introduction

In light of the current refugee crisis the impact of non-EU migration on the European economy has received extensive media attention, with the potential economic outcomes often misinterpreted or misused for cheap populist propaganda. This essay will elaborate on the economic effects of non-EU immigration using a number of different theoretical models and empirical evidence. The second part of the essay will examine the specific economic effects which are expected to follow the recent migration crisis as well as the impact on the European political landscape. The essay will conclude with a summary and an answer, based on the key findings, to the question of whether or not non-EU immigration has to be considered the major threat currently facing the EU.

Immigration, Wages and Unemployment

The common belief in the European Union, that immigration depresses native wages, is only true in the most simplistic neoclassical analytical framework. Under the assumption that wages are determined by competitive forces and labour is homogeneous, the laws of supply and demand imply a rightward shift of labour supply caused by immigration will, ceteris paribus, lead to a lower equilibrium wage.

However, this appears to be wrong under a more realistic theoretical modelling. Firstly, labour is certainly not homogeneous, which means that immigrants can be seen as substitutes or complements to native labour, depending on the immigrant's skills and level of education. Moreover, immigrant labour can be a substitute to some native groups, but a complement to others. If immigrants show a high level of substitutability for native workers the demand for native labour decreases, resulting in lower wages. However, immigrants acting as complements for native workers will trigger a higher demand for native

workers the demand for native labour decreases, resulting in lower wages. However, immigrants acting as complements for native workers will trigger a higher demand for native labour and therefore higher wages (Borjas, 1989). Secondly, in the European Union, wages are to a large extent determined by the structure of the national labour market, particularly minimum wages and tariffs negotiated by unions and therefore the effect of immigrants willing to work for less than the prevailing market wage is restricted (Schmidt, Stilz and Zimmermann, 1994). Thirdly, immigrants themselves create an additional demand for goods and services produced by natives, leading to a rightward shift of demand for native labour and consequently to higher wages for native workers (Zimmermann, 1995).

Empirical findings from Ottaviano and Peri (2011) on the impacts of immigration on the US labour market support this theoretical argument. The key findings of their regression analysis over a period of 16 years suggest a significant negative effect of immigration on the wages of immigrants (-6.7 per cent) where labour has a highly substitutable character, and a small positive effect on the wages of native workers (+0.6 to 1.7 per cent) where immigrant labour has a complementary character.

To conclude this first argument, it should be emphasized that the impact of immigration on native wages depends on the substitutability of native workers and on the interactions between domestic and immigrant labour. Indeed an increase in low skilled immigration which serves as a complement to high skilled native labour is very likely to raise the domestic market wage.

The aforementioned framework with flexible wages cannot account for displacement of native workers by immigrants since at an equilibrium wage unemployment does not exist. Therefore I want to introduce a new labour supply, one determined by a wage negotiated by workers unions and set above equilibrium wage. An increase of substitutable immigrant workers in this framework leads to a drop in wages and a decrease in domestic employment. However, if the relation between union-set labour supply and individual labour supply is proportionate, an increase in immigration does not affect domestic unemployment, but it may certainly increase the total employment in the economy (Baldwin and Wyplosz, 2015). In addition to this, under this framework, immigrants serving as complements to certain native sectors are very likely to even reduce native unemployment (Zimmerman, 1995).

Empirical evidence from Longhi and colleagues (2006) supports this theoretical argument. They used a meta data analysis of 165 estimates of the impact of immigration on native unemployment from 9 different OECD countries, concluding that a 1 per cent increase in immigration amounts to an average decrease of 0.024 per cent in native employment, a negligible effect. In addition Jean and Jiménez (2011) found no significant long-run impact of immigration on native unemployment in their study of eighteen OECD

countries over a period of 19 years. In conclusion, the effect of immigration on native unemployment is unlikely to be significant in either direction and is highly dependant on the modelling choices, in fact is seems that under more realistic models immigration is likely to increase total employment.

Immigration and European Efficiency

The last prejudice I want to examine is that immigrants are a net drag on the domestic economy, in particular on its efficiency, growth and social welfare. First of all, using the simple analytical framework of homogenous labour and competitive wages from my first argument, immigration can lead to a sectorial drop in wages and an expansion of total employment. The result is a net income gain for the economy, held by capital owners (Baldwin and Wyplosz, 2015; Hanson, 2009). This has to be followed by a redistribution of national income to realize an increase in overall social welfare and to achieve Pareto efficiency (Zimmermann, 1995). In a broader interpretation, additional national income can be created by immigrants through the aforementioned complementary immigration and positive spillover effects, realized by immigrants acting as market participants and consumers.

Secondly, migration within the EU is important for an efficient allocation between labour and capital (Baldwin and Wyplosz, 2015). Non-EU Immigrants can serve as 'a flexible reserve to compensate the low mobility of natives' (Zimmermann, 1995:53) and increase the efficiency in the European labour and capital market.

Thirdly, non-EU migration can be an important counteracting force for expected demographic change within the European Union. Low fertility rates and a higher life expectancy have led to an aging population and a decline in population growth in the European Union. Non-EU migrants tend to show higher fertility rates than natives and constitute a disproportionately high share of Europe's working age population between 25 and 64 (Cuaresma et al., 2015). As a counteracting force for the demographic change, immigration promotes human capital accumulation with positive effects on economic growth. Immigration also increases the tax base, spreading the tax burden with positive effects on social welfare and the intergenerational contract (Hanson, 2009; Cuaresma et al., 2015).

To conclude the theoretical point, non-EU migration is by no means a net drag on the European economy, but rather could be viewed as a means of increasing economic efficiency and adding to the accumulation of human capital to promote economic growth and increase social welfare.

Reality of Current Migrant Crisis

As of mid-2015, the civil war in Syria and uncertain political conditions in the Middle

East and North Africa had forced an estimated 15.5 million people to leave their home country as refugees. Out of those, 3.5 million fled to Europe to seek asylum within the European borders (UNHCR, 2016). This massive inflow of refugees has added a new dimension to the economic and also political impacts of non-EU migration.

Economically, the OECD Economic Outlook (2015) estimates that additional public spending for newly arrived refugees as well as public long-term support for asylum seekers in 2016 and 2017 will boost aggregate demand in the European Union by 0.1 TO 0.2 per cent of GDP and therefore will likely increase national income and social welfare. The aforementioned labour market effects will probably build up gradually since labour market integration of current refugees takes a certain amount of time. By the end of 2016, refugees will make up less than 0.4 per cent of the EEAs total labour force (OECD Economic Outlook, 2015).

Kai Arzheimer (2008) developed a regression model, using data from the European Social Survey Project in 2003 to analyse the motivations of extreme right voters in Europe. His key findings suggest that anti-immigrant sentiments, especially beliefs regarding their negative impactson the labour market and on the economy in general are some of the main motivations for European voters in voting for extreme right parties (Arzheimer, 2008).

In the light of the extraordinary increase in recent non-EU migration, the latest regional election outcomes in France and involvement in government of populist right wing parties in Poland, Hungary, Switzerland and Finland reveals a dramatic rightward shift on Europe's political landscape, fuelled by a fear of immigrants that seems to be economically irrational (The Economist, 2015). Besides their negative views of immigrants, Europe's far right parties either push for regional autonomy (Belgium's Vlaams Belang and Italy's Northern League) within the EU or they completely reject EU membership (UKIP, Finns Party, Front National). They all have one thing in common: a pronounced euroscepticism combined with strong claims for national sovereignty, which is endangering the European Union and the process of European integration which lies at its core (The Economist, 2014).

Conclusion

In conclusion, I want to stress the three main findings of this essay. First of all, as discussed extensively in the first part, the labour market impacts of immigration are ambiguous and very likely to be positive, but also very dependant on the modelling choices. Moreover, the impacts on the overall economy are most likely stimulating. Both points can be proven through conclusive theoretical reasoning and empirical findings. Secondly, even though Europe is facing an extraordinary increase in non-EU migration the effect of those migrants on the European economy has to be seen as a chance for increased prosperity rath-

er than a threat, at least from an economic point of view. Finally, on the political level, Europe is experiencing a rise of right wing populism, which is very likely being fuelled, at least in part, by ill-informed prejudice against immigrants. This failure in public relations, or more precisely the established parties' failure to communicate the economic opportunities of immigration is leading to a return to nationalism and euroscepticism, which this essay argues is endangering the future of the European integration process and therefore has to be seen as the biggest threat to the European Project that has arisen in recent years.

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The Last Resort: The EU's Rocky Road To Quantitative Easing

Ellen Brennan
Junior Sophister

With the European Central Bank having commenced a programme of Quantitative Easing (QE), roughly six years after the United States, Ellen Brennan examines this scarcely used measure. Involving high investment and relatively low returns, she describes QE as unreliable and potentially fraught when implemented in an economy as varied as the EU. Emphasising the lack of integration within the EU countries with respect to monetary and fiscal policies, she describes potential pitfalls but also the possible rewards rewards of a well-implemented programme of QE.

Introduction

In 2012, the president of the European Central Bank (ECB), Mario Draghi, promised to do 'whatever it takes' to save the shared Euro currency from ruin (Draghi, 2012). This promise came to include the controversial implementation of quantitative easing (QE). There remains little to no consensus amongst experts as to whether QE truly helps or hinders an economy. Despite such uncertainty, some of the world's largest economies implemented QE as a last resort to revitalise their struggling economies following the global financial crisis which shook the world in 2008. It took 6 years for the EU to follow in their footsteps. In the early stages of 2016, less than a year into the ECB's first ever attempt at QE, the outcome of this contentious and arguably desperate policy is still unclear. However, it is clear that the EU has an economy like no other. The sheer size, not to mention the multifaceted and ever changing nature of the EU economy, poses unique challenges to implementing a one size fits all monetary policy, such as QE. As the deadline for the ECB to end QE draws nearer, the success of this unusual policy and likewise the future of the single currency relies almost exclusively on further integration of the EU, both economically and politically. This essay will explore the intuition behind QE, drawing from the experiences of the US, UK and Japan, to highlight the importance of further integration for the future of the EU economy.

No Interest in Quantitative Easing

The basic assumption behind all monetary policy starts with the central bank making small changes to the nominal interest rates in the short term. The effect of this leads to changes

in asset prices, which then drives further economic decisions in the marketplace, such as whether consumers buy a house, firms invest and banks lend. When an economy starts to lag, monetary policy is one of the simplest and most effective ways to get things back on track. However, sometimes this short-term fix isn't enough. As Keynes warned, once interest rates tend toward zero, the economy is ensnared into a liquidity trap and thus conventional monetary policy is essentially useless (Keynes, 1936).

This is the predicament in which the European economy found itself in the years following the crisis. When economies reach the lower zero bound, central banks, including the ECB, have few other options but to accept the last resort of QE. It's essentially gambling. Central banks buy up long-term assets, like bonds, with money they do not really have making a bet that their bluff will pay off. This money, created out of thin air, increases the size of banks reserves allowing them to give out more loans, effectively bypassing the issue of lower short term interest rates (Coenen *et al.*, 2004). It is meant to have the same stimulating effect as conventional monetary policy by altering the monetary base in the economy rather than the nominal interest rates. However, as many economists warn, nothing is guaranteed. It is possible that unsecured overnight lending rates will plummet to zero, there will be record low government borrowing rates and uncontrollable inflation paired with low confidence. Furthermore, unconventional monetary policy, like QE, was basically unheard of before the crisis and no two QE programs since have been the same. What limited QE programs there have been vary significantly among economies depending on the specific aims of the central bank as well structural differences, effectively making each new attempt at QE a shot in the dark. While the outcomes of the most recent QE programs in the US, UK and Japan seem to have at least helped a little, the jury is still out.

Peer Pressure

On a global scale, the European QE program is late to the party. In 2001, the Central Bank of Japan (BOJ), followed in 2008 by the US (Fed) and UK (BOE), began purchasing government bonds, asset backed securities and equities to stimulate their struggling economies. Figure 1 shows the interest rates of each of these central banks from 1999 to 2015 converging towards 0 as a response to the crisis. The crisis policies of these nations not only prompted the ECB to adopt its own QE program in 2015, but also deliver important insight into the future of the ECB's policy.

The ECB announced the first bout of QE, buying securities from EU institutions and agencies, in 2015 christened the Public Sector Purchase Programme (PSPP) (Claeys *et al.*, 2015). So far, the ECB's approach to QE has mirrored the Japanese program the most. The ECB chose to focus more on lending money to banks in the EU rather than buying significant amounts of bonds outright. Japan is no stranger to QE as the first coun

try in the world to officially attempt it. The ECB can learn a lot from Japan's 'Abenomics' (Ito and Mishkin, 2006). It's clear from Japan's massive investment, equivalent to €1.3 trillion, that the ECB might be playing it too safe. For QE to work, especially in a bank centric economy like the EU's, the banks must be flooded with excess liquidity, as Japan did in 2001 and 2006 (Bowman *et al.*, 2011). The ECB has committed to investing €1 trillion into its QE program. While this is a significant amount of money, as the world's largest economy, the EU should be investing much more than the world's 5th largest economy. Proportionally, the numbers do not add up, which means the ECB is going to have to be prepared to create a lot more money to reach its targets in the long term. Furthermore, Japan's relapse into another QE program has shown that QE is not a permanent fix. When there are unattended structural failures, like Japan's aging population, the issues will never completely go away. Until Japan and the EU attend to other such issues inherent in their economies this won't be the last time they're forced into QE.

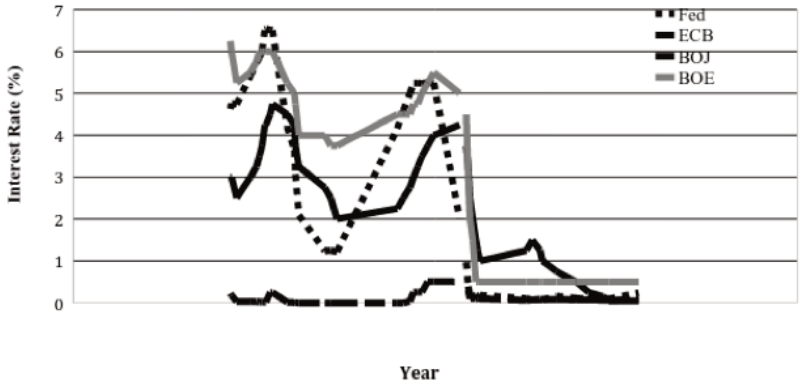

Figure 1: Key Policy Rates from 1999 to 2015 (Source: ECB main financing operations, FED federal funds target rate, BOJ uncollateralized overnight call rate, BOE official Bank rate)

The lessons from the US and UK are pertinent as well. The Fed went through three rounds of QE, starting in 2008 when the housing bubble burst, acquiring a total of $4.5 trillion in securities (Appelbaum, 2014). The recovery the US experienced at the end of their program, while impressive, represented only a fraction of the money that was put in. The same was seen in the UK whereby GDP increased by 3 per cent of the original QE spending (Monaghan, 2014). QE is subject to diminishing returns, so investment in the EU should be exponentially higher than the results the ECB expects to obtain. Thus, instead of worrying about the effects of too much new money, like out of control inflation, the ECB should prepare itself for the effects of not enough, like the stagflation felt in the US, UK and Japan. The experiences of those who attempted QE before the ECB are sobering.

They reaffirm what economists have been saying this whole time: QE is unreliable at best. While it's still up for debate whether these cases can be considered successes, the ECB should pay close attention if it hopes to experience anything close to their recovery.

An Ever Closer Union

The European Union is a one-of-a-kind institution so, while comparison to other nations is useful, QE poses unique problems within the EU. The majority of these can be traced back to a lack of integration within the EU project. The Vice-President of the ECB, Víctor Constâncio, noted, 'The lesson from the crisis is quite clear, namely that we need more integration within the monetary union' (Constâncio, 2015). While politically this sentiment is less popular, the fact that the EU has been forced into the last resort policy of QE is evidence enough that integration is lacking. Furthermore, the longest recession in Europe's history would not have happened if the EU's Economic and Monetary Union (EMU) were fully functional. While the Five Presidents' Report sets out goals to reach a fully integrated economy in the coming years, the economy must make some pretty major changes soon to see real growth from QE.

Currently the EU functions more like separate countries with a trade agreement than one streamlined economy. In federal systems, investment into public goods, like technology, is an integrated group effort among states. In the EU, investment is still very decentralised (Cottarelli and Guerguil, 2014). QE is the perfect opportunity to invest significant amounts into infrastructure and technology, as many bail out packages do. As of now, the PSPP leaves much of the purchasing up to national banks, which have acquired mostly sovereign debt and agencies such as French social security debt (CADES). As Figure 2 shows, the majority of purchasable debt made available by the ECB is sovereign.

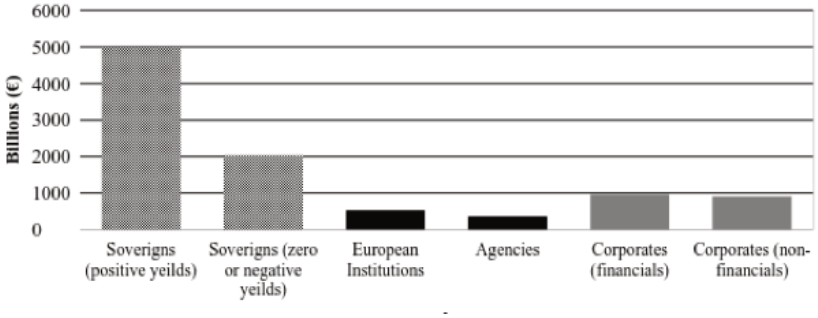

Figure 2: ECB's Purchasable Agencies and Institutions (Source: ECB)

While safe investments, these do little to promote long-term growth and innovation. The ECB should take this opportunity to promote further integration of investment in the EU and focus its spending on agencies like National Promotional Banks or aspects of the Junker Plan, which will contribute to the long-term growth and, in turn, ensure QE succeeds.

With innovation centralised the EU can overcome intrastate competition. Policies like Ireland's low corporate tax rate highlight the inwardly focused nature of member state economies. This mind-set takes the focus away from the competitiveness of the EU as a whole. By coordinating fiscal policies between members, levelling the playing field, the effects of QE will be felt much more consistently throughout the EU. This means sharing risk, making big fiscal decisions together and creating regulations on policies that give one state an unfair advantage. As Benoît Cœuré said in his speech to the ECB, 'we cannot advocate a Europe of solidarity while believing that the economic policies of each euro area country are the business of that country's parliament alone' (Cœuré, 2015). Likewise, when the national economic goals of states are aligned with the supranational goals of the ECB, QE will have a much greater chance of increasing growth and stability in the region. This also means further integration of the European banking sector. Creating a more streamlined and accountable banking union will ensure not only that QE can be effectively implemented everywhere, but also that a recession of this magnitude will never happen again.

Finally, the EU must stand by and protect the integration it has fought hard to achieve, namely, the Schengen Agreement. This is the cornerstone of the economic union and an important aspect of maintaining the optimum currency area in the region. Without free movement it will be very difficult to increase production and growth through QE. The influx of refugees, currently seen as the threat to the Schengen agreement, will actually help the EU's long-term growth according to the head of the IMF (Lagarde, 2015). They will replace an aging population of workers and add to consumption and investment in the medium and long term, the very goal of QE. The EU's PSPP has quite a few roadblocks to overcome before the region sees meaningful change. While much is still uncertain, the EU is on the right track with their new goals to fully integrate the EU economy in the coming years. Time will tell whether this will be enough to make QE, and the euro, a success.

Conclusion

QE remains somewhat of an enigma. While vast amounts of research have been done on the subject, its use in the real world remains limited. The Chair of the Fed, Ben Bernanke, famously joked in 2014, 'The problem with QE is it works in practice but it doesn't work in theory' (Bernanke, 2014). However, this remains to be seen. Without counterfactual

data on QE it's impossible to truly say that QE 'worked'. Thus the international community may have to remain split on the matter forever. Regardless, the real merit of QE lies in the fact that it can be used when nothing else will work. Like it or not, in times of crises QE is the last saving grace available to struggling economies. This is the circumstance that led the EU, rather contentiously, into its QE program in 2015. Less than a year into the program the ECB can still learn a lot from those who have attempted QE before.

Primarily, that the ECB must be prepared to significantly increase its spending if it hopes to reach anything close to its goals of near 2 per cent inflation and lower long-term interest rates. Furthermore, for QE to be a success for the European community and never be necessary again, further integration of the Economic Union is vital. The economies of the EU must become more centrally focused with shared fiscal goals, more regulation on policy and banking, and EU wide investment starting with the money QE has created. It must also be steadfast in protecting the integration already in place and not let the high unemployment and stagnant economy dismantle the amazing success of the EU project. While the EU is on rocky road to recovery, all is not lost. If the EU can attend to the structural issues plaguing the economy QE will remain an unconventional monetary policy.

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Why The Market Cannot Roam Free In EU Fields

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The EU is often criticised for the breadth and complexity of its Agricultural programmes, however in this essay Aisling Kirby presents a strong argument in favour of the EU's involvement in this market. The Agricultural sector currently faces two main challenges; moving to a more environmentally mode of operation and securing future food supply for an increasingly urbanised population. She argues that the unique challenges facing the agricultural industry, as well as its vital importance, necessitate centralised decision making by the EU.

Introduction

Europe's record as an Agricultural economy is impressive. There are currently 12 million full-time farmers within the EU-translating into 46 million jobs for the agri-food industry (European Commission, 2013). The new Common Agricultural Policy (CAP) and Europe's expanding dairy sector in a post-quota era illustrate the growth of a sector driven by centralised decision making. This essay seeks to provide reasoning as to why a laissez faire approach cannot be adopted for this 'distinct sector' (O'Hagan and Newman, 2014). The market's inability to protect the environment and the necessity of ensuring a secure and safe supply of food means it is essential to have a common set of policies in place. In addition, a centralised approach promotes the development of rural areas, often ignored by the market.

Environment

Increasingly severe climate change requires a European approach be favoured over national decision making. If left in the hands of individual member states the progress needed to deal with the 'major threat' that the UN have warned climate change poses will not be achieved (UN, 2015). The environmental issues that can only be adequately addressed at an EU level are many and varied. In the case of agriculture switching to a more environmentally sustainable model of farming creates short term profitability limits and must therefore be incentivised. Increased unit production costs and lower yields have meant that only a small proportion of Europe's farming community have transformed their farm enterprises to become more environmentally friendly. However the existence of past

schemes like REPs have allowed a greater emphasis to be placed on the conservation of natural features and permitted farmers to operate in a more sustainable manner while remaining viable. Under CAP reforms the new 'Green Payment' will continue to support these initiatives,. Without centralised EU decision making increases in productivity would continue to overshadow the need for greater environmental responsibility.

Weather

Adverse and extreme weather conditions are already hampering Europe's agricultural sector as member states grapple with the external threat that weather poses (Fitzgibbon, 2015b). These adverse weather conditions have significant negative economic implications linked to the production and distribution of agricultural products as decreasing soil fertility and a rising number of plant diseases. (Guha-Khasnobis, Acharya and Davis, 2007). These adverse weather patterns increase the already considerable risk involved when investing substantial amounts in farm inputs and this high level of risk both justifies and necessitates intervention by the EU, given the importance the agricultural sector and its continuing development.

Energy

Agriculture and Energy are becoming increasingly interlinked, creating opportunities for the EU overall. Within the EU, energy policy is directed at a national level as governments 'like the clout of national energy markets' (Economist, 2015). Given Europe's lack of control regarding energy policy, central decision makers have the opportunity to exercise a greater influence on energy provision through the agricultural industry. On farm diversification has increased due to rising farm incomes making more money available for investing in new ventures and technologies. Solar panel farms, which have been successfully introduced in France and are beginning to come into operation in Ireland, allow for great economic efficiencies to be leveraged while also providing environmental gains (O' Riordan, 2015).

Europe is coming under increasing international pressure to take action on climate change, as highlighted at the COP21 talks, and centralised agricultural policies mean that member states can not only benefit in the long run through a cleaner environment but also in the short to medium run as this new mechanism allows for multiple land uses. The continued existence of a common agricultural policy within the EU will enable the sector to engage in meaningful environmental stewardship going forward.

Population

The demographic challenge facing the farming industry faces raises issues regarding the

security of food supply, with only fourteen percent of EU farmers under forty and thirty percent over sixty-four (Fitzgibbon, 2015). Even more worryingly, more than half of Europe's farmers will retire within the next ten years. Given the scale of this demographic challenge the market, and the importance of securing future food supply the market cannot be relied upon to tackle this problem.

Attracting Young Talent

According to the Guardian, 'access to technology or finance could improve and infrastructure developed, but none of these efforts will secure food security if we do not entice more young people to enter into farming' (Guardian, 2015). Young people seeking to enter the industry face many many barriers and while the new Basic Payment Scheme seeks to address several of these this 'carrot' may not be enough to tempt young people into a sector with high entry costs and difficulties with transferring ownership. The failure to attract young talent is a short run problem as well as a long run danger as an agricultural sector dominated by a more mature demographic will be less enthusiastic about introducing new forms of technology, such as robotic milking parlours or developing their farms infrastructural capacity. It is therefore vital that agriculture is promoted as a viable career option for young Europeans and it has to be incentivised through common policies like the Basic Payment Young Farmer Top-Up Scheme.

The Field

Three quarters of the European Union's population now live in towns or cities (European Environment Agency, 2013). This trend is projected to continue and is reflective of a global pattern. By 2050, there will be over 2 billion more people, all of whom will need food, which could drive up prices by forty to fifty percent (Vidal, 2013). In order to meet huge increases in demand the Agricultural sector will need to make large productivity gains and the current Eu model has an advantage here. Common policies provide a platform for the twenty eight member states to benchmark themselves against, sustaining economic competitiveness within the sector and pushing farmers to innovate.

The majority of this increase in demand will come from outside Europe, and the agricultural sector will likely see increasing exports in the suture. As superpowers like China continue to develop economically they are also becoming more westernised and the demand for protein laden food products traditionally associated with the European agricultural sector, (which has already risen in recent times) will continue to rise. The CAP allows European farmers to benefit from increased economies of scale and to compete on an international platform. Trade agreements like the Transatlantic Trade and Investment Partnership will ensure that The EU's agriculture sector has markets for its produce. The EU's involvement is essential for maintaining vital trading arrangements,

as evidenced by the United States' unwillingness to 'do business' with individual countries (Donnan, 2015).

Rapid Change

The changing nature of geographical and social patterns has led to an increase in the female labour force participation rate, a fall in leisure time and rising incomes. This urbanisation has caused changes to eating habits, a rising number of well-educated consumers and an increased awareness regarding the nutritional, health and ethical decisions being made. It is therefore crucial that the EU ensures food safety remains a primary agricultural policy to protect both consumers and the agri-food industry. The EU exports €85 billion worth of food and drink each year and, as consumers grow increasingly conscious of food origins, needs to maintain a reputation for having the most stringent food regulation in the world (EC, 2013). If left in the hands of each member state the need for traceability, food safety and labelling will be come into conflict with the desire to maximise profit.

Just as a market led approach does not adequately safeguard the consumer against threats to food safety it fails to place importance on reducing food waste. Again European intervention is needed here as the market and individual countries are not sufficiently motivated to take action, despite the scale of the problem. In a world where 1 in 7 people suffer from food poverty, 1.3 billion tonnes of food is wasted globally every year (Food Cloud, 2016). This issue must be tackled in order to minimise environmental damage and economic losses in the future. More social enterprises like 'Food Cloud' need to be set up and further measures introduced in order to realise the European Commission's (EC) target of reducing food waste by fifty percent by 2025 (EC, 2014).

Rural Development

Migration to large towns and cities is now a common feature within member states and is posing new challenges for rural areas to manage. Similarly to patterns seen in the provision of broadband and transport, without market intervention the economic viability of less densely populated rural locations would be under increased threat. A centralised EU approach has and continues to ensure that, through the CAP, rural development remains at the forefront of agricultural policy decisions. Agriculture remains the largest economic and social driver outside of urban areas (O'Hagan and Newman, 2014) and the direction the sector takes going forward will have a powerful impact on rural life and development. In addition, a European wide structure supports the family farm model, sustaining communities and providing a cushion against a market that favours the development of tertiary sectors.

Conclusion

It is difficult to envisage how individual member states can overcome the challenges facing the agricultural sector within an increasingly globalised environment. Agriculture is uniquely exposed to a number of challenges which provide economic justification for a centralised decision making process to remain in place. The EU must act to lessen the negative impact the sector has on the environment through incentivising more sustainable methods of farming. In addition, a centralised approach is necessary to ensure that the de-population outside of urban centres is managed through sustainable rural development. An ageing demographic, unpredictable weather patterns and rapidly changing consumer preferences pose threats that are best dealt with on an EU level. The Agricultural sector's exposure to significant volatility and a plethora of external difficulties provide economic justifications for protecting an industry which provides one of our most basic human needs. EU farmers are hungry for exactly the same thing as the consumers of farm outputs: food.

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AGENCY THEORY AND IMPLICATIONS FOR FIRM FINANCING DECISIONS

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In a lucid treatment of agency theory, which considers the relationship between two parties, 'the principal' and 'the agent', Colm Ryan comprehensively addresses the issues, specifically the costs, arising from the relationships between stockholder-managers and debtholders-stockholders. By showing that decision makers in these instances operate at the optimal level of efficiency given the constraints of reality, this paper furthers the discourse surrounding perfect rationality in contrast with its 'bounded' counterpart.

Introduction

Agency theory, a cornerstone of management theory, considers the relationship between two parties; 'the principal' and 'the agent'. Having been the subject of many authors, including, Myers (1977) and Smith and Warner (1979), agency theory has been examined rigorously in the context of firm financing. Perhaps the most significant contribution to the field came from Jensen and Meckling (1976) who defined the principal-agent relationship as:

> *'A contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent.' (Jensen and Meckling, 1976:308).*

They go on to note that if both the principal and the agent are utility maximisers then probability would suggest that the agent will not act in the interests of the principal. This is due to the agent pursuing goals which maximise their own utility. So agency issues and therefore agency costs arise due to asymmetric information. This asymmetry then further gives way to moral hazard. If the principal knew every decision the agent made there would be no agency issue. Thus the agent must be monitored however perfect monitoring is impossible due to the high costs involved in doing so. Agency costs are borne by the principle and are involved in resolving principal-agent conflicts of self-interest.

Agency costs consist of three parts; financial costs, the costs of monitoring the agent to the principal and finally the loss of wealth the principal suffer as a result of the

the agent pursuing goals which are not in the principal's interests within an imperfect contract. The third and final cost is highest when the first two are minimised.

Jensen and Meckling (1976) asserted that firm behavior is an aggregate function of the contracts within the firm. Contracts are framed to minimise agency issues. They further contend that firm behaviour is the aggregate equilibrium of a complex set of variables. This essay will examine how decisions regarding firm financing are the aggregate equilibrium result of agency issues and costs. In particular it will be noted how companies make acquisitions that are not maximising for the shareholders of firm itself but also how bond warrants and indentures are the result of agency issues.

The Debt/Equity Choice

Along with factors such as tax incentives and ease of access of funds, the choice of source for firm financing can be driven by agency theory. Figure 1 below outlines some of the key Principal-Agent relationships that can be at play within certain types of entities. Perhaps the most interesting of these entities are the publicly held corporations. Jensen and Meckling (1976) observed that the larger a firm becomes, the larger the agency costs accrued. This is due to monitoring being inherently more expensive and difficult in large organisations.

Entity	Principals	Agent(s)
Publicly-held corporations	Stockholders	Managers
Publicly-held corporations	Debt-holders and other lenders	Stockholders
Publicly-held corporations	Consumers	Firm
Closely-held company	Lenders to the company	Owner-manager(s)
Limited partnership	Limited partners	General partner(s)
Leveraged buyout fund	Investors	Fund manager

Figure 1: Principal-Agent Relationships (Source:Emery D.R. and Finnerty J.D, 1991:221)

Outside Equity

A privately held company's actions will be the result of utility maximisation of the sole owner-manager. This utility maximisation will be dependent upon their preference for consumption i.e. does the manager get satisfaction from company profits or from job benefits such as a nice office. Jensen and Meckling (1976) formalised this rationale by noting the situation where the owner-manager to sell equity to an outsider. As the owner-manager's share in the firm falls his/her claim on the residual profits falls. Thus the owner-manager, as a utility maximiser, will use firm resources to gain perquisites in place of

profit. The conflict between owners and managers takes four principle forms (Masulis, 1988); (i) managers favour greater privilege levels and lower effort levels so long as they do not have to pay for the full costs (ii) managers favour less risky investments and lower leverage to lower the probability of bankruptcy (iii) managers prefer investments with short time horizons at the expense of more profitable long term projects (iv) managers prefer to minimise the chance of them being terminated which increases in probability with corporate control.

Figure 2 below outlines a scenario for a one hundred per cent equity financed project, if it were to be financed entirely by an owner-manager or by an owner manager and outside equity. The expansion path OBZC denotes were the project entirely financed by the owner-manager. Point C on this graph shows the point at which any additional investment will not be beneficial to the firm's value. The curve OBZC also may be considered as the scenario whereby agency costs equal zero and monitoring costs are zero. This would be the ideal scenario.

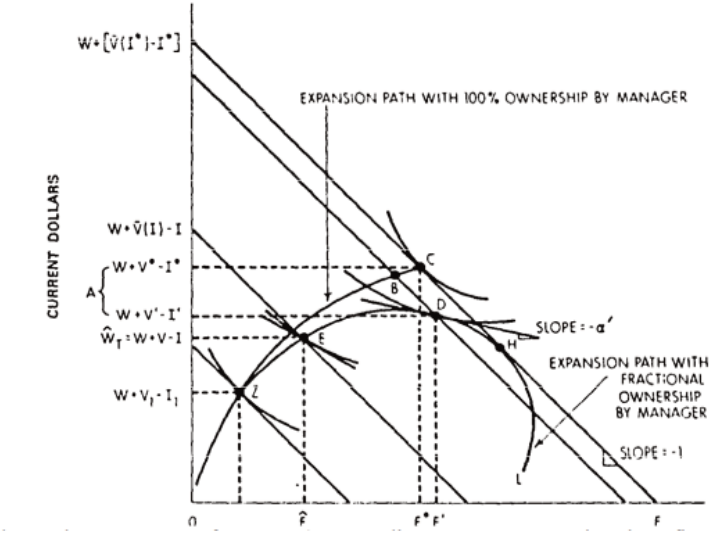

Figure 2: Equity Financed Project (Source: Jensen and Meckling, 1976)

Alternatively curve ZEDHL denotes a potential equilibrium path for the owner-managers non-pecuniary benefits at each level of investment. At points E and D his remaining claim on the firm is equal to his indifference for these factors. As we move along ZEDHL his claim on the residual value of the firm falls as the manager raises more capital. This curve shows his complete opportunity set for combinations of wealth and non-pecuniary benefits

given the costs of the agency relationship. The area highlighted by 'A' shows the probable agency costs for a similar level of investment. Agency costs in this case will equal (V*-I*)-(V'-I').

This quite technical analysis by Jensen and Meckling is underpinned by a number of assumptions, which do diminish the real life validity of the theory. For example this scenario assumes that debt is unavailable, there are no potential convertible bonds or preferred stock and all taxes are zero. However while flawed, the analysis highlights the effects agency issues may have on an entirely equity financed firm. Ultimately the manager will stop increasing the size of the firm when the incremental gain in value is offset by the incremental loss involved in the consumption of additional benefits due to his/hers declining interest in the firm. To limit this undesirable behavior from managers' principles may engage in bonding or monitoring.

Monitoring and Bonding

As previously mentioned a principal can encourage an agent to behave in a desirable fashion through incorporating appropriate constraints, incentives and punishments in their contracts. Monitoring however is a cost of the principal-agent relationship. Figure 3 below illustrates the tradeoff scenario faced by the owner when deciding to monitor the agent. Point M denoted the point at which monitoring is optimal. At this point they will benefit from monitoring the agent i.e. revenue gains resulting from goal congruency. Their overall welfare however will not increase as much because they must forego some level of non-pecuniary benefits they previously enjoyed when they did not monitor the agent.

If the manager were able to put aside firm resources to guarantee to equity shareholders that he limited his behavior this would take the form of 'bonding costs'. These take the form of contractual obligations whereby the manager would have the financial behavior of the firm audited by an accountant and also contractual limitations on the manager's decision-making power. The audit/limitations bonds the manager against any wrongdoing. The costs of this however may be that the manager cannot make certain decisions that would benefit the firm. Ultimately the resulting cost of equity is then the stock price plus the cost of actually monitoring the agent or it is the stock price appropriately discounted to the amount of D-C (denoted by point M in figure 3) for the monitoring and bonding costs.

Finally figure 4 below denoted the three possible scenarios of one hundred per cent ownership by management, factional management ownership with bonding and monitoring and lastly fractional managerial ownership without bonding or monitoring.

In a perfect hypothetical world we would be at point C where agency costs were zero and as such so too were monitoring costs. However the reality is that without monitoring or bonding we reach a point such as D. Thus owners are left with no other option

than to monitor agents and reach point G on the above Figure 4. Debt financing is an alternative to outside equity fundraising and may also be viewed as a form of bonding.

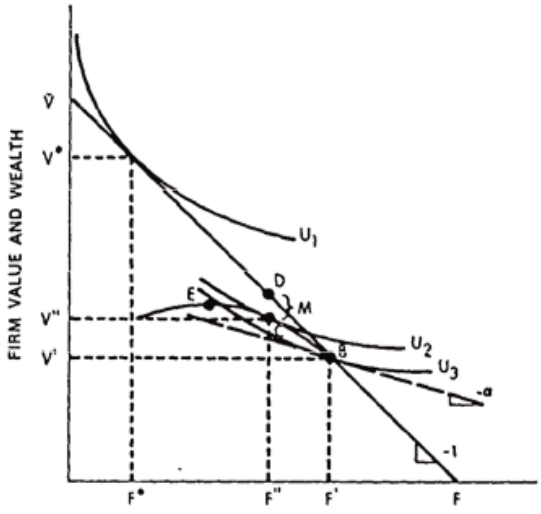

Figure 3: Market Value of Manager's Expenditures on Non-Pecuniary Benefits (Source: Jensen and Meckling, 1976)

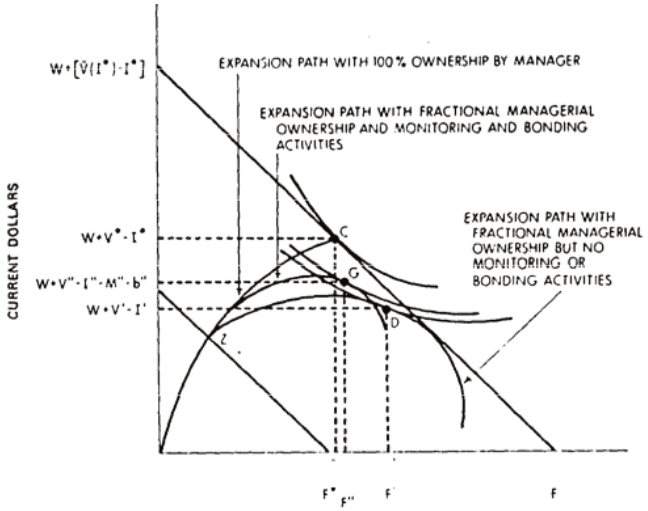

Figure 4: Market Value of the Stream of Manager's Expenditures on Non-Pecuniary Benefits (Source: Jensen and Meckling, 1976)

Debt

By issuing debt 'management deliberately changes its incentives in such a way as to bring them into line with those of the shareholders (the principle)- because of the resulting effect on market value. In other words… the management bonds itself to act in the shareholders interests' (Williamson, 1998:109). There are benefits to debt financing such as it avoiding share dilution, signaling better opportunities and the bonding reasoning outlined above. There is of course also the tax benefits generated from debt.

However debt issuing also creates a Debtholder-Stockholder agency problem. Debtholders have the senior most claims on the firm's assets. Meanwhile stockholders have residual claims on the firm's assets after debtholders and bondholders are repaid. In this scenario debtholders may be viewed as the principals who must protect themselves from the stockholders or the agents. This agency problem takes four major forms: (i) asset substitution (ii) under investment problem (iii) claim dilution (iv) asset uniqueness (Emery, 1991). Agency costs associated with debt include the cost of monitoring or bonding the agent and also bankruptcy and reorganisation costs. For the most part owner managers incur the agency costs of debt (Jensen and Meckling, 1976).

Asset Substitution

As outlined above managers will try to maximise their utility from shareholders. So too does this problem arise when faced with debtholders. Managers and shareholders will attempt to transfer bondholder wealth into shareholder wealth. The shareholders may elect to pursue projects that benefit them i.e. generate firm value through increasing the share price.

However, Jensen and Meckling contend that potential investors are aware of this and as such when bonds are being issued they are immediately discounted accordingly. This prevents shareholders from benefitting from such detrimental behavior. Debt/equity conflicts may further be reduced through bond covenants but the effectiveness of this is dependent upon the contracting phrasing (Masulis, 1988). Smith and Warner (1979) observed that issuing convertible debt limits shareholders from conducting such behavior, as were they to do so the benefit may be offset through share dilution. Further debt features such as call options and secured debt limit asset substitution. However the partitioning of debt into these differing forms of asset classes further develops an agency issue but now amongst debtholders (Masulis, 1980).

Propensity towards asset substitution is further dependent upon the firm's asset composition. Myers (1977) argued that the more growth assets that a firm has, the easier it is to manipulate a firm's market value to benefit stockholders at bondholders expense. He contended that firms with greater growth asset had greater conflicts of interest and thus bears greater agency costs than firms with small amounts of growth assets, ceteris-

paribus.

Under Investment

This issue in a sense is the opposite of the asset substitution problem. Under investment occurs when positive Net Present Value investments are rejected because the benefits of the project accrue to bondholders. Smith and Warner (1979) observed that bondholders could specify in bond indentures specific investment policy. They noted however that this was rarely the case in reality. They observed that firms would be foregoing the opportunity cost of freedom of investment and as such deem debt issuance too costly in that scenario. Smith and Warner use the 'Costly Contracting Hypothesis' to predict that firms with a high propensity for mergers will allow fewer restrictions on investments within their issued bond's covenants. Ultimately a debt call provision would partially relieve the risk of asset substitution or under investment (Thatcher, 1985).

Claim Dilution

Litzenberger (1986) found that in two cases of capital restructuring when the announcement of large increases in debt associated with these actions it appeared to cause a decrease in the market values of company debt issues. Lehn and Poulsen (1989) observed that in the event of a leveraged buyout non-convertible debt holders did not share in the price gains of common stock holders and debt holders experienced a rating reduction.

Asset Uniqueness

As claimants to the assets of the firm the debtholder will likely prefer to charge a premium for highly specific investments. Assets that are unique tend to have more risk associated with their disposal due to a niche market. Knowing this the firm may opt to invest in assets that are less specific (Williamson. 1988). This is however dependent upon the marginal benefits of using less specific assets being greater than the marginal costs of using highly specific assets.

Though perhaps dated, Smith and Warner (1979) observed how standard covenants protect bondholders in each of the four types of actions outlined above. They found that in a sample of eighty-seven indentures filed in 1974-1975 91 per cent contained restrictions against the issuance of additional debt, 36 per cent contained restrictions on the disposition of assets and only 23 per cent contained restrictions on dividends. They finally noted that firms in weaker financial positions have stricter protective covenants. One must assume then that these bonds are discounted for the given level of risk unaccounted for by protective covenants.

Implications for Firm Financing

A firm will have a preference for its mode of financing. Myers (1977) noted that this 'pecking order theory' dictates that firms rather internally finance projects. Then when this option is exhausted they will finance with debt or a hybrid convertible bond and then finally they with equity. Figure 5 below illustrates the factors CFOs consider when issuing new debt for project financing. We can see financial flexibility plays a major role for decision makers. Ultimately financial flexibility (debt covenants, timeliness of payments, discount rates) will be dictated by how the market interprets the need for monitoring. As such the financing costs can clearly be linked to the severity of agency problems within the firm.

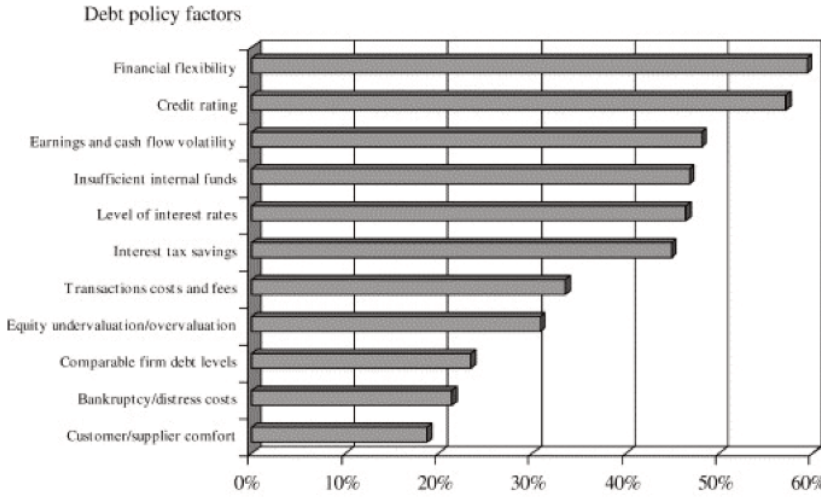

Figure 5: Percent of CFO's Identifying Factor as Important or Very Important (Source: Graham and Harvey, 2001)

Figure 6 below illustrates the tradeoff model, which shows that the value of the firm is optimal where agency and insolvency costs are offset by a favourable tax shield/ subsidy. Ultimately the optimal level of debt is that where by the marginal benefits of debt financing outweigh the marginal agency cost and this too outweighs the marginal cost of further equity financing (Jensen and Meckling, 1976).

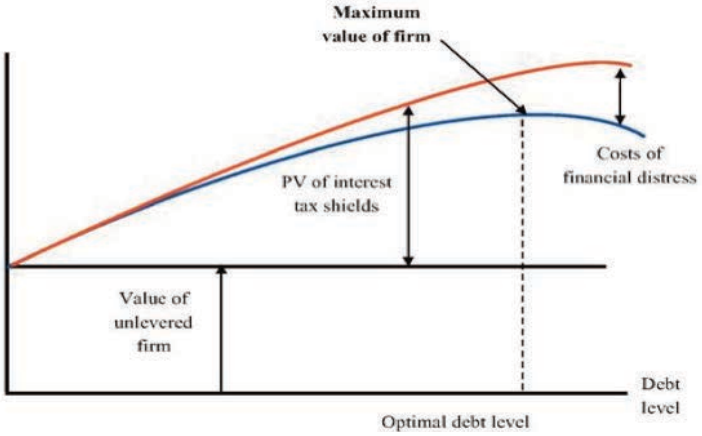

Figure 6: Trade Off Model (Source: http://academlib.com/735/business_finance/trade-off_theory_capital_structure)

Conclusion

This essay has examined agency issues arising from two key relationships; stockholders-managers and debtholders-stockholders. We have seen that the relationship between stockholders and managers can directly effect how a firm may utilise equity financing. Particularly we saw that the costs associated with a fully equity financed project will be reflected in the prices of said equity. In a fully equity financed project we noted that stockholders would surely have to accept the costs of bonding and monitoring as a given when entering into the equity agreement. We then saw how debtholders and stockholders may see a conflict of interest arise in a number of scenarios and the effect this had on the structure of bond contracts. The structure of these bond contracts then has a direct effect on the pricing of these bonds.

The concept of agency costs may go against the theory of economics that all must be rational and efficient. By their very nature additional costs are inefficient. But to assert that these costs are inefficient would be incorrect. They are only inefficient in the perfect hypothetical academic world described with the theory itself. In reality the actors in the principal agent relationship are behaving as efficiently as they perceive to be possible within the constraints of the environment. They are entering into what Simon (1991) described as "bounded rationality" whereby they make the most efficient decision possible given the parameters and constraints of the situation. Ultimately this is what underpins agency theory with regard to firm financing. The equilibrium position reached by firms when all variables considered may not theoretically be efficient but it is the optimal level of effi-

ciency given the constraints of reality.

We can conclude that at the equilibrium position the firm's capital structure will be the aggregate position of the marginal benefits of debt/equity financing instruments exceeding their marginal costs. This equilibrium position will be the aggregate position resulting from a complex set of variables stemming from the issue of information asymmetry, insuring against this asymmetry and the self-interest of the individual groups of investors, managers and stockholders.

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AID AND GROWTH REVISITED: IMPACT OF FOREIGN AID ON GROWTH IN SUB-SAHARAN AFRICA

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This econometrics paper involves an exploration of the link between the foreign aid received by countries in Sub-Saharan Africa and the growth of real GDP per capita, a relationship characterised by the difficulty in establishing causality. Using an approach introduced by Bruckner (2013) Paul Reidy attempts to tackle the simultaneity problems present in such a study. His analysis finds that aid has a positive effect on growth and that this effect is of a similar magnitude the one identified in Bruckner's study.

Introduction

The impact of foreign aid on growth in developing countries has hugely important policy implications. Firstly, if economic growth leads to improved living conditions for the poor (as argued by Dollar and Kraay, 2002) then it is important to know if foreign aid can promote this. Secondly, over $4.6 trillion has been spent on foreign aid by developed countries over the past 50 years (Easterly and Williamson, 2011). This aid has been largely financed by taxpayer money from Western governments and it is important to know if it has been effective.

This paper revisits the question of whether foreign aid has a significant and positive causal effect on real GDP per capita growth. Using the empirical approach employed by Bruckner (2013) to establish causality, it is shown that foreign aid only has a positive impact on economic growth in Sub-Saharan Africa once the simultaneity of aid and growth has been accounted for. This result contrasts with the recent trend in some of the literature to find insignificant or negative effects of foreign aid on growth. We also examine East and West African countries separately and find evidence that foreign aid has different effects in these regions but that the empirical approach is likely be invalid.

Literature Review and Motivation

While we may generally expect that foreign aid should have a positive impact on economic

growth, the aid-effectiveness literature finds ambiguous results. The first generation of this literature generally found a positive relationship between foreign aid and growth. Levy (1988) finds that aid is positively correlated with growth and investment in Sub-Saharan Africa. Sachs *et al.* (2004) argue that in many poor countries incomes are too low to generate the savings needed for investment and sustained growth and therefore foreign aid helps countries escape this poverty trap.

The second generation, by contrast, argues that foreign aid does not have a positive effect on growth and may in fact undermine it. Easterly (2006) argues that foreign aid is often wasted with resources frequently ending up on the black market or being used for unintended and unproductive purposes. Bulir and Hamann (2003) show that aid is significantly more volatile than domestic fiscal revenues which undermines its effectiveness, particularly in countries which are heavily dependent on foreign aid.

In the third generation of the literature, researchers emphasise that the effectiveness of foreign aid on economic growth is context-specific and depends on the presence of a range of other factors. Burnside and Dollar (2000) find that foreign aid positively impacts economic growth in developing countries that have good fiscal, monetary and foreign trade policies. In countries where policies are poor, however, the authors fail to find a significantly positive effect of foreign aid on economic growth. Dalgaard, Hansen and Tarp (2004) find that the size and sign of the impact of foreign aid on long-run productivity can depend on policies, structural characteristics, and the size of the aid flow.

Given the extent of aid-effectiveness literature available it is important to emphasise the unique contribution of this paper. Firstly, while the aid-effectiveness literature generally recognises the serious endogeneity concerns in the aid and growth relationship, Deaton (2010) notes that attempts to deal with this problem so far have largely been unsatisfactory with many of the instruments failing to satisfy the exclusion restriction. Therefore, this paper will use the strategy employed by Bruckner (2013) to estimate the causal effect of foreign aid on growth and argue that this is a valid approach. Secondly, much of the aid effectiveness literature examines a very diverse group of countries. However, Dalgaard *et al.* (2004) argue that geographic location is an important factor in determining aid-effectiveness and Roodman (2007) notes that it has frequently been shown that aid seems to be much less effective in tropical regions. Askarov and Doucouliagos (2015) also suggest that aid works through different channels in different regions. Thus, this paper also builds on Bruckner's (2013) work by confining the study to Sub-Saharan countries as well as smaller subsets of this region, namely East and West African countries. This region was chosen because many Sub-Saharan African countries are among the poorest in the world and it is therefore important to assess the effectiveness of foreign aid here.

Empirical Approach

Endogeneity is a serious concern in examining the relationship between foreign aid and growth. This endogeneity mainly comes in the form of simultaneity bias. In particular, we would generally expect that foreign aid will have a positive effect on economic growth. However, economic growth may also have a negative effect on the amounts of foreign aid received by a country because as countries grow their reliance on foreign aid should fall and/or donor countries may be more likely to reduce aid.

If this simultaneity is present the zero conditional mean assumption is violated and the OLS estimates of the effect of foreign aid on growth will be biased and inconsistent. This may explain why some studies have failed to find that foreign aid has a positive effect on economic growth. Deaton (2010), for example, highlights that studies which use OLS and fail to account for the reverse causality typically find a negative effect of foreign aid on growth.

With the above issues in mind, this paper will follow the empirical strategy used by Bruckner (2013). This involves using a two-part process with 2SLS fixed effects models to address the endogeneity issue and to enable a causal effect of foreign aid on economic growth to be estimated. The two investigations that make up the empirical approach are outlined below.

Investigation 1: The Impact of Growth on Foreign Aid

In this first investigation we will estimate the effect of economic growth on foreign aid. This estimate will help us examine whether simultaneity may be a problem in the aid and growth relationship and will also be used in the second investigation below. The basic regression model in this investigation comes from the original paper and is given by equation (1):

$$\Delta \log(aid_{i,t}) = \beta_1 \Delta \log(y_{i,t}) + \beta_2 war + \beta_3 \Delta pol\, a_i + b_t + e_{i,t} \quad (1)$$

In this equation Δlog (aidi,t) is the log-change of aid per capita. The log-change in foreign aid per capita is used instead of the level because the Im-Pesaran-Shin (2003) test for panel data failed to reject the null hypothesis that the level of foreign aid has a unit root but rejects this null for the first difference of foreign aid. Δlog (yi,t) is the log-change in real GDP per capita. The equation also controls for civil war and changes in the political institutions of the country because these are likely to impact aid inflows. ai represent country fixed effects which help to address the problem of unobservable heterogeneity and control for any long-run (time-invariant) differences across countries which may be driving aid flows such as colonial ties. If we fail to account for this unobserved heterogeneity then

we will get biased estimates. We use fixed effects rather than random effects because we cannot argue that the specific effects will be uncorrelated with the other independent variables in cross-country data. bt are year fixed effects that allow us to control for the effects of the business cycle and other global shocks (Bruckner, 2013).

As highlighted above, the simultaneity problem will cause the OLS estimates of this regression to be biased. In order to overcome this two-stage least squares (2SLS) will be used with log-changes in rainfall, rainfall squared and international commodity prices as Instrumental Variables (IVs) for the log-change in real GDP per capita. The validity of these instruments will be considered later.

Investigation 2: The Causal Impact of Foreign Aid on Growth

In the second investigation we will estimate the effect of foreign aid on growth after accounting for the reverse causality examined in Investigation 1. Consider equation (2) from the original paper below:

$$\Delta \log(y_{i,t}) = \propto_1 \Delta \log(aid_{i,t}) + \propto_2 war + \propto_3 \Delta pol + \alpha_4 \Delta \log(cprce) + \alpha_5 \Delta \log(rain) + \propto_6 [\Delta \log(rain)]^2 + h_i + i_t + u_{i,t} \quad (2)$$

In this equation we are investigating the effect of foreign aid on economic growth. As in equation (1) we control for civil war and changes in political institutions as these are likely to affect real GDP per capita growth. We also control for the instruments used in the first investigation as we have already argued that these have an impact on real GDP per capita growth. hi and it are country and year fixed-effects respectively.

If economic growth has a significant effect on foreign aid, then the OLS estimate of regressing economic growth on foreign aid will be biased. More concretely, if $\beta 1 \neq 0$ in equation (1) then, Cov[Δlog (aidi,t) , ui,t] $\neq 0$ and the OLS estimate of $\propto 1$ will be biased. As Bruckner (2013) notes, the OLS estimate of $\propto 1$ will be upward biased if $\beta 1 > 0$ and downward biased if $\beta 1 < 0$.

Therefore in this stage we will use 2SLS for a second time to overcome this problem, which involves two steps. Firstly, we extract the causal response of foreign aid to economic growth that was estimated in Investigation 1 to get the residual variation in foreign aid that is not caused by growth in real GDP per capita (Bruckner, 2013). This is shown in equation (3):

$$\Delta \log(aid_{i,t})^* = \Delta \log(aid_{i,t}) - \beta_1 \Delta \log(y_{i,t}) \quad (3)$$

Secondly, as in the original paper, we use this 'endogeneity-adjusted aid series' as an instrument for Δlog (aidi,t) to obtain the 2SLS fixed effects estimate of the effect of foreign aid on economic growth. The validity of this instrument will be considered in Section 5. This method overcomes the simultaneity bias and gives a consistent estimate of $\propto 1$, assuming that the error ei,t from equation (1) is uncorrelated with ui,t from equation 2 (Bruckner, 2013).

Dataset

The dataset was sourced from the online data appendix of the Bruckner (2013) paper. It is an unbalanced panel dataset with 1,713 observations from 47 Less Developed Countries (LDCs) for the period 1951-2000. To examine the impact of foreign aid on growth in Sub-Saharan Africa it was necessary to edit the data and exclude observations from outside that region, resulting in the number of observations falling to 1,321. Table 1 lists the variables that will be used in the regression estimates in Stata. Figure 1 shows real GDP per capita growth and net foreign aid flows as a percentage of GNI in Sub-Saharan Africa from 1970-2000.

Variable Name	Key
Country	Country Name
Year	Year of Observation
lgdp	Log of real GDP per capita
lcru_l	Log of rainfall
lcru_l_sq	Log of rainfall squared
loda	Log of net official development aid
polity2	Polity IV Score of Democratic Institutions
war	Civil War Indicator 1 if there is a domestic Civil, 0 otherwise
index_g_l	Log of the Commodity Price Index
Outlier	Outlier indicator 1 if outlier identified by Hadi procedure, 0 otherwise

Table 1: List of Variables

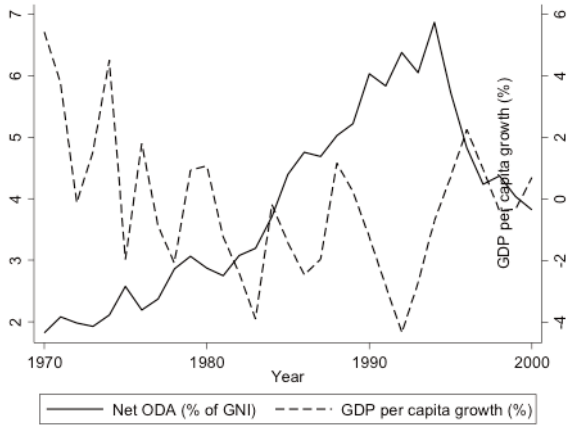

Figure 1: Real GDP Per Capita Growth

	GDP Per Capita Growth		Net ODA per year ($US Millions)	
Country	Mean	Std. Dev	Mean	Std. Dev
Benin	0.81	4.76	110	102
Burkina Faso	0.44	4.42	189	160
Burundi	0.13	7.89	101	94.3
Cameroon	0.62	5.52	227	204
Cape Verde	3.22	6.43	69.7	43.7
Chad	-0.76	7.77	144	96.2
Comoros	0.02	6.65	30.5	16.6
Congo, Republic of	0.75	11.63	86.8	92
Djibouti	-0.45	12.71	93	33.8
Equatorial Guinea	4.79	19.24	24.9	20.8
Eritrea	0.76	8.46	143	34.3
Ethiopia	1.40	6.82	390	388
Gambia, The	0.57	6.90	38.1	35.5
Guinea	-0.13	4.73	139	150
Guinea-Bissau	1.15	12.73	66.9	50.4
Lesotho	2.81	7.95	60.7	48.2
Liberia	-4.78	21.28	77.5	45
Madagascar	-1.07	3.22	195	177
Malawi	1.50	5.24	198	192
Mali	0.71	6.64	219	179
Mauritania	0.58	4.85	179	79.7
Mozambique	0.69	6.05	412	466
Niger	-0.92	6.63	173	132
Rwanda	-0.01	13.80	175	177
Sao Tome and Principe	0.95	9.13	26.5	22
Senegal	-0.34	4.65	302	252
Sierra Leone	-2.21	5.68	84.4	67.3
Somalia	-2.34	8.99	281	218
Sudan	0.21	4.45	471	329
Tanzania	1.24	8.13	513	418
Togo	-0.05	5.90	85	71
Uganda	0.32	5.79	258	298
Zambia	0.29	8.50	327	397
Zimbabwe	1.14	8.24	175	196

Table 2: Summary Statistics

Results

Effect of Growth on Foreign Aid

Table 3 shows the estimates of the effect of growth on foreign aid. We used the modified Wald test and the Wooldridge (2002) test to check for the presence of heteroskedasticity and autocorrelation respectively. In both cases we strongly rejected the null hypothesis of no heteroskedasticity and autocorrelation, suggesting that these two issues are present. We therefore use Huber robust standard errors clustered at the country level that are robust to heteroskedasticity and arbitrary (intragroup) correlation. The OLS estimate of the coefficient on growth is -0.16 and is not statistically significant. However, as highlighted above, we cannot interpret this as the causal effect of growth on foreign aid. If we assume that foreign aid has a positive effect on per capita growth, the OLS estimate will be biased upwards. The 2SLS estimate of the effect of growth on foreign aid implies that a 1 percentage increase in real GDP growth reduces foreign aid by -3.83 per cent and is statistically significant at the 5 per cent level. The absolute size of the effect is much larger than the OLS estimate and highlights the extent of the endogeneity bias. The results for the control variables are also shown in Table 3 but these are not our primary interest in this study.

		OLS				2SLS		
Variable Name	Coefficient	t-stat	SE	p-value	Coefficient	t-stat	SE	p-value
$\Delta\log(y_{i,t})$	-0.16	-1.05	0.16	0.30	-3.83	-2.20	1.74	0.028
War	-0.00	-0.16	0.03	0.88	-0.14	-1.71	0.08	0.087
Δpol	0.00	0.77	0.01	0.45	0.02	1.71	0.01	0.086
No. of Observations	1,047				1,047			

Table 3: Estimates of the Effect of Growth on Foreign Aid (Sub-Saharan Africa)

Effect of Foreign Aid on Growth

With the possible endogeneity issue in mind, Table 4 presents the estimates of the effect of foreign aid on growth. We tested for heteroskedasticity and autocorrelation using the same tests as in the previous section and again found that both issues are likely to be present. Therefore, we use Huber robust standard errors in this investigation too. The OLS estimate of the coefficient on foreign aid is -0.01 and is not statistically significant. However, this OLS estimate is very likely to underestimate the true effect of foreign aid on economic growth because of the downward bias resulting from the fact that economic growth seems to have a negative effect on foreign aid (as highlighted in the previous section). By contrast, the 2SLS estimate implies that a 1 percentage point increase in foreign

aid is associated with an approximately 0.21 percentage increase in real GDP per capita, all else equal, and this estimate is significant at the 1 per cent level.

	OLS				2SLS			
Variable Name	Coefficient	t-stat	SE	p-value	Coefficient	t-stat	SE	p-value
Δlog(aid)	-0.01	-1.05	0.01	0.30	0.21	5.33	0.04	0.00
war	-0.04	-2.23	0.02	0.03	-0.04	-1.93	0.02	0.05
Δpol	0.00	1.89	0.00	0.07	0.00	1.03	0.00	0.30
Δlog(cprce)	0.33	2.29	0.15	0.02	0.68	4.11	0.16	0.00
Δlog(rain)	0.22	2.41	0.09	0.02	0.33	3.15	0.11	0.00
$[\Delta\log(rain)]^2$	-0.02	-2.22	0.01	0.03	-0.02	-2.77	0.01	0.00
R^2	0.09				-0.80			
No. of Observations	1,047				1,047			
F-Statistic	-				6.29			

Table 4: Estimates of the Effect of Foreign Aid on Growth (Sub-Saharan Africa)

Validity of the Instrumental Variables

While Instrumental Variables (IVs) have been used extensively in the aid effectiveness literature, they should always be treated with caution. Two assumptions are particularly important. Firstly, the IVs must be relevant, meaning that $Cov(z, x) \neq 0$ where z is the instrument and x is the endogenous variable. If this is not the case, the estimation strategy will fail to produce consistent estimators. This assumption also affects the variance of the IV estimates as noted in Table 3. Secondly, the chosen IVs must be exogenous. This means that the instrument, z, must not be correlated with the error term, u, in the regression equation of interest - that is, $Cov(z, u) = 0$. If an instrument fails to satisfy this requirement it will not give consistent estimates of the parameter of interest. It is often difficult to test this assumption and so we may have to rely on intuitive reasoning.

Investigation 1 Instrumental Variables: Relevance and Exogeneity

The IVs used in this investigation are the log-changes in the index of international commodity prices, rainfall and rainfall squared. Deaton (1999) and Miguel *et al*. (2004) show that rainfall and commodity price shocks can significantly impact GDP growth in sub-Saharan Africa. This is because these countries tend to rely on agriculture and on commodity exports (Bruckner, 2013). We can test if this is true by running a regression of real GDP per capita on the exogenous variables. The results of this regression are shown in Table 5. We can clearly see that the three instruments are significant at the 5 per cent level. We

can also note from the negative sign on the quadratic term that after some level rainfall is negatively associated with real per capita growth. This may be because excessive rainfall disrupts agricultural productivity and hence lowers GDP growth (Bruckner, 2013).

Variable Name	Coefficient	t-stat	SE	p-value
Δlog(cprice)	0.34	2.41	0.14	0.02
Δlog(rain)	0.22	2.39	0.09	0.02
$[\Delta\log(\text{rain})]^2$	-0.02	-2.22	0.01	0.03
war	-0.04	-2.23	0.02	0.03
Δpol	0.00	1.73	0.00	0.10
R^2	0.08			
No. of Observations	1,047			
F-Statistic	-			

Table 5: Testing the Validity of Investigation 1 IVs

In order to satisfy the exclusion restriction, the instruments should not be correlated with the error term e(i,t). This means that the IVs should not have an independent affect on foreign aid other than through their effect on GDP per capita growth (Bruckner, 2013). Because we have more instruments than endogenous variables in this case, we can use over-identification tests. The Hansen J-test gives a p-value of 0.33 and hence the test fails to reject the hypothesis that the instruments are uncorrelated with the error term. Intuitively, it also seems unlikely that the instruments here will have an independent effect on foreign aid (which is the dependent variable in this investigation).

Investigation 2 Instrumental Variable: Relevance and Exogeneity

The IV used in this investigation was the endogeneity-adjusted aid series given by Δlog (aidi,t) - β1Δlog (yi,t). We must check that Cov(z, x) ≠ 0 where z represents the chosen IV and x is Δlog (aidi,t). This should be trivially true by definition because our IV is just our aid series adjusted for the reverse causality between foreign aid and growth. We can check this by running a regression of the aid series on the exogenous variables. The results of this regression are shown in Table 6 and we can see that the instrument is highly statistically significant.

In order to be exogenous, the instrument should not be correlated with the error term ui,t. Because we only have one instrument in this case we cannot use the over-identification tests that we used in the previous part. In the unusual case of Investigation 2 in

this paper, it turns out that the exclusion restriction is equivalent to saying that the error term from equation 1 is uncorrelated with the error term from 2. Thus, in order to satisfy the exclusion restriction we have to try to convince ourselves that there are no omitted variables that should be in both equation 1 and equation 2. Although it is difficult to be certain, we hope that the control variables and the fixed effects specifications that we have used in both equations 1 and equation 2 will help to minimise this risk.

Variable Name	Coefficient	t-stat	SE	p-value
$\Delta\log(aid_{i,t})$*	0.56	11.55	0.05	0.0
Δpol	0.00	1.05	0.00	0.30
War	0.00	0.05	0.04	0.96
$\Delta\log(cprice)$	-1.44	-4.35	0.33	0.00
$\Delta\log(rain)$	-0.71	-3.16	0.22	0.00
$[\Delta\log(rain)]^2$	0.05	2.73	0.02	0.01
No. of Observations	1,047			
F-Statistic	-			

Table 6: Testing the Validity of Investigation 2 IVs

Outliers and Sample Size

Easterly *et al.* (2004) argue that outliers often drive the results in regressions which examine the relationship between policies and economic growth. Bruckner (2013) uses the Hadi (1992) procedure to identify and exclude outliers. We follow this method and our results in Table 7 below are very similar to the estimates from Table 4. In particular, the OLS is still insignificant, while the 2SLS estimate remains positive and significant.

	OLS				2SLS			
Variable Name	Coefficient	t-stat	SE	p-value	Coefficient	t-stat	SE	p-value
$\Delta\log(aid)$	0.00	0.06	0.01	0.96	0.18	6.36	0.03	0.00
war	-0.03	-3.54	0.01	0.00	-0.03	-3.29	0.00	0.00
Δpol	0.00	1.78	0.00	0.09	0.00	0.90	0.01	0.37
$\Delta\log(cprce)$	0.27	3.13	0.09	0.00	0.41	3.73	0.11	0.00
$\Delta\log(rain)$	0.19	2.24	0.08	0.03	0.30	2.95	0.10	0.00
$[\Delta\log(rain)]^2$	-0.01	-2.07	0.01	0.05	-0.02	-2.60	0.01	0.00
R^2	0.05				-0.69			
No. of Observations	1,026				1,026			
F-Statistic	-				7.34			

Table 7: Estimates of the Effect of Foreign Aid on Growth Excluding Outliers (SSA)

East and West Africa

Table 8 below shows the estimates of the effect of foreign aid on growth in East and West Africa. The results suggest that foreign aid has a positive impact on growth in West Africa while it has a negative impact in East Africa. This may lend support to the idea that foreign aid can work through different channels. However, we cannot reliably interpret the results presented in this table because it was found that the instruments were not significant predictors of $\Delta\log(y_{i,t})$ in Investigation 1, meaning that it is likely that we suffer from the problem of weak instruments in this case. Imbens and Wooldridge (2007) show that statistical inference can be very misleading in the case of weak instruments.

	West Africa				East Africa			
Variable Name	Coefficient	t-stat	SE	p-value	Coefficient	t-stat	SE	p-value
$\Delta\log(aid)$	0.28	2.54	0.11	0.01	-0.14	-3.17	0.04	0.00
war	-0.08	-1.35	0.07	0.18	-0.02	-2.44	0.01	0.02
Δpol	0.00	0.47	0.00	0.64	0.01	-2.42	0.00	0.02
$\Delta\log(cprce)$	0.61	1.23	0.50	0.22	-1.35	-1.27	1.06	0.20
$\Delta\log(rain)$	0.38	1.73	0.22	0.08	0.50	3.34	0.15	0.00
$[\Delta\log(rain)]^2$	-0.03	-1.73	0.02	0.08	-0.04	-3.56	0.01	0.00
R^2	-1.16				-0.24			
No. of Observations	424				445			

Table 8: Estimates of the Effect of Foreign Aid on Growth

Possible Extensions

Alternative Econometric Methods

The majority of the studies which examine the relationship between foreign aid and economic growth use either OLS or 2SLS. The Arellano-Bond (1991) or Blundell-Blond (1998) GMM models are suitable alternatives which account for the endogeneity problem and also conveniently incorporate fixed effects. Under these models the lagged values of the endogenous variables are used as instruments (Rajan and Subramanian, 2005). It would be interesting to see if the results of this study could be replicated using these or other econometric methods.

Lagged Effect and Diminishing Returns

This study has focused on the contemporaneous or immediate effect of foreign aid on economic growth. It would be very useful to see if the results differ if we allow for the

fact that lagged aid values are likely to have an effect on economic growth. This would allow us to assess the medium and long-term impact of foreign aid on growth. Additionally, it would be useful to investigate whether there are diminishing returns to aid by including a squared aid term as in Rajan and Subramanian (2005).

Channels

While some useful policy insights can be drawn from looking at relationships between foreign aid and growth on a cross-country basis, examining the channels at work at a country or region specific level may be more fruitful for future research assessing aid effectiveness. Bourguignon and Sundberg (2007) advocate opening the `black box' and investigating the chain of causality from donors to policymakers and from policymakers to policies and outcomes more closely.

Conclusion

The effectiveness of foreign aid in developing countries continues to provoke heated debate amongst NGOs, Western governments and development academics. This paper contributes to the extensive aid effectiveness literature by employing the empirical approach proposed by Bruckner (2013) to estimate the causal effect of foreign aid on economic growth in Sub-Saharan African countries. Our estimates indicate that a 1 per cent increase in foreign aid will lead to a 0.2 per cent increase in real GDP per capita once the simultaneity problem has been addressed, which is broadly similar to the results from the original paper. The OLS estimates, on the other hand, were statistically insignificant.

However, the validity of these results rests on the assumption that the empirical approach used by Bruckner (2013) is appropriate. While we have conducted some robustness tests in this paper, space constraints prevented a more complete examination of the method and results. The use of instrumental variables in development literature remains controversial and so our results should be interpreted with caution. Nonetheless they provide an interesting new platform which should be useful for future research on aid effectiveness.

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United We Stand, Divided We Fall: On Requiring The Empowerment Of Women

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The study of developmental economics faces numerous problems in attempting to identify causal relations. In this essay, Andrew Price examines economic theory and empirical evidence in an attempt to establish whether or not women's empowerment is necessary for economic development. While no firm conclusions can be drawn, he makes a strong argument for women's empowerment being, if not absolutely necessary, of tantamount importance.

Introduction

In recent years, specific emphasis has been placed on women's rights across the planet. See, for example, the UN's sustainable development goals, or the explicit position held by the World Bank on the matter. This essay will discuss this emphasis in relation to developing countries. Through a brief combing of the academic literature on the subject will we used to explain why the expansion of women's rights and opportunities are viewed as essential developing countries. This shall be done by outlining, through economic models, the expected effects of the expansion followed by results from some empirical studies. Then, deeper analysis shall be conducted, focusing particularly on whether or not the expansion of said rights and opportunities is, in fact, 'essential' or merely desired and/or beneficial. This shall be accomplished through empirical analysis of currently developing countries and analysis of the histories of now developed countries. Through these analyses, this essay will show that the expansion of women's rights and opportunities is essentially essential. That is to say not absolutely necessary, in a strict sense of the word, but for all intents and purposes, necessary. However, this must be achieved with great care, with respect to what policies are implemented and in what contexts.

Theoretical Basis

The argument for a particular focus on the expansion of women's rights and opportunities is best illustrated through the augmented Solow growth model (Mankiw, Romer and Weil,

1992). Through the expansion of women's rights (e.g. right to property, work, education, etc.), we directly affect their opportunities in the market. Specifically, we increase the overall levels of human capital (e.g. through increased education) and physical capital (e.g. by removing credit constraints/barriers). These increases in human and physical capital also increase the level of innovation in a country (e.g. technological growth and innovation) and while the standard Solow model actually takes technological growth as a given, it is possible to relax that assumption under the augmented model. These improvements to human and physical capital, combined with technological progress, cause not only a movement along the curve, but a shift of the curve itself, meaning greater output and economic well-being for all in the country. On top of this, we would also expect to see a kind of feedback effect, in that better human capital, physical capital and technology also allows for greater economic opportunities. These new opportunities once again improve human capital and physical capital, which once again improves technology and so on and so forth. Essentially, through the augmented Solow model, the empowerment of women is seen as a kind of perpetual motion machine for economic growth.

Similarly, if we imagine a hypothetical country in which only men are allowed to work, if we were to move that country to a state in which women could work, we would expect to see an effective doubling of the size of the work force. In so doing we would expect to see large increases in economic output. If we also consider the Aggregate Supply Aggregate Demand model (ASAD) this boost in output should be met with a fall in prices for consumers (assuming the boost to aggregate supply is greater than the boost to aggregate demand). If we consider other economic models and theories, specifically, the Investment-Savings Liquidity-Money (ISLM) model, Okun's law and the Fisher effect, we would also expect to see more favourable interest rates, inflation rates and unemployment numbers. From all this, it is easy to see why the empowerment of women is, generally speaking, given such priority by international institutions and organisations.

Practical Basis

Theories are often a useful starting point, but unless they are backed up by the data they are of limited worth. As such, we must compare these theories with empirical findings. Mankiw and colleagues (1992) ran a study using the available global data and found that the augmented Solow model excellently accounted for the current state of affairs with their model accounting for nearly eighty percent of the observed variation across countries. However, empirical studies on this issue are tricky. The feedback and relations between all the variables of the model often make regressions biased. If we accounted for this, the model would likely explain far less variation. This issue noted, for the purposes of this essay we must narrow the focus of the model to the effects of empowerment of women on GDP per capita. According to the augmented Solow model, a decrease in the

population growth rate should (holding other factors constant) shift the depreciation line and improve income per capita. The empowerment of women is, intuitively, likely to reduce the population growth rate. Improving the educational standards of women is empirically correlated with lower birth rates (Reading, 2011), which in turn implies lower population growth rates. Due to the aforementioned correlation issues among variables, it is difficult to find studies in which this correlation is entirely negated. This difficulty noted, there is a striking negative correlation in the data between high fertility rates and GDP per capita (IndexMundi, 2004), just as the augmented Solow model predicts there should be. Similarly, under this augmented model, improved levels of female education implies higher levels of human capital, leading to higher GDP per capita. The data again supports the prediction of the model (Hanushek and Wößmann, 2007).

If we look to the overall output of the economy, theory predict that if more women are employed, as opposed to staying at home, overall output should increase. An article in The Economist (2009) notes that in the developed world, increasing the female participation rate is estimated to significantly increase GDP, in some countries by nearly twenty percent. There is wide variation between developing countries in their respective female participation (Verick, 2014), but there is little initial reason to believe higher participation rates would have different results to those seen in developed countries. Between the early 1970s and mid-1990s, the female participation rate grew by fifteen percent in East Asia and Latin America, this period also saw a significant decline in the wage gap and a large increase in female life expectancy (between twenty and twenty-five years) (Duflo, 2012). In East-Asia these remarkable gains coincided with rapid economic expansion but this was not the case in Latin America, which experienced a period of great turmoil. Given these differences, drawing causal relations between female participation rates and economic development in less developed countries is tricky. Indeed it may have been the case that economic growth caused the increase in participation.

Furthermore, in many cases, poorer regions often see high female participation rates out of sheer necessity (Verick, 2014). To account for this a 'U-shaped' model of female participation rates is often advocated; beginning high out of necessity, then gradually declining with economic growth, only to rise again after a certain threshold (Goldin, 1994). Determining what point an economy is at on this curve is key to policy decisions. These difficulties and complications also present obstacles in determining the effect of increased female participation on the unemployment rate or on interest rates and identifying possible instrumental variables for these situations can be extremely difficult.

Finally, in the ASAD model, the government contributes heavily to overall output, meaning they have a large say in how an economy works and where it allocates its resources, however globally in an average parliament roughly twenty percent of the representatives are women (Duflo, 2012). It is generally assumed that men and women

have different priorities and values, ergo, as things stand, male priorities and values are receiving more focus than women's. The theory goes that if we change the composition of these parliaments and governments to a more gender equal state, we will see increased funding for things women value and prioritise. There is some empirical evidence for the claim that the values differ. It has been found that when in positions of influence in a community women do indeed invest differently to men (Duflo, 2012). However, this is not necessarily a desirable thing for economic development in and of itself, what matters is what these priorities are. If, for example, a male dominated government who focused its budget on health care is replaced by a female dominated government who focuses its budget on education, it is unclear which is better for development or for society as a whole as each has merit. It is therefore difficult to empirically argue that greater female representation in government will be directly beneficial to economic development. It is certainly desirable for other reasons and it may well be better for economic development, but as of yet there has been no satisfactory method to empirically evaluate this claim.

One thing we can say empirically on this matter is that greater female representation and participation in government does have several positive externalities. In systems which have introduced gender quotas, numerous studies have seen a corresponding rise in levels of female educational enrolment, attainment and in their corresponding aspirations for their future (Duflo, 2012). A study in West Bengal found that in regions where there had never been a female leader, 86 per cent of parents wanted their daughters to be 'either a housewife or whatever their in-laws would decide for her. The corresponding fraction was below 1 per cent for the boys (Duflo, 2012:1057). It seems clear that gender quotas in West Bengal would help women immensely, we would expect to see improvements in the levels of education and female labour-force participation, which, as was discussed above, has been shown to be beneficial for GDP per capita and possibly for overall output as well.

Is it Essential?

Ultimately, to determine whether or not the expansion of women's rights and opportunities is essential for policy makers in developing countries, we must look at the data. It must be stressed here that what we are discussing is not whether such an expansion is a good thing, or a desirable thing, but whether it is effective. Can we say or show that in placing particular emphasis on the empowerment of women, we see a greater improvement to economic development than would otherwise occur? Phrased like that it is, of course, impossible to say one way or the other. We cannot construct a test in which we empower the women of a national economy and monitor the results, whilst simultaneously not empowering them and monitoring the results. As such, everything discussed here must be with the caveat that we lack a perfect control group for comparison.

This caveat noted, there are several studies worth discussing here. The first of these is a study conducted by Ashraf (2009) in the Philippines on spousal control and decision making. In the study, cash or vouchers were offered to couples under three distinct sets of conditions. The first of these was a private scenario, in which the spouses were kept apart as much as possible. The second scenario was a public scenario, where both people were informed of all the possible outcomes for them and their spouse, but were only allowed to communicate after their respective decisions were made. The final scenario was one of negotiation, where spouses could communicate throughout the process. In dividing the couples between these three scenarios, the study could (in as much as is feasibly possible) control for the effects of information and communication.

The initial results of the study appear to show differences between genders in terms of decision making in the three scenarios. Men appear far more likely to commit their cash or voucher to consumption than women do. If we were to stop here we might infer that if we were to empower women, through political representation and workplace employment, we would see better outcomes for economic development as women save more. A higher savings rate leads to higher GDP per capita under the augmented Solow model. However when researchers accounted for who in the household has control over how the money taken in is spent the apparent difference between genders is negated. As such, we cannot identify significant differences in propensity to save between genders from this study, but we can infer that the relative position between genders due to pre-existing structural differences affects this propensity. This illustrates the need to consider underlying conditions and social settings before any gender based policies are implemented.

It is generally assumed that women in developing countries are more credit constrained than men. As such, if we were to remove these constraints we would expect to see a large return to investment. This implies improved physical capital which should increase GDP per capita under the augmented Solow model. De Mel and colleagues (2009) carried out a study on credit constraints and microenterprise for women in Sri Lanka. In this study, grants, the size of which was randomly varied, were issued to recipients chosen randomly based upon certain initial criteria. They found that the grants issued to men saw a high and enduring returns, while those issued to women had no effect. Even when adding controls for liquidity constraints, natural ability, risk aversion and industry, the result was the same. The results of this experiment has important implications for policymakers; it is not enough to simply give women more money, if a policy doesn't also address the underlying constraints placed upon women it will be neither effective nor efficient.

This finding that women in developing countries are not merely credit constrained seems self-evident upon reflection. In many nations women lack equal rights to their male counterparts (Duflo, 2012), which will of course limit how they can spend or

invest their money. It may be more beneficial, in the long run, to invest in improving institutional factors in order to empower women in the future, making future grants and loans effective. But finding an empirical study to support this course of action is made impossible by the lack of a control group. Moreover, convincing current business owners that constraining their current credit for future business owners' benefit is, to put it mildly, a hard sell politically.

The final paper to be discussed is an overview paper by Duflo (2012), which gathered information from several other studies together in an attempt to address a similar question to the one proposed here. Namely, should we improve gender equality to reduce poverty, or reduce poverty to improve gender equality? Duflo began by outlining the argument in favour of reducing poverty to improve equality. Essentially, the argument is that reducing poverty disproportionately benefits women. The example that best illustrates this is that in South Africa, the spreading of electricity not only increased overall standard of living also led to a ten per cent increase in the female employment rate, while male employment remained constant. Through the improvement of overall standard of living, a significant gain for female empowerment was also observed. It could be argued that it seems unnecessary to give specific consideration to women's rights and opportunities as they will improve as a side effect.

Conclusion

Why then does this essay claim it to be essentially essential? This is done because there are several simple steps that could be taken, with minimal cost that would greatly benefit not only women, but economic development as a whole. As has been noted above, drawing a direct link between governmental gender quotas and economic development is tricky, but the positive externalities are clear. Such quotas could be implemented with little effort on behalf of and we would expect to see higher levels of female educational enrolment, attainment and future aspirations as a result. By signing a bill, a developing country's government could bring about an improvement to human capital at virtually no extra cost. Similarly, though the study in Sri Lanka found that grants had no effect on women's long run income, this does not refute the claim that women should be given a particular economic focus. If anything, it emphasises the necessity to end the subjugation of women. It is of course economically inefficient to give grants to women instead of men if the men will see greater returns. However it is also economically inefficient to leave women in such a situation. To do so would be to leave a massive well of potential and actual human capital unused.

Ultimately the context is what determines whether or not a policy aimed at the empowerment of women is essential. Taking the Sri Lanka study, it would make no sense for the government of a developing country to loan or give grants to female micro-

enterprise owners if said grants will have no lasting effect. But neither does it make sense to keep women in this position when taking steps to change it could improve female human capital, which would turn improve GDP per capita. This is what was meant by essentially essential. The developing countries of the world could still develop without empowering women. Indeed the empowerment of women came long after the industrial revolution in the West. But to neglect the empowerment of women as an economic tool for growth would be inefficient, not to mention immoral.

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ANALYSING THE EFFECT OF TRADE ON INCOME INEQUALITY

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In this essay, Robert Cronin looks at the effect of trade on income inequality both between and within countries.While it may prove impossible to answer this question conclusively, in an age of globalisation and rising inequality, it is one nonetheless worth asking. Using theoretical concepts and empirical evidence from developing countries he shows that opening up to trade may lead to increased inequality through a number of different and possibly self-reinforcing channels.

Introduction

Our understanding of the implications of trade for income distribution has taken many leaps since the days of David Ricardo and his idealistic proposal that trade provides overall gains. Abrego and Edwards stated the above in the opening summary of their paper on the wages debate. Such a quote appears inherently pessimistic but does indicate that their paper will not attempt to wow you with impressive results hinging on tenuous assumptions. Instead it attempts to provide framework for future generations of economists to build on.

Models and propositions generally build on previous iterations as society as a whole gravitates towards an acceptable solution. It is interesting to consider that the trade of information in this era of globalisation will may be what allows us to determine whether we even wish to be in a globalisation era.

This essay will focus on the inequality within countries around the world and provide plausible reasoning for why trade may be an underlying cause. The proposals discussed will be extensions of well-established trade models; the significance of the Hecksher-Ohlin model and Stolper-Samuelson Theorem on the developing world and how the effects of firms' drive for productivity on inequality are magnified under the Melitz model.

The Intuitive Set-Back

The Hecksher-Ohlin Model (HOM) is a relatively simple framework that has aided important theorems, including the Stolper-Samuelson Theorem. It builds on Ricardo's theory of comparative advantage, albeit under slightly more realistic assumptions. The HOM es-

sentially takes a 2 country, 2 industries and 2 factor framework. It is a long run model and hence allows the factors to move between industries. Among other things it assumes each country is abundant in a different factor and each industry uses one factor intensively. Each country therefore favours production in the industry which intensively uses the factor it holds in abundance, i.e. the good it has a comparative advantage in.

If we assume perfect competition, then pre-trade the two factors are free to move between industries and so will only move when given an incentive to do so i.e. increased earnings. This implies that at equilibrium, the returns for each factor are equalised across industry.

When these two countries open up to free trade, the relative price of our favoured good increases due to our comparative advantage in it over our trade partners. It can be shown relatively easily that the owners of the factor used intensively in the good whose price increased, gain in real terms while the other owners lose in real terms. This is effectively the Stolper-Samuelson Theorem (Stolper and Samuelson, 1941).

There is nothing inherently difficult about the reasoning or the maths behind the Stolper-Samuelson Theorem. The intuitive logic presents the first setback to an argument for universal gains from trade. In the standard usage of the HOM the two factors used are Labour and Capital and so opening to trade will either see capital owners or workers losing out. In either case it will lead to a divide in real money earned by different citizens.

Inequality within Developing Countries

Skill Premium

Wood (1998) put forward the idea of modelling a worker's skill level with the HOM to demonstrate the effect of trade on income inequality. He proposed using skilled and unskilled labour as the two factors in the HOM and the rich North and poor South as the two countries. Here it seems reasonable to assume that the North is relatively abundant in skilled workers while the South is relatively abundant in unskilled workers.

Applying the Stolper-Samuelson Theorem to this model suggests that if these two countries open up to trade (i.e. the developed world begins trading with the developing world) then the wage gap will shrink in the South and increase in the North. The South has a comparative advantage in unskilled work due to its abundance in this factor and therefore the real return on unskilled labour increases while the real return on skilled labour falls. This has the effect of reducing the wage gap between the skilled and unskilled, which is also known as reducing the skill premium. This suggests that trade is a good policy for developing countries (assuming that income inequality is a bad thing) whereby they not only receive overall gains but they receive them in such a way that aids the process of redistributing income.

Contradictions to Theory-Colombia

Attanasio, Goldberg and Pavcnik (2003) chose to test this theory in Colombia, a developing country which had radical tariff cuts in 1990-91, as it provided a case with conditions as good as could be expected in reality. Prior to 1990 Columbia had relatively high tariffs so a drastic cut was roughly equivalent to opening up to trade. Colombia negotiated the terms of their tariff reduction with the WTO and as a result eliminated the chance of lobbying affecting the resulting tariffs meaning the final tariffs were 'exogenously predetermined'. Before this they used tariffs in an attempt to protect their unskilled citizens. When they reduced tariffs they cut them so that all tariffs were roughly the same, resulting in a change in tariff structure and a simulation of opening to trade.

The theory discussed indicates that the skill premium should reduce as a result of being exposed to trade. Unfortunately Attanasio, Goldberg and Pavcnik's (AGP) data shows the exact opposite occurring which will potentially discourage other developing countries from opening to trade in the future but it is intriguing from a theoretical perspective.

Plausible Explanations

AGP claim the evidence completely follows the theory due to the manner in which the trade barriers were taken down. When a tariff is placed on a good, it effectively increases the world price that the domestic consumers face. In economic terms Colombia is small and holds no influence on the world price forcing it to 'take' this increased price. The tariff allows domestic producers to also charge at this higher price. Given Colombia pre-1990 was protecting its unskilled labour by placing higher tariffs on these goods it meant that they were the goods most affected by the cut in tariffs. Colombia's attempt to reduce all tariffs to roughly the same point meant these unskilled-intensive goods saw the largest fall in tariffs and consequently the largest fall in price as shown by AGP.

The mechanics behind the HOM predicted that Colombia's abundance in unskilled work gave them a comparative advantage in unskilled products. This would mean that when the trade barriers were brought down these products should increase in price. Due to the nature of the tariff cut the opposite actually happened meaning the Stolper-Samuelson Theorem should be applied to a fall in price of unskilled products. Therefore a reduction in wages for unskilled labour should be seen relative to skilled wages which conforms to the data provided.

Further Evaluation of Theory

The HOM is a long run model which assumes all factors are mobile and hence can move between industries. Opening to trade, which increases the price of one good, therefore causes the two factors to shift towards the more profitable industry to the point that re-

turns equalise for each factor. In our Colombian model (accounting for the reversal in expected price movements) we should then see all labour (skilled and unskilled) shift towards the good which increased in price. However as expected when testing any model, the model doesn't explain all the data and in fact we observe labour to be relatively constant. AGP claim the change in price due to tariff cut to be statistically insignificant as an explanatory variable to change in employment shares. The fact that this shift did not occur implies trade may not be the underlying reason for the increase in inequality.

Additionally the HOM predicts that both industries will increase their share of the now cheaper factor post-trade implying Colombian firms should begin hiring a lower proportion of skilled workers. Unsurprisingly the data continues to disagree with the model and we actually saw an increase in the share of skilled workers in most industries (AGP).

Peering from the Giant's Shoulders

AGP attempted to apply these well-established theories to the Colombian data at every step and continued to stumble. This stumbling only spurred them to investigate further and brought them to the idea of skill-based technological change. While the HOM assumes identical technologies across countries it is fairly logical to assume that a developing country like Colombia does not have access to the same technologies as the USA say. Allowing trade of goods between your borders has the added benefit of encouraging exchange of information, exchange of capital and foreign direct investment. All of these inevitably increase the technologies present in Colombia.

AGP adapted Wood's idea of 'defensive innovation' and inferred that the reduction of tariffs brought increased import competition most heavily upon the industries that saw the biggest cuts. In this case, unskilled labour intensive goods. As a result they were forced to adapt these new technologies and 'look for new methods of production that economise on unskilled labour'. This defensive innovation naturally requires more skilled labour and hence it became the factor with increased demand and thus increased returns providing an explanation to the increase in skill premium.

When Colombia reduced its tariffs industry wide and effectively opened itself to trade it saw a gradual increase in income inequality which standard trade theory couldn't effectively explain at every point. This suggests that trade may be a red herring and just coincidentally increased at the same time as income inequality. We find however that although trade didn't work the traditional channels it indirectly affected inequality by promoting innovation and forcing firms to either adapt or fail.

Implications for the Developing World

The Colombian conclusion appears to be very specific to strict conditions related to the

structure of tariff cuts. The research, though fascinating and thorough, may then be inconsequential for trade theory moving forward. However AGP drew many comparisons with Hanson and Harrison's (1999) analysis of Mexico. Mexico opened to trade by cutting tariffs drastically and they saw even bigger increases in inequality than Colombia. Given they also protected their unskilled labour pre-cut they ended up having the largest cuts in these sectors. As a result of this, after the reversed price changes employment did not move as predicted by the HOM and stayed relatively constant. The theory constructed by AGP is therefore equally applicable to Mexico and perhaps many other developing countries considering a tariff reform.

'Within Group' Inequality

Melitz Model: A Summary

The Melitz model (Melitz, 2003) shows the relationship between firms' productivity and likelihood to produce. It assumes heterogeneous firms with varying productivities and shows that only the most productive firms can afford to produce. The more efficient a firm is, the more profits they will earn. Opening to trade leads to a larger market but also higher production and transport costs which only highly productive firms can afford. This encourages the top firms to produce more which increases labour demand and hence wages for all firms. This increased cost of production however forces some low-productivity firms to exit the market.

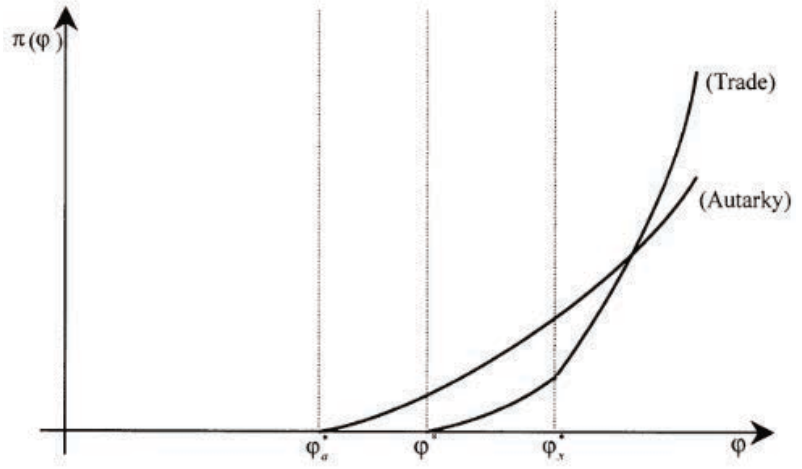

Figure 1: Profits versus productivity under the Melitz model (Source: Melitz, 2003)

There are some benefits to trade here as we see real wages do increase and given the low productivity firms exit the market, the overall level of productivity increases. However it also conveys how trade can create income inequality between firm owners/investors. The most productive firms were originally earning more but after opening to trade the income redistributes even more in favour of these top firms. Those who can still produce profitably but can't export are facing increased costs without any extra gain and even some firms who can export are still earning less than before as the gain doesn't outweigh the loss. The top firms reap all the gains and while there is overall gains from trade it all sits in the pockets of the top firms. Melitz demonstrates these effects in Figure 1 (ϕa^* is original productivity cut-off, ϕ^* is after trade, ϕx^* is export cut-off).

Further Melitz Inequality

Helpman, Itskhoki & Redding (2010) built on this Melitz model to demonstrate how there is potentially a further effect on inequality. They use a reasonable assumption that workers' abilities are not homogenous and firms must screen their workers to get an idea of their ability. This is effectively describing the interview process. Interviewing is expensive but given the importance of a worker's ability to the profitability of a firm, it is an efficient investment of time and money. Small firms have less incentive to screen thoroughly as they do not have the same resources as larger firms and may not be able to afford a lengthy interview process, despite the long term gains.

So firms who can afford to spend more time screening potential employees will end up hiring more competent workers and hence are far more likely to be highly productive. As Melitz reasonably implied, more productive firms earn higher profits. They are then inclined to continue intensive screening with higher resources. However, given the added expense of hiring a worker through this process, they are inclined to pay their workers a higher wage to encourage them to stay with the firm, known as an efficiency wage.

An ability premium is thus in effect as the most able workers will be employed by the more productive firms who pay their workers higher wages. This is a form of 'within group inequality' since workers who have the same skill level (education etc.) will not all be paid the same wage. This result is intuitive and efficient in the sense that the best workers get paid the highest amount which incentivises workers to pursue a career in their most productive field.

Using this model to determine the consequences of opening to trade leads to worrying results. The Melitz model shows that trade liberalisation redistributes income towards more productive firms. These top firms, who suddenly boost their income through exporting, are further motivated to interview their employees more comprehensively. The bigger a firm becomes the more they stand to win or lose from the decis-

ion making/competency of its employees. The increased screening process further boosts the cost of hiring which encourages them to pay their employees even higher wages.

At the other end of the spectrum, firms who were previously making respectable profits find themselves scraping by, near the zero profit cut-off. They can no longer afford to screen their employees as meticulously. As a result their productivity levels (and hence profits) fall. They then have less incentive to pay their employees to stay as the interview process will be less complex and it is cheaper to rehire than pay higher wages. As a result the less able workers who work for the less productive firms potentially face a wage decrease, further widening the income gap. Helpman *et al* (2010) reference findings from Menezes-Filho and colleagues (2006) which provide empirical evidence for increased within group inequality after trade.

Melitz (2003) assumed lower productivity firms went out of business due to higher wages whereas this suggests they face lower wages when the country opens to trade. However Melitz does propose an alternative as to why these firms exit whereby they face an 'increase in product market competition associated with trade' so this model is still plausible and intuitive.

This model does however suggest that firms who face lower profits due to having low productivity levels initially not only lose once trade begins, but also slowly become less productive over time due to less screening of employees and inadvertently hiring less productive workers. So opening to trade has the initial Melitz inequality effect of rich firm owners becoming richer due to higher productivities. Then we also see an increase in income inequality for workers due to efficiency wages. Finally, over time the productive firms become more productive due to increased screening and unproductive firms become less productive. This leads to further income inequality for both firm owners and employees developing in the time period after trade liberalisation, an extremely unfavourable result of trade.

Conclusion

David Ricardo's original ideas of comparative advantage from the early nineteenth century represent a very positive view of the potential gains from trade. The prevalence of global trade today is perhaps the best endorsement for Ricardo's theory. However the world has since learned that these gains from trade can come at the cost of increased income inequality.

In all the cases encountered in this essay, inequality of some form increased after a country lowered its trade barriers. However it is difficult to prove conclusively that trade is the underlying reason for this effect. A country that opens to trade is likely to be attempting to boost their economy in more ways than just trade. In an attempt to integrate their country into the global market, the government are possibly implementing many

new policies to increase productivity and profitability. This was evident in Colombia where we concluded that trade indirectly caused firms to adapt new technologies to compete on a global scale. So while Colombia was opening up it was also attempting to boost its output in other ways.

Perhaps a stronger case for this is the results of the Melitz model which when appropriately tweaked reveal that trade can effectively increase inequalities for the two standard sectors of the economy, Capital and Labour. Governments can claim they plan to redistribute the gains from trade fairly, through taxes and subsidies, but doing this in practice is a near impossible task. The evidence presented in this article implies that trade is likely to increase income inequality, but ultimately free trade policies must evaluated on a case by case basis and depending on your confidence in the political system there may be some comfort in the fact that the vast majority of countries around the world have opted in favour of trade.

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A Theoretical Analysis Of The Mechanisms Of Competition In The Gambling Market

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In this essay, Rory McStay describes the the effects of information asymmetries in the gambling market and outlines the ways in which firms design products to take advantage of this asymmetry. A number of different regulations are suggested, as he argues that Government intervention in the gambling market is essential to protect consumers, correct for inefficiencies and maximise economic surplus. He concludes by highlighting the scale and complexity of the industry, which may call for EU intervention.

Introduction

Legislation and government intervention in the gambling industry is generally dismissed as a lucrative tax revenue stream. In order to properly investigate the regulation present in the gambling industry, we should ask whether governments are simply trying to maximize tax revenue or are there other, perhaps even benevolent, motivations? This paper intends to identify the forces present in the market which reduce competition and will seek an efficient regulatory mechanism, which maximizes competition in the market, in order to maximize the economic surplus.

The Gambling Market

The market consists of a product of satisfaction derived through the participation in a game of chance with many buyers and sellers; the gamblers and casinos respectively. Bookmakers offer games of chance to consumers in the form of an odd or a payout. We will refer to these games of chance as events. The events consist of two outcomes, Success or Failure. We will assume that the outcomes of events are independent in the long run. In the long run, the gambler can either win or lose and events are distributed by a Bernoulli trials distribution. If the gambler is successful, they will receive a payout;

$$r = ay, \text{ if successful, } r = -y \text{ otherwise}$$

With the existence of a $P\{S\}$, we can derive the price (p) of the product as the expected return;

$$P = Ec\{r\} = P\{S\}ay - (1-P\{S\})a$$

Similarly, the firm also faces an expected return - $Ef\{r\}$;

$$Ef\{r\} = a(1-P\{S\}) - P\{S\}ay$$

The firm faces a cost of offering the event. The marginal revenue received by the firm is equal to the $Ef\{r\}$. In the long run, firms must cover all costs, therefore $Ef\{r\} > 0$. As $MR = P$, the consumer will experience $Ec\{r\} < 0$. At lower prices, the consumer can afford to place more bets. Firms seek to differentiate their products in order to maximize bets placed. Does this description of the market warrant interference? Are there mechanisms present, which cater for a dominant player in the market?

Analysis of Competition

First we will examine the information available in the market. No gambler has an advantage over another, but their knowledge is uncertain. The firms however, know for certain the information about their own event and have reasonable knowledge of competitors' events. This means that the consumer cannot see the cost of the product until after it has been consumed while firms can predict $Ef\{r\}$.

Firms can design the events to alter the consumer's perceived $P\{S\}$. The firm can then artificially inflate the odd, causing the consumer to make irrational decisions. This is possible because of the lack of certainty amongst the gamblers. Virtual chance simulations are designed with the intention of making them as easy to use as possible and to stimulate the gambler to bet. In order to maximize bets placed, the software behind the games is designed to make the player play fast. This leads to the consumer making irrational decisions and minimizes the risk involved with expected returns.

Firms do not compete on price, as consumers cannot see it. This means that firms heavily differentiate their products as well as using loss leader techniques and incentives to sign up (ie. 'Free' bets, money back). Firms develop sophisticated lines of credit, which are intended to speed up play by making funds readily available. The consumer tops up an account instead of paying for bets on an individual basis. This also masks the cash value of bets placed, making the consumer gamble more (Schüll, 2014).

The play rate of a gambler is an important factor as the faster the gambler plays the more outcomes of the event will occur. Intelligent software encourages fast play but also matches the speed of the player. This way a slow player is not intimidated and a fast

player will not get frustrated.

In a typical slot machine or any simulated chance terminal, the consumer sees all the events that imply a success. If the gambler plays a particular order or combination of symbols, they will win the bet. By increasing the amount of possible winning combinations as well as the total number of possible combinations, it will look more attractive when compared to a game with the same P{S} but only a few events that imply success. This artificially inflates the consumers' perceived P{S}.

These dynamics of the design are purely intended to maximize revenue, they are not necessarily in the consumer's favour and may not directly improve the experience received by the consumer. Can these aspects of product differentiation be deemed unfair? Are they taking advantage of the consumer ignorance present in the market? Does it warrant regulation?

There is another key aspect to the design of the product, which is the user interface and game play. Gambling by nature is addictive. Firms take advantage of this by making the games attractive and fun to play. They are making the games more enjoyable and disassociating it with a chance element. This takes advantage of the gamblers natural addictive tendencies. It can however be argued that this improves the quality of the product, which is paid for by the gambler through an increased deficit in their expected return as a result. One must ask, are the actions taken by the online casinos to make their events addictive to the consumer fair? Or is it a product of the free market and allowing competition?

Regulatory Mechanisms

We have just described the main challenge facing the market. We will now look at how it is possible to regulate this challenge. The fundamental problem with this market is the lack of information. The consumer cannot know the price upon consuming the good. It is only until after where they can see the cost of consuming the good. Can we regulate the expected loss experienced by the gambler on each event by altering the odd and the P{S}? This can be done through regulating the design of the software. However, to do so would be to impose a maximum price on the market. This is a contradiction to EU competition policy.

Suppose the government applies an excise duty of t per cent of the stake $T=t\%*y$. Let us assume that the tax is regressive in a conditional sense. If you win the bet, you get taxed. If you lose the bet you do not incur the tax.

In order to investigate the effects of the tax, we must examine the relative elasticities. The good is addictive by nature as well as by the actions taken by the firms. This implies that the relative elasticity of Supply and demand;

$$(PES/PED < 1)$$
$$\Rightarrow Pt = Ec\{r\} = P\{S\}(ay\text{-}t\%y) - (1\text{-}P\{S\})a$$
$$Pt > P$$

The government's ability to discourage consumption is less effective because of the lack of information available. It also further distorts the implied $P\{S\}$, making it harder for the consumer to make a rational decision. This means it is counterintuitive to apply a tax as we are trying to protect the consumer. The tax will only increase the loss experienced by the consumer. It is clear to see how this proves to be an effective tax revenue stream, as the consumer is ignorant as to how much tax they are paying.

Suppose that the government instead, forces firms to advertise the actual $P\{S\}$. Then, the consumer can make a rational decision as to whether or not it is worth the risk. The consumer is now aware of the price of the product. As a result of this complete transparency consumers will be able to directly compare prices. This will cause a fall in price and lead to Demand becoming a function of the market price.

With perfect information consumers can now make smarter decisions and the loss experienced by the consumer is minimized. Information has been made available in the market, reducing the firm's ability to distort the consumer's interpretation of the event. The consumer is no longer vulnerable as the market price now shows the true cost of chance. The firm's cost of offering an opportunity to make money, and the opportunity cost of potential profit is displayed.

Criminal Activity

There is a criminal aspect to the market, which may warrant regulation. If a gambler is successful, it allows them to explain receiving a large sum of money by chance whereas someone deem it suspicious to receive such a sum of money. This allows concealment of the origins of large sums of money. With the ever-increasing technological aspect to online gambling operations. It is growing increasingly easy to launder money in this manner. How is it best to regulate this aspect without altering the competition now present in the market?

Suppose you limit the success rate of events conditionally. This implies that the chance of success is reduced after a series of successes (This will reduce the ability of firms to strategically pay large sums of money to a consumer. However, this is altering the $P\{S\}$ and leaving the events non-independent. A contradiction. As a result of this they are altering the price offered to the gambler and reducing competition in the market.

Suppose governments regulate by analyzing the distribution outcomes of events that occurred. If it does not match the advertised distribution, then they may suspect the firm is altering the outcomes of events possibly to launder money. This will then warrant

investigation. Regulation in this manner will also ensure that the firms are advertising the correct P{S}.

The Market

The EU gambling market is estimated at around €84.9 billion and grows at a yearly rate of around 3 per cent. Online gambling is particularly popular with around 6.8 million consumers in the EU and a wide variety of operators offering services. In 2012, online gambling services represented more than 12 per cent of the EU's gambling market with annual revenues of over €10 billion. Annual revenues in 2015 for online gambling are expected to increase to €13 billion (European Commission, 2014).

In order to investigate the effectiveness of current regulation on competition in the market, we will assume the non-existence of externalities as a result of public consumption, which may not directly alter competition.

Bookmakers in Ireland offer two types of products/events. They consist of natural events which have a P{S} outside the power of firms in the market (i.e. Card games, Horse Racing and Football). In this form of gambling there is a presence of expertise in the market. Information is readily available so the consumer can make rational decisions. This does not warrant regulation, as knowledge of the event is available to the gambler allowing them to have reasonable knowledge of the price.

Alternatively, the bookmaker offers an event in which they control the P{S}. (i.e. Virtual sports gambling, virtual stock markets, virtual slot machines and games.) There is no information of the determining factors of the outcome available. Outcomes are purely generated by computer simulations whose P{S} are predetermined by the firm. An odd is determined by the firm and is the only information available to the consumer.

Online gambling was prohibited in Ireland until 2001, when the Horses and Greyhounds Act stated that a gambler could place a bet with a bookmaker outside of Ireland, allowing Irish consumers to gamble online. The growing complexity and size of the gambling market means prohibition simply will not work. Since 2001, Ireland has passed a new act, the Irish Betting Act (2015). However, to date legislation has failed to address the firm's ability to determine a P{S} of the events offered (Oireachtas, 2015).

The nature of the online marketplace reduces the Irish government's ability to regulate the market in all respects. This is where the EU needs to step in to appropriately regulate the market to allow competition and therefore protecting the consumer by making information freely available.

Conclusion

Demand in the gambling market is not a function of the price of the good and firms are

able to affect demand by their own actions in differentiating their products. In order to maximize competition in the market, knowledge must be made available in order to allow demand be a function of price. This will allow for price competition and reduce non-price competition, minimizing the price and therefore the expected loss experienced by the consumer. As a result economic surplus would be maximized, competition increased and the consumer made less vulnerable.

The increasing size of the online marketplace, technological advancements and unification of the EU are making the regulatory challenges harder for national governments to tackle. This difficulty and the current inefficiencies present in the market have increased the need for industry specific regulation from the European Commission.

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ARGENTINE RAIL DEVELOPMENT AND IRISH MEAT IN BRITAIN, 1857-1910

JAMES KELLY
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In an in-depth examination of a narrow topic with broad policy implications, James Kelly illustrates the extent to which changes in a single country's competitiveness can affect economies worldwide, through the impact that Argentina's railway development had on Irish meat exports to Britain. He makes the confident case that applying econometric techniques, combined with the study of economic history, is a vitally important tool for understanding market reactions today.

Introduction

One of the most visible legacies of the first phase of globalisation and international capital flows, the railways influence was felt in both the domestic economy integration and world markets. This proposal aims to investigate its impact on the Argentine economy and also on the economies of competing nations during this period. Railways had a substantial influence on other countries, with much being written about their unifying effect in the US market. Could reducing the costs of trade through the introduction of railways in Argentina, lead to a more unified international market?

A further aim of this proposal is to evaluate the influence of infrastructural development, transport in this case, in a previously underdeveloped country and its effect on rivals in an international market, agri-business in this particular case. In a global economy quickly becoming ever more interconnected and urbanized, the concept of long distance exports of food from land abundant to labour intensive urban areas is very relevant. Since the Baltic grain trade in Amsterdam in the late sixteenth century, the concept of sea-borne trade of bulky low value goods changed the pattern of economic integration and production specialization, and has raised the issue of self-sufficiency versus import heavy policies. Although food prices in major world markets are at or near a historical low, there is increasing concern about food security. Despite strides in technology in the industry a new set of exogenous factors (climate change, competition for water, energy, and land) look set to affect food networks and systems for generations to come. Food imports and reliance on international markets look set to continue, and this research topic will offer useful insights into the effects of such developments on both global players and in particular local competitive suppliers.

Admittedly, it would be unrealistic to expect a discovery that would rival the impact the New World had on the international agricultural produce market, however, understanding the market reaction to global shocks in the industry is still important today. This is what this paper aims to achieve.

Objective

To meet the aims addressed above the objective of this proposal is to determine whether the development of the Argentine rail network (holding all other variables constant) influenced the international competitiveness of Irish agricultural produce in Britain (modern day) at the turn of the nineteenth century.

Relationships within the international meat industry can be best described in terms of two complementary regions: one of surplus production and the other of surplus demand. Argentina was 'land abundant' compared to the 'labour intensive' nature of Western Europe at the time. With their abundant land and sparse populations this new economy was self-sufficient and could also provide the rapidly industrialising Europe with large amounts of food. Its agricultural growth was attributed to a European economy with increasing populations and income and the subsequent increase in demand. The British economy required imports and in order supply these imports Argentina required external capital investment. Given Argentina's flat land abundant nature, investment in rail networks was relatively inexpensive and had favourable returns when compared to domestic returns for British investors, even when risk was controlled for (Edelstein, 1984). Aggregately, railway development represented a significant factor of the productivity growth during this period. The agricultural revolution of the pampas increased the total cultivated area in the Argentine economy from approximately 40,000 to 143,000 square kilometres between 1895 and 1914 (Fajgelbaum, 2014).

First we must establish the effect of the railway development on Argentine exports to Britain, then we must see what effect these exports had on the Irish exports to Britain. Two regression should be run to identify these variables: a multiple linear regression and an instrumental variables regression. Most of the railway building occurred in the period 1857 – 1910, and since data for both dependent and explanatory variables are available over all of this time, the time under consideration will be these 53 years. This means that there will be a considerable number of data points in the analysis. Explanatory variables in this analysis include the speed of delivery, and other technological advancements that could have led to an increase in exports, such as the refrigeration shipping method. The effect of railways on Argentine exports acts as the control variable in the instrumental variable regression when researching the effects on Irish exports. For the purpose of this proposal 'meat' will consist of three products; cattle, pig and sheep. Furthermore, price data is not available for all agricultural products in this period, how-

ever it is for the meat ones listed above. Irish agricultural volume and production is influenced primarily by land tenure and the nature of demand for the products (Crotty, 1966). The nature of demand for its products internationally would have stemmed from Britain, and a large shock to supply from increased Argentine beef imports could certainly have had an effect on Irish agricultural volume and produce. Investigating this is the objective of this research proposal.

Literature Review

International Rail Competitiveness: Why Argentina?

By 1914, three quarters of the current rail network of 27,000 miles was in full operation and substantial freight cost reductions were achieved. In 1910, the British capital investments in Argentine rail was £174,464,274. This equalled their entire investment in Argentina twenty years previously and by 1914 British companies accounted for 70 per cent of Argentine rail miles (Gravil, 1985). The factors of production adjusted in response to the agro-pastoral orientation of the economy. Railways were used as a tool for colonization as the eastern provinces were explored, leading to further domestic integration and national efficiency. Table 1 shows the railway mileage expansion of Argentina, 1850-1910.

Year	Argentina
1850	6 (1857)
1860	24
1870	455
1880	1,437
1890	5,750
1900	10,419
1910	17,220

Table 1: Public Railway Mileage, 1850-1910 (Source: Mitchell, 1983)

The export led rail development and level of domestic integration perhaps gave Argentina a competitive advantage over other land-abundant agri-exporters, Australia for instance. The Australian network was far from an integrated one, with each state building their own railways (Perren, 2006). The increase in demand for Argentine beef in Britain was due to a lack of real growth in domestic meat production or imports, coupled with an increase of 4.5 million in population in Britain between 1900 and 1913. Other key developments were supply and commodity adjustments, including the decline in meat exports from the US as their domestic consumption increased, and the introduction of trans-Atlantic ref-

rigerated animal trade.

Argentina's integrated network possessed cheaper animals, lower freight costs and faster deliveries over rivals, and their produce continued to succeed in the British market. The Australian production was seasonal, more susceptible to drought and had institutional defects in distribution. The advantages for Argentina were considerable. As it was compulsory for meat packing product processing to occur in the exporting country, their organised and integrated network was more efficient.

Argentina's efficiency advantages allowed for growth. There was a positive correlation between railway construction and government capacity (Bignon *et al.*, 2015). Through a multiple equilibrium model Bignon, Esteves and Herranz-Loncan estimate that some Latin American nations were stuck in a non-development trap, whereby growth in government revenues and foreign trade were depressed due to insignificant railway development, and similarly, railway development stagnated due to low levels of trade and subsequent scarcity of state resources. The Argentine economy had a competitive advantage in the market, given the British propensity to invest in their developing infrastructure. Their model suggests even a modest capital injection would achieve higher levels of railway density. Revenues triggered railway development, which led to trade, which led to further revenue, making the investment guarantees more credible.

Railways' Influence on the Argentine Economy

Fajgelbaum's paper (2014) uses quantitative methods, and the natural experiment of the Argentine development and integration into world markets in the late-nineteenth century, to investigate the role of internal trade costs in shaping the effects of external integration on the pattern of economic development and welfare within countries. During the period 1869 to 1914, livestock and agricultural exports from Argentina accounted for over 95 per cent of the total value of exports. Fajgelbaum concluded the price of exported agricultural goods declined with remoteness, perhaps giving Argentina a cost advantage from their sparsely populated 'pampas' in the world market. Reductions in transport costs and technology improvements were attributable to the quadrupling of real exports between 1869 and 1910. Reductions in both internal and external trade costs induced changes in the composition of agricultural exports and the allocation of cultivated land across agricultural goods. The distribution of economic activity across sectors and regions were determined by relative prices and productivity, whereby these relative prices depend on both internal and external trade costs.

Perhaps the most noteworthy aspect of this paper is that it did not view the countries in the aggregate, but instead modelled the internal reallocation of resources across regions and sectors central to economic development, thus isolating the influence of the railway development in the 'pampas' on economic development. This allowed them to

identify a simple general equilibrium for the impact of internal geography on the level and pattern of development, which they referred to as the spatial Balassa-Samuelsson effect. A spatial Balassa-Samuelson effect is evident from the results, whereby locations close to a global market have high population densities, high shares of employment in the non-traded sector, high relative prices of non-traded goods, and high land prices relative to wages (resting on the assumption of inelastic demand). This technique further indicates the importance of the rail development on the marginal benefit of 'pampa' infrastructural development. Their analysis underlines the influence of complementary investments in internal infrastructure and technology adoption in determining Argentina's economy response to external integration.

Herranz-Loncon's paper (2013) measures the contribution of railway development, this time to economic growth, in four Latin American countries before 1914. Railway density was quite low in Argentina. This resulted in high land prices relative to wages and cost differentials from the 'pampa's' remoteness. Herranz and Loncon use the Solow model to measure the growth contribution of the new technology in the economy. Interestingly, Oliner and Sichel (2002) have used a disaggregated version of this Solow expression, in which different types of capital and components of total factor productivity growth are distinguished. This adjusted model could help measure the contribution of growth from railway development, from both total factor productivity growth and through the capital effect of investment in railways. The TFP contribution can be split into two sections, the growth from within the sector in question and the growth from the substitution of the previous technology. These theories can be illuminated by comparison between the effects of railways on Argentina and on Britain. Herranz-Loncan (2006) show that the first British railways had no great cost advantage over waterways when implemented initially. In contrast, levels of growth in Argentina from the railways were much higher, because previous to their introduction there were no viable alternatives. It can then be concluded that the difference of a growth contribution of a new technology should be included in the total factor productivity term.

Herranz-Loncon (2013) go on to investigate the contribution of railways to economic growth by using a capital term, estimates beginning in 1865. This estimation highlights the importance of the railways development for Argentine growth. In fact, the Argentine ratio of 1.81 per cent between net revenues and GDP in the period resembles the British equivalent figure of 2.52 per cent, and compares favourably with similar nations undergoing railway expansion during this period (Mitchell, 1983). The contribution of railways to economic growth is expressed in a total factor productivity term. This is based on the comparison at the end of the period between the cost of railway transport and traditional pre-railway transport. The estimation relies on the evaluation of direct real income gain from railways derived from the social savings. These results are then expressed as

percentage points once social savings have been converted into additional consumer surplus and increased by railway profits. Argentina's railway freight output of 8,985.4 is significantly larger than other rail oriented countries in 1913 (Herranz-Loncan, 2013). Table 3 below shows the contribution of railways to productivity and growth before 1914.

	Argentina (1865 - 1913)
a) Railway capital stock per capita growth	6.36
b) Railway profits share in national income	1.81
c) Railway capital contribution (a x b)	0.115
d) TFP contribution	.533
e) Total railway contribution (c + d)	.648
f) GDP per capita growth	3
g) Railway contribution as % of GDP growth (e/f)	21.6

Table 2: The Contribution of Railways to Productivity and Growth before 1914

Irish Agriculture

Geary and Stark's paper (2002) aims to evaluate the GDP level of each of the United Kingdom nations between the period 1861 and 1911, and their values are sector specific. The variables they employ are labour force and productivity grouped by sector and by country. Irish employment in agriculture decreased from over 1.2 million in 1861 to approximately 846,000 by 1911. Though this can be explained in part by the declining population, the dynamic in Irish agriculture had changed from labour to land intensive. They then identify sectoral output in the United Kingdom, derived from Feinstein's (1972) index numbers of sectoral output at constant factor cost. Employment in agriculture decreases from over 3.2 million in 1861 to just over 2.2 million by 1911 across Britain, and agricultural output remained rather constant during this period during a time of extensive growth in other industries. This relative slowdown emphasises the need to check for endogeneity bias in the regression as the Argentine rail development could possibly be due to openings in British markets.

By 1908, 58 per cent of the net value of livestock production came from exports out of Ireland. Between 35 to 40 per cent of Irish cattle in the 1850s were exported to Britain. This figure increased to 50 per cent in the 1860s and up to 70 per cent by the end of the nineteenth century (Turner, 2002). Adjustments in the price terms of trade encouraged a big push towards a livestock economy. There was a diminishing size of the domestic Irish market and consequently Irish agriculture was heavily dependent on the British market as seen from Turner's figures. The British economy was a free market and once the issue of livestock product perishability had a solution through improved refrig-

eration technologies and further technological advancements internationally, any protection Irish suppliers received was eroded by new competitors, namely Argentina (Turner, 2002).

Approach

For our research, we recommend running a two-stage regression model. Firstly, we need to establish the effect of railway development on Argentine exports to Britain and for this we must run a multiple linear regression model. It is important to isolate the railway's impact from other technological advancements, namely strides in refrigeration technology and shipping. As we are investigating the effects of technology change, GDP growth per capita may yield more accurate results than simply GDP per capita (Matthews, 1982). This model can be written as follows, with A denoting Argentina and B denoting Britain:

$$\text{ExportAt} = \beta 0 + \beta 1\text{railwayAt} + \beta 2\text{techAt} + \beta 3\text{speedAt} + \beta 4\text{GDP-capgrowthBt} + \beta 5\text{relPBt} + \beta 6\text{tarBt} + \beta 7\text{exzt} + \text{et}$$

Where the explanatory variables are:

Railway = Mileage in Argentina at period t (Mitchell, 1983)
Tech = Increases in trans-Atlantic shipping volumes from refrigeration techniques (Gravil, 1985)
Speed = Trans-Atlantic delivery speed (Gravil, 1985)
GDPcapgrowth = Per capita GDP growth in Britain (Matthews, 1982)
RelP = Relative price of meat across regions (Perren, 1978)
Tar = Tariffs in trade between Argentina and Britain (Gravil, 1985)
Exz = Meat exports of other competing nations to Britain (Perren, 2006)
et = error variable

This regression will determine the influence of railway development on Argentine exports to Britain. The results of this regression exploring railway development influence on exports are important and even without further research they offer useful insights into this topic.

One concern is the endogeneity of the railway development. The development of the Argentine railways could have been in response to price or quantity factors in the British meat market and not vice versa. In order to empirically assess the impact of the development of rural Argentine rail networks in the late nineteenth century on the prices and exports of Irish agricultural produce in Britain we will need an econometric model that takes this endogeneity bias risk into account. An instrumental variable approach would

overcome the issue. Argentine railway miles will be used as an instrument for the exported goods in Britain from Ireland. ExportAt from the earlier regression, being the increase in Argentine exports as a results of the railways will act as the control variable in this case. The instrumental variable model can be written as follows, with I denoting Ireland:

$$\text{ExportIt} = \beta 0 + \beta 1\text{ExportAt} + \beta 2\text{techIt} + \beta 3\text{speedIt} + \beta 4\text{GDPcap-growthBt} + \beta 5\text{relPBt} + \beta 6\text{tarBt} + + \beta 7\text{exzt} + \text{et}$$

Where the explanatory variables are:

Tech = Technology driven increases in exports from Ireland to Britain (Perren, 1978 & Agricultural Statistics of Ireland Journals, 1891, 1901, 1911, 1916)
Speed = Delivery speed (Perren, 1978)
GDPcapgrowth = Per capita GDP growth in Britain (Matthews, 1982)
RelP = Relative price of meat across regions (Perren, 1978)
Tar = Tariffs in trade between Ireland and Britain (Perren, 1978 & Agricultural Statistics of Ireland Journals, 1891, 1901, 1911, 1916)
Exz = Meat exports of other competing nations to Britain (Perren, 2006)
et = error variable

Given the available data this regression can be run every year of the 1857 to 1910 period, leaving 53 data points of analysis. Regression results will be presented without controls and then with controls.

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HOW SHALE FRACTURED THE OPEC OLIGOPOLY: A GAME THEORY ANALYSIS OF THE OIL MARKET IN 2015

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Richard Roberts deftly applies the principles of game theory to the oil market's shift from a cartel-driven to a supply and demand based equilibrium. In his model, the dominant Organization of the Petroleum Exporting Countries play against US Shale Producers, who wish to enter the market. In a complex crisis, his clear treatment of the strategic game draws conclusions which can help to explain the dramatic fall in prices.

Introduction

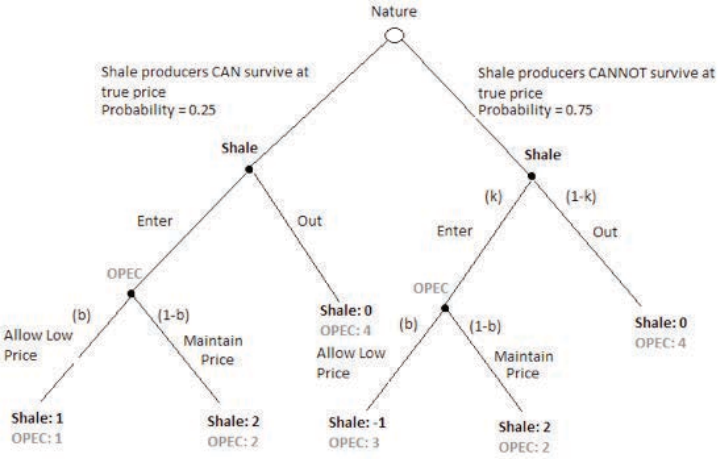
The Organisation of the Petroleum Exporting Countries (OPEC) is an oft-cited example of an oligopoly in introductory economic textbooks. Its ability to essentially dictate the global price of oil in recent decades rather than allowing market forces to determine a true equilibrium price has secured steady and regular returns to member countries. Rather than striving to compete through efficiency and lower prices that would benefit consumers, a number of oil producing economies have instead united to impose price rigidity on the market. Moreover, the significant barriers to entry associated with the incredibly high capital costs of entering the industry, combined with the threat of predatory pricing and the insatiable global demand for oil, has allowed these nations to maintain their dominance despite such uncompetitive behaviour. However, this long standing market dynamic has begun to change. The economic slowdown in China has precipitated a faltering in global demand and this combined with the influx of US shale producers has undermined the supremacy of OPEC.

In June 2014, the price of Brent Crude oil was close to $100 per barrel. It has now dipped below $40, representing a nadir in a seven year period since the global economic crisis. This dramatic rout of oil prices is strongly linked to the rise of fracking technology and the resulting global supply glut that has forced OPEC to reconsider its pricing strategy. 'Fracking' refers to hydraulic fracturing, a process whereby a mixture of water, sand and chemicals is blasted into underground shale rocks with the intention of releasing

reserved fossil fuels. Improvements in this technology, combined with the use of horizontal drilling techniques, allowed oil to be extracted from shale rock at commercially viable costs leading to a boom in the U.S. oil industry. This shale revolution has seen U.S. production swell from 5.4 million barrels per day in 2009 to 9.4 million in 2015 (Crooks, 2015) leading to a significant increase in the global supply of oil and presenting OPEC with a decision to make regarding its policy of price rigidity.

In the face of mounting pressure from this surge in oil production and wavering global demand, OPEC met in November 2014 to decide on the best course of action. In a seminal moment in the history of the oil industry, the members of OPEC, led by their de facto leader Saudi Arabia, took the decision not to reduce their official production level and effectively allow market forces to determine the price of oil for the first time since the 1970s, fearing that any contraction in volume would be quickly filled by marginal barrels from the shale producers (Crooks, 2015). The decision to essentially ignore production ceilings was officially corroborated in December 2015 but had for all intents and purposes been the case since that pivotal meeting in November 2014 (Shenk, 2015). This resolution from OPEC implied a seismic shift in their strategy away from dictating prices and towards protecting market share from the usurping forces of non-OPEC producers. The following game theory model outlines the decisions faced by OPEC and by the US shale producers during this period.

Model



Outline

The model, above, represents an extensive form game with incomplete information. It illustrates the scenario outlined in the introduction section whereby a dominant organization, OPEC, is confronted by the possibility of the entry of a new player in the industry. This game diverges from similar challenger/incumbent situations by way of the presence of incomplete information. The incumbent, OPEC, is not privy to the cost structure of the new entrant and is unsure of whether or not they could survive at the low price which would arise were they to cease their price rigidity strategy. OPEC is, however, aware of the probability that such an entrant to the market can survive at the lower oil price. OPEC must make a decision to either maintain the false price as they have done previously but lose market share and thus profits to the entrant or, alternatively, forgo this traditional tactic and trust that the Shale Producers will be driven out by an oil price below their average cost.

The type space for the Shale Producers consists of two types; one in which the Shale Producers can survive at the true market price of oil and one in which they cannot survive. Type 1 has probability 0.25 and Type 2 has probability 0.75. To model this random variable, Nature is introduced to the game as a third player and moves first to determine which type the Shale Producers will take on. After Nature moves, only the Shale Producer is aware of its type i.e. OPEC remains oblivious and must rely on the probability distribution to guide its strategy.

Assumptions

There are a number of governing assumptions associated with this game. Firstly, it is assumed in this model that OPEC are totally ignorant of the cost curve faced by the Shale Producers and that they have no means of estimating same. Rather, they must choose their strategy on the basis of probability. In reality, OPEC could well have a reasonable approximation of the marginal and average costs of producing shale oil based on their own data and also from freely available financial statements of publicly listed firms. If this is the case, OPEC could use this information to guide their decision on whether or not to allow prices to fall.

Secondly, this model assumes that there are just two players in the market-OPEC and Shale Producers. This is a simplification of the real world oil industry where, although OPEC is responsible for upwards of 40 per cent of global oil supply, there are a number of other players such as Russia, China and Brazil who can also influence market prices. This assumption is not overly-constraining as the price-setting power of the OPEC cartel is well-renowned and recognised as a genuine feature of the oil market.

The values in the above model were ascribed to the pay-offs for the following reasons:

1. If the Shale Producers choose 'Out' at the first decision node, regardless of type, they receive no benefit whilst OPEC continue to enjoy their oligopolistic position (0,4).

2. In the event that the Shale Producers can survive at the lower price, they choose to enter the market and OPEC allows the price to fall, both they and OPEC receive a payoff (1,1) that is lower than if the price remains high (2,2).

3. Similarly, if it is the case that Shale Producers cannot survive at the lower price, they still enter the market and OPEC doesn't allow the price to fall both players receive the same payoff (2,2). However, if OPEC does allow prices to fall it enjoys a larger benefit whilst the Shale Producer receives a negative payoff as it makes a loss and must exit the market (-1,3).

Thus, it is apparent that from OPEC's perspective, the most advantageous outcome is if the Shale Producer does not enter, however, if it does, it is worthwhile to allow prices to fall if the Shale Producer is unable to survive at the low price. 'k' is the probability with which the Shale Producers choose to enter the market when they are unable to survive at the lower price. 'b' represents the probability that OPEC allows a lower price to arise at either node.

Equilibria

As this is a Bayesian game, there is just one Perfect Bayesian Equilibrium (PBE). In fact, if the players are constrained to using pure strategies, there is no PBE at all. However, an equilibrium is reached if players are permitted to mix strategies. If the Shale Producers are of the type whereby they can survive at the lower oil price, they will always enter the market, however, if they know they are unable to survive they will be less likely to enter the market. So as not to betray their type to OPEC, Shale Producers who cannot survive adopt a randomised approach to entering the market or staying out. As such, the strategies for each player are as follows;

1. Shale Producers' strategy:
-If able to survive at the lower oil price, then always enter the market.
-If unable to survive at the lower price, then enter the market with probability k.

2. OPEC's strategy:
-Choose to allow the lower oil price with probability b.

3. OPEC have the following beliefs:
-If Shale Producers enter the market, they are able to survive with probability (11+3k).
-If Shale Producers choose to remain outside of the market, then they are able to survive at the low oil price with probability 0.

The equilibrium prediction is that the Shale Producers will enter with certainty if they are able to survive at the low price, and if they are unable to survive there is still roughly a 33 per cent chance of them doing so based on their mixed strategy. OPEC believe there is a 50 per cent chance that the Shale Producers are able to survive at the lower oil price given that they have entered the market (0.50=0.25/(0.25+0.33*0.75)) and in response there is a 66.67 per cent chance that OPEC will facilitate the lower oil price. The solution to the game is derived in full in the Appendix below.

Analysis

The primary prediction from this model is that when faced with the prospect of a new entrant who may or may not be able to survive at lower oil prices, OPEC will choose to randomise between maintaining oil prices and allowing prices to fall by increasing supply. This equilibrium is useful in understanding the oil crisis of today as it goes some way to explaining how prices have fallen so dramatically. With the rise of Shale Producers, OPEC, in this instance, opted to pursue a policy of increased production in the hope that the lower price would drive out Shale Producers who generally operate on a higher cost function than OPEC. However, Shale Producers have surprised both OPEC and industry analysts by their resilience to this predatory strategy. Through a combination of hedged contracts, continued improvements in technology, and 'high grading' projects, Shale Producers have proved to be able to survive at the lower oil price i.e. they can be conceived of as being Type 1 in the model above and the game has reached the leftmost outcome where both players receive a pay-off of 1. Thus, the model describes how the real world situation of low prices and surviving shale producers has been reached through the Perfect Bayesian Equilibrium.

An important implication from this game is that it is absolutely critical for entrants to the oil industry to be thoroughly clandestine in relation to their cost functions. By maintaining this secrecy, shale producers leave OPEC with incomplete information which forces them to adopt a strategy that can, in some instances, lead to higher payoffs to the entrant than if perfect information existed. As mentioned previously, this assumpt-

ion of incomplete information may not be entirely representative of the real world but, as with most assumptions, this does not undermine the lessons and implications the model provides.

Of course, the assumptions associated with this model are not completely realistic. There are more than two players in the oil industry and thus decisions taken by OPEC in response to new entrants cannot be made in isolation. In reality, maintaining high oil prices is more complex than is portrayed here. Indeed, the current situation global oil producers now find themselves in (as a result of outcome of the game described above) has been likened to a classical Prisoner's Dilemma (Aumann, 1959). Each player in the game is confronted with the choice between agreeing to reduce their production in order to benefit producers as a whole or to selfishly increase their own production thereby boosting revenues hit by low margins. Indeed, Saudi Arabia said at the most recent OPEC meeting that OPEC would need cooperation from countries outside the group, such as Russia, to support prices without 'others stepping in and taking volumes' (Raval, 2015). It is apparent that the industry is now marooned in a Prisoner's Dilemma as seen in Figure 1, below, at the Nash Equilibrium (Don't Cooperate, Don't Cooperate).

		Country B	
		Cooperate on Supply	Don't Cooperate on Supply
Country A	Cooperate on Supply	(10, 10)	(5, 15)
	Don't Cooperate on Supply	(15, 5)	(7, 7)

Figure 1: Prisoner's Dilemma Faced by Oil Producers Today

To move away from the inefficiencies of this Nash Equilibrium, the players in the game must view the oil industry as a repeated, infinite game in which players evaluate discounted payoffs over time. In this context, it may be possible to generate a degree of cooperation within the industry by means of a 'Grim-Trigger' strategy (Harrington, 2015) in which any deviation is punished severely. This is similar to the approach adopted by OPEC before the rise of other oil producers. Now it is faced with the challenge of incorporating these producers into a cooperative agreement or face the prospect of lower prices and profits for the foreseeable future.

Conclusion

In conclusion, principles of game theory have been applied to a real-world situation to shed light on how the current oil crisis has taken shape, and to provide a greater understanding of how the dynamics of the market are shifting from being cartel-driven to a traditional supply and demand based equilibrium. An extensive form game of incomplete information with sequential moves has been successfully modelled and solved to this end.

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Appendix

k: the probability that the Shale Producer enters the market given that it cannot survive at the lower oil price.

b: the probability that OPEC allows the lower market price.

Let p denote OPEC's belief that they are at the decision node on the left hand side of the model i.e. that the Shale Producers can survive given that they have entered the market.

E U0(Allow Low Price)=p(1)+(1-p)(3)=3-2p

E U0 (Maintain Price)=p(2)+(1-p)(2)=2

OPEC will prefer to Allow Low Price if:

$$3-2p > 2$$
$$1 > 2p$$
$$P < ½$$

If $p < ½$: OPEC will Allow Low Price

If $p > ½$: OPEC will Maintain Price

If $p = ½$: OPEC is indifferent between playing Allow Low Price and playing Maintain Price

p=Prob (Enter)

=Prob (Can Surive)*Prob (Can Survive)Prob (Can Surive)*Prob (Can Surive)+Prob (Cannot Survive)*Prob (Cannot Survive)

= 1*(0.25)1*(0.25)+k*(0.75)

=11+3k

Case 1: For what values of k will p < ½ ?

$$p = 1/(1+3k)$$
$$1/(1+3k) = ½$$
$$1 < 3k$$
$$k > 1/3$$

Case 1: $k > 1/3 \quad => \quad p < ½$

Since $p < ½$, OPEC will always play Allow the Low Price.

If OPEC will always Allow the Low Price in this case, then the Shale Producers should stay out of the market.

$\therefore k = 0$

However, this statement conflicts with the opening statement of Case 1 (k was said to be to greater than 1/3) and hence this cannot be deemed an equilibrium.

Case 2:

$k < 1/3 \quad => \quad p > ½$

Since $p > ½$, OPEC will always play Maintain Price.

If OPEC will always play Maintain Price in this case, then the Shale Producers should always enter.

$\therefore k = 1$

Again, this statement is in conflict with the opening statement of Case 2 (k was said to be to less than 1/3) and hence cannot be deemed an equilibrium.

Case 3:

$K = 1/3 \quad => \quad p = ½$

Since p = ½, OPEC are now indifferent between playing Allow Low Price and Maintain Price.

If k = 1/3, the Shale Producers that cannot survive at the low price is mixing between Enter and Stay Out of the market.

For these Shale Producers to be willing to mix between these strategies, they must be indifferent between them i.e. given OPEC's strategy, the expected payoff from both actions must be equal. This can only be the case if OPEC are also mixing,

E UShale(b)=-1*(b)+(2-2b)

=2-3b

E UShale(b)=0

0=2-3b

3b=2

b=23

OPEC is willing to play Allow Low Price with probability 2/3 because they are indifferent between Allow Low Price and Maintain Price at this probability distribution.

Pricing's Next Top Model: A Game Theoretic Analysis Of 'Freemium' Pricing

Greg Mangan
Senior Sophister

The Freemium pricing model, where a firm offers a service simultaneously at a free and a premium price, is skilfully examined by Greg Mangan using a game theory approach and then shown, under certainty, to be the firm's optimal pricing choice. The ease with which he extends his model and analyses its conclusions, from adding the case of imperfect information, to the discussion of in-game purchases and add-ons and the presence of network effects, is a testament to the insightful nature and the relevance to industry of the ideas expressed in this essay.

Introduction

The freemium pricing model, a simple portmanteau of free and premium, functions as it sounds - a firm offers a service simultaneously at a free and a premium price point. In the last decade or so, the freemium pricing model has been actively adopted by many firms, though primarily in the technology industry. Freemium services should be viewed as distinct from services that are `free-to-try' or that offer free samples, the important distinction being that the free service offered in a freemium model may be consumed in the long-term, beyond any form of trial period. In short, 'Users get basic features at no cost and can access richer functionality for a subscription fee' (Kumar, 2014).

This paper builds a simple game-theoretic model of firm and consumer behaviour under the freemium pricing model, and shows that it is generally an optimal choice for firms in the face of uncertainty over their customers' willingness to pay. Firstly though, a simple pricing game without a freemium option is presented as a motivator for the firm's decision. The model is then expanded to include freemium as a pricing strategy. Finally, the element of uncertainty is introduced into the game, where the firm is uncertain whether they are playing against a consumer who is willing to pay for their service or one who is not. An analysis of the model is then provided with some discussion of possible extensions.

Simple Pricing Game

Firstly, a simple pricing game without a freemium option is considered. There are two players in this sequential game, the Firm and the Consumer. The firm moves first, choosing to either offer a 'Premium' service or a 'Free' service. Providing the premium service involves a more development, refined service, but sunk costs (such as R&D) are incurred. The consumer then chooses to 'Use' or 'Don't Use' the service.

The firm prefers to have a paying customer than a non-paying customer, however it prefers to have a non-paying customer than no customer at all, such that:

$$Uf(Premium, Use) > Uf(Free, Use) > Uf(Free, Don't\ Use)$$

If the firm offers a Premium service and does not gain a customer it is assumed that it is at a financial loss due to sunk costs. No such sunk costs exist when operating under the Free model and so:

$$Uf(Free, Don't\ Use) > Uf(Premium, Don't\ Use).$$

The consumer prefers the outcome when it uses the service for free to either of the outcomes in which it does not use the service, and is indifferent between the latter two outcomes such that:

$$Uc(Free, Use) > Uc(Free, Don't\ Use) = Uc(Premium, Don't\ Use)$$

When the consumer uses the good in the case of the Premium model, they are charged a fee. Denote the payoff to consumer in this case, Uc(Premium, Use), as x. It is assumed that the Firm is playing against a consumer who is willing to pay for the service, in the sense that their personal valuation of the service - vi - is above the price paid - p - such that $p<vi$. The Consumer receives a positive payoff from using the premium service; for this game the case of $x=2\$$ is considered. This is arguably a valid assumption to make for any pricing model where perfect price discrimination does not occur; it simply assumes that a positive consumer surplus exists for this consumer.

The game is presented in extensive form in Figure 1. Solving for a stable state, the only pure strategy Nash equilibrium is the strategy profile (Premium, Use). For this strategy profile, neither player has an incentive to deviate as each is playing optimally given the others' action. This seems an intuitively plausible outcome. If the firm is playing against a consumer that is willing to pay for the premium service ($vi>p$) and who furthermore has a dominant strategy in the form of 'Use', it is logical that the firm will incur the sunk costs of providing the premium service, safe in the perfect information that the

consumer will use the service.

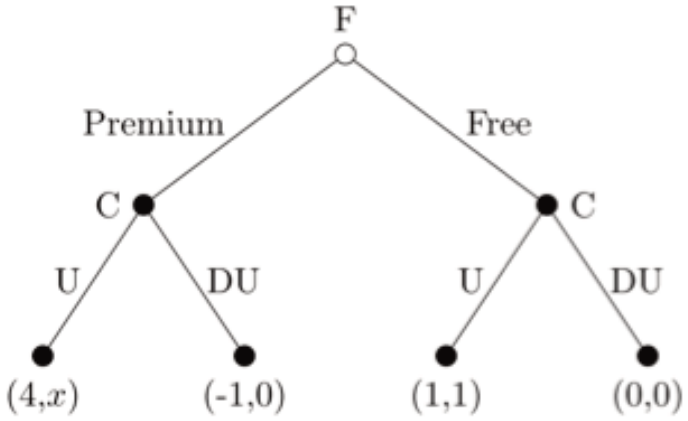

Figure 1: Simple Pricing Game

The Extended Pricing Game

Introducing Freemium

Building on the simple game presented, the game is expanded to include a choice for the firm to operate under a 'Freemium' pricing model, giving a new strategy set Af={Premium , Free, Freemium} .The consumer's actions are similar to those in the simple game, though now in the case of the firm choosing a freemium pricing model the consumer's choice to use the service is split in two: they may use the premium service (Fp) or use the free service (Ff). All preferences that the firm and consumer held in the simple game, over the actions 'Premium' and 'Free', and 'Use' and 'Don't Use' respectively, still hold in the extended game, including the assumption that the Consumer is willing to pay for the service (x=2). Preferences regarding outcomes involving the Freemium model will be justified below.

The firm now prefers to have a non-paying customer under the Freemium model than under the Free model. This is at the core of the rationale for the freemium business model. Customers using the free service are valued as there is potential for them to convert to paying customers(although this 'potential' is never realised within the confines of a single-shot game, it is still relevant for modelling). Under the Freemium model, paying customers are higher-valued than customers using the free service. This gives the relation Uf(Freemium, Fp) >Uf(Freemium, Ff)>Uf(Free, Use). An important assumption made

is that the firm prefers to have a paying customer under the Premium pricing model than under the Freemium model. This is justified in that the firm may charge a higher price under the Premium model given that the customer's only alternative is to not use the product, unlike the case of the Freemium model where the customer also has the alternative of using the free version of the freemium service should the firm consider charging a higher price, and so Uf(Premium, Use)> Uf(Freemium, Fp).

The consumer now prefers to use the free service under the Freemium model than to use the free service under the Free model, as a more valuable and developed (free) service is being offered in the case of the Freemium model, and so Uc(Freemium, Ff) > Uc(Free, Use). The consumer is again indifferent between the choice of business model when it does not use the service such that:

$$Uc(\text{Freemium, Don't Use}) = Uc(\text{Free, Don't Use}) = Uc(\text{Premium, Don't Use})$$

It also assumed that the consumer is indifferent between paying for the premium service under the Freemium model and paying for the premium service under the Premium model. Though it was assumed that the Firm may charge a higher price under the Premium model, a higher-valued service is being provided at this higher price. The slightly lower-valued premium service under the Freemium model comes at a slightly lower price, but it is assumed that the positive difference between consumer valuation and price paid (consumer surplus) is equal in both scenarios such that Uc(Premium, Use)=Uc(Freemium, Use) .

This game is presented in Figure 2. To solve this game via backward-induction, it is clear from the preferences that the consumer will always choose to use the product, and in the case of the Freemium pricing model the consumer will choose to pay to use the premium service. Knowing this, the firm will behave optimally by choosing to operate with a Premium pricing model, giving a subgame perfect equilibrium (Premium (Use, Use, Fp). This results in the pareto-optimal outcome whereby the firm chooses a Premium pricing model and the consumer pays for this service.

Now deviating from the Firm's ideal of operating in a market where their customer has a strong willingness to pay for their service, the case of a consumer who is unwilling to pay for the service is considered. This type of customer does not value the premium service at the price it is offered under either the Premium pricing model or the Freemium pricing model but rather at a value $v_i < p$, receiving a negative payoff from consuming the premium good in either case. Their preferences may be modelled as specified for the other consumer type above in each outcome with the only exception being of a value of x= -1. This changes the subgame perfect equilibrium to (Freemium, Don't Use,

Use, Ff)) with the equilibrium outcome now being that the Firm operates under a Freemium pricing model and the consumer uses the free service.

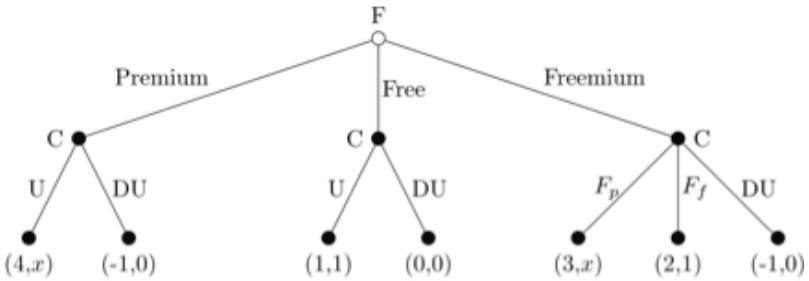

Figure 2: Extended Pricing Game with One Consumer

Imperfect Information

The extended game presented above showed that when the Firm knows that the Consumer is willing to pay, the Firm maximises their payoff by choosing a Premium pricing model. However, when the consumer does not value the service at the price charged, it is optimal for the Firm to choose the Freemium pricing model and gain a non-paying customer.

In reality, it is unusual for a firm to have complete information about the willingness to pay of all consumers in a market. To consider the more realistic scenario of uncertainty over the customer's willingness to pay, the extended game may be amended to include the case of imperfect information. In this game, the Firm does not know whether they are playing against the Customer who is willing to pay (x=2) or unwilling to pay (x=-1) for the service. Denote these Customer types as C1 and C2 respectively, so that the Customer's typeset is TC={ C1,C2}. Nature moves first and decides the type of the Consumer, and the Firm has some accurate prior belief (α) of the distribution over the Customer's types which is common knowledge. After Nature plays, the Firm forms a belief (p) as to the type of the Consumer that is playing, which is (given that there is no signalling involved or any intermediate decision nodes) trivially equal to α for this belief to be consistent.

This game is presented in extensive form in Figure 3. This game has a unique pure strategy perfect bayesian equilibrium (PBE) whereby the Firm chooses the Freemium model in the case of α<¾ (but chooses the Premium model for that of α >¾), Consumer C1 chooses strategy (Use, Use, Fp), Consumer C2 chooses (Don't Use, Use, Ff) (which

coincide with the strategies each employed in the previous games) and the Firm has a consistent belief p= α . While the game was modelled as a two player game, and the consumer thought of as an individual, the model is of course applicable to the game of a firm playing against an entire market of consumers. In this case, α is simply reinterpreted as the proportion of consumers of type C1 in the market.

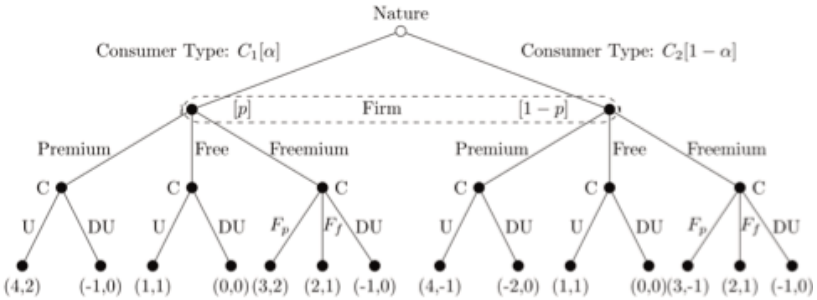

Figure 3: Extended Pricing Game with Two Consumer Types and Incomplete Information

Analysis and Extensions

The intuitive result of the extended game with imperfect information is such that if the Firm has strong reason to believe they are playing against the type C1 (i.e. if p=α >¾), it is optimal for them to choose the Premium pricing model, as in the case of the previous game in which the Firm is only playing against the consumer of C1. However, without this strong belief (i.e. if p=α <¾), the firm chooses optimally by operating with a Freemium pricing model, and Consumer C1 uses the premium service or else Consumer C2 uses the free service (depending on which Consumer type nature determines to be playing). This equilibrium outcome is notably applicable in the case of pure uncertainty (α=½).

The consumer's choices in the freemium model presented in this paper were limited to either using the premium service or using the free service. This is often how this pricing is operated; for example, Spotify customers can either pay for full access to a premium music-streaming service, or else use the ad-supported supported service at no cost. While this modelling approach captures the necessary element of choice for the consumer between premium and free under the freemium model, other industries take extended freemium model far beyond this binary choice. The mobile-gaming industry is one of the most prominent examples, and indeed successes, of the freemium model in

action-as of May 2014, 92 per cent of mobile gaming revenue in the Apple App Store were generated under the freemium model (Lescop, 2014). In using the freemium model, gaming companies release games for free and then profit from sales of a plethora of in-game purchases for additional content such as levels, character customisations etc.

What is most fascinating about the mobile-gaming industry's approach to freemium is that consumers are allowed to 'set the price and even determine the precise characteristics of the product,' by choosing any combination of in-game purchases and add-ons, which constitutes a 'form of near-perfect price discrimination' (Holmes, 2013). In terms of policy implications, this could have huge relevance to competition in regulated industries. One such approach of adopting the freemium model for regulation could see regulators involved in determining minimum standard of service of the free tier, and then allowing firms to structure their premium pricing in a much less regulated way. With a firm's premium services now effectively competing with their own free service, they could conceivably be incentivised to offer multiple price points for additional services above those available for free (as in the mobile gaming industry) which ultimately benefits the consumer in terms of choice and could lead to a highly competitive market outcome.

One extension to the model presented in this paper that would be particularly interesting to consider is that of network effects. The freemium model is most prominent in the technology sector, and most technology services increase in value to the consumer as the consumer base grows. Spotify offers a social experience to listening to music, and mobile games generally involving playing with and against other users of the game. In both of these cases, the service is much more valuable when the service has an active user base, and more valuable to a specific user when that user's friends are also users of the service. In terms of modelling, this would need to be modelled as an n-player game with 1 firm and $n-1 \geq 2$ players, where individual players' payoffs from using the service are positively correlated with the total number of players choosing to use the service (whether by paying or as a free user). In this model, the customer who is willing to pay for the service would strictly prefer the freemium model as it results in the greatest number of users of the service (as those willing to pay would pay, those not willing would use the free service) and so the equilibrium outcome would almost certainly involve the firm choosing the freemium pricing model.

Conclusion

This paper presented a game-theoretic analysis of the firm's decision concerning their pricing model. Starting with a simple case of the choice between 'Free' and 'Premium' pricing, the model was extended to include the choice of the 'Freemium' pricing model. In the face of pure uncertainty, it was shown that firm chooses optimally by operating with a freemium pricing model. The use of the freemium pricing model is on the rise.

Though mainly employed by technology firms at present, it would be interesting to see how it functions if adopted by other industries, and especially if incorporated by regulators into an approach to competition policy.

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Appendix

Calculating the Perfect Bayesian Equilibrium

Let α denote the prior belief that consumer is of type C1.

Let p denote the Firm's belief that the consumer is of type C1.

The firm's expected payoffs are calculated as follows:

UF(Premium | p) = 5p-1

UF(Free | p) = 1

UF(Freemium | p) = 2+p

From this it is clear that for any p in [0,1] the pure strategy 'Free' is strictly dominated by 'Freemium' for the Firm.

The 'Premium' strategy will be preferred to the 'Freemium' strategy in the case of:

UF(Premium | p) > UF(Freemium | p) which is true only when p>¾

For the firm's belief p to be consistent, it need only be consistent with the prior beliefs i.e. p= α

The unique pure strategy Perfect Bayesian Equilibrium is defined as:

Firm: Freemium if $0 \geq \alpha <$ ¾ or Premium if ¾ < $\alpha \leq$

Consumer C1: (Use, Use, Fp)

Consumer C2: (Don't Use, Use, Ff)

Beliefs: p= α

The Game Theory Of Open-Source Software

Paul Reidy
Senior Sophister

In this paper, Paul Reidy utilises a game theoretical framework to explore the decision of a firm to make its software open-source and to anticipate how programmers are likely to respond and which open source projects are most likely to attract contributions from Programmers. Examining the motivations and decision making processes of all involved parties, he also emphasises the role of the Government in encouraging contributions to projects that are beneficial, or provide value, to society.

Introduction

Open-source software refers to software where the source code is made publicly available and modifications of the software are permitted (e.g., Mozilla Firefox). This contrasts with proprietary software such as the Microsoft Office suite where there are restrictions on how the software may be used and the source code is not made available.

Open-source software may be regarded as a public good because it is both non-rival and non- excludable. However, many open-source projects enjoy frequent contributions such as bug-fixing or patches by a large community of unpaid volunteers across the globe (Lerner, Pathak and Tirole, 2006). This suggests that the classic public goods game is not an adequate description in this case and in this paper we use game theory to present alternative models of some aspects of open-source software. In the first game we examine the decision of a private firm to release its software as open-source. In the second game we consider which open-source projects will attract contributions from programmers.

Game 1: Private Firms and Open-Source Software

Game Setup

In this game, a firm has developed new software and is considering whether to release the source-code publicly as open-source or to keep it private as proprietary software. At the initial node Nature decides whether the Firm is greedy or altruistic. Only the Firm knows the outcome and then it decides between Open-Source (OS) and Proprietary software. If it chooses Proprietary the game ends, while if it chooses OS the Programmer

decides whether to Contribute (C) or Do Not Contribute (DNC) to the open-source code. If the Programmer chooses DNC the game ends. If the Programmer chooses C the Firm decides again whether to keep the code Open-Source (OS) or to take it back under its control as Proprietary. The game is represented as a Bayesian game in strategic form in Figure 1.

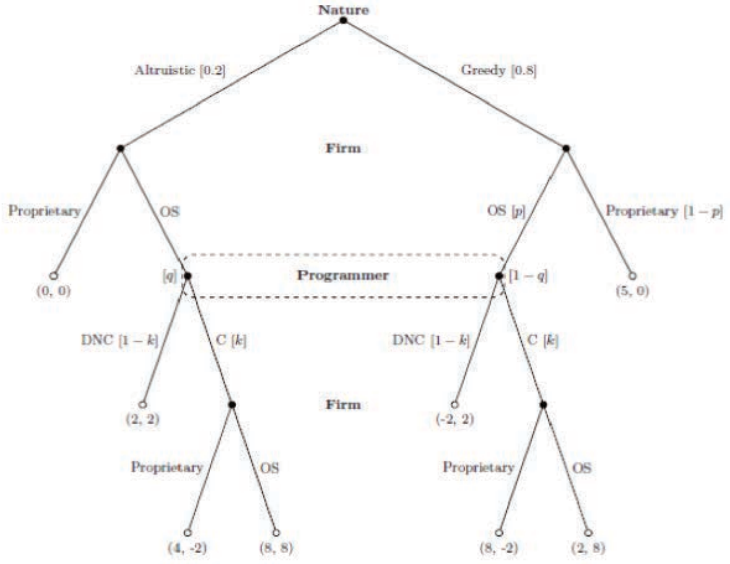

Figure 1: Private Firms and Open-Source Software

If the Firm is greedy, it wants to initially release the source code and then, following an unpaid contribution by the Programmer, make the code proprietary again as it earns higher profits from the improved code, which it can sell only if its proprietary. It thus ranks the outcomes as follows:

$$U(OS,\ C,\ Proprietary) > U(Proprietary) > U(OS, C, OS) > U(OS, DNC)$$

where U(x, y, z) denotes the utility derived from the case where the Firm chooses action x at its initial stage, the Programmer choose action y and the Firm chooses action z at the final stage. If y or z are missing the game ends before reaching the relevant stage.

The altruistic Firm does not want to exploit the unpaid contribution of the Programmer and prefers to keep the code open-source because it cares about societal welfare. It ranks the outcomes as:

$$U(OS, C, OS) > U(OS, C, Proprietary) > U(OS, DNC) > U(Proprietary)$$

Similarly, the Programmer is passionate about open-source and his most preferred outcome is that the company releases the code as open-source initially and does not renege on this decision later. He strongly dislikes his contributions to be used solely for the firm's benefit in earning profits. He therefore ranks the outcomes as:

$$U(OS, C, OS) > U(OS, DNC) > U(Proprietary) > U(OS, C, Proprietary)$$

Equilibrium

The unique semi-separating Perfect Bayes Equilibrium (PBE) is:

1. Firm's Strategy: If altruistic choose OS at the initial stage and if the Programmer chooses C choose OS. If greedy choose OS with probability p at the initial stage and if the Programmer chooses C choose Proprietary

2. Programmer: Choose C with probability k

3. Programmer's Beliefs: If the Firm chooses OS it is altruistic with probability q= 0.20.8p+0.2. If the Firm chooses Proprietary it is greedy with probability 1.

These beliefs are derived used Bayes's rule as shown in Appendix A.1.

We can show that this is a PBE by deriving suitable values of p and k and illustrating that the strategies of both players are sequentially rational. Assuming the Firm chooses OS at the initial stage, the Programmer will only be willing to randomise between C and DNC if:

$$2 = (0.8p0.8p+0.2)(-2) + (0.20.8p+0.2)(8)$$

$$\therefore p=0.375$$

The Firm's strategy is sequentially rational because if the Firm is altruistic it is optimal to choose OS with probability 1 at its initial stage as the payoff is always higher than choosing Proprietary regardless of the Programmer's action. It is optimal for the altruistic Firm to choose OS at the final stage. On the other hand, if the Firm is greedy it is optimal for

it to choose Proprietary at the final stage. The greedy Firm will be willing to randomise between OS and Proprietary at its initial stage only if:

$$\overbrace{5}^{\text{Payoff from Proprietary}} = \overbrace{(k)(8) + (1-k)(-2)}^{\text{Payoff from OS}}$$

$$\therefore k = 0.7$$

Appendix A.1 rules out other PBE.

Analysis of the Game

The setup and assumptions of the game seems quite realistic because when firms release their code as open-source, volunteer programmers may be wary that the firm is trying to benefit from their unpaid contributions and will later make its source code private again. Indeed, it does seem puzzling that profit-maximising companies would make their source code publicly available. However, some companies such as Google appear to have genuinely altruistic intentions when they participate in open-source.

The predictions of the game and the semi-separating PBE are also quite interesting and realistic because they show that the possibility of a greedy Firm means that the Programmer will fear being exploited and will only contribute to the open-source project some of the time. This is disappointing for the altruistic Firm which genuinely wants to work with the Programmer to make the open-source software better and will not renege on its commitment to open-source.

However, suitable policies can help to avoid this undesirable outcome. An altruistic Firm may try to distinguish itself from the greedy Firm by making some costly investments in open-source prior to the start of the game such as donating large sums of money to open-source foundations. Alternatively, if the government wishes to ensure that programmers always contribute to open-source projects it could impose fines on greedy firms that try to choose Proprietary in the final stage. This could reduce the probability that greedy firms play the game and yield a pooling equilibrium where Programmers always choose Contribute. Specifically, as shown in Appendix A.2, if the probability of the Firm being altruistic is greater than or equal to 0.4 there will be a pooling PBE of the form:

1. Firm's strategy: If altruistic, choose OS and if the Programmer chooses C then choose OS. If greedy, choose OS and if the Programmer chooses C then choose Proprietary

2. Programmer's Strategy: Choose C if given the opportunity

3. Programmer's Beliefs: Prior Beliefs

A particularly interesting policy solution involves the use of the GNU - General Public Licence (GNU GPL). If the Firm releases its code under this licence it guarantees that any alterations to the code will be made 'freely available … to whomever the program is distributed' (Lerner and Tirole, 2005). Thus in a game with this licence the greedy Firm could not renege on its decision to make its software open-source and always has to choose OS in the final stage as shown in Figure 2.

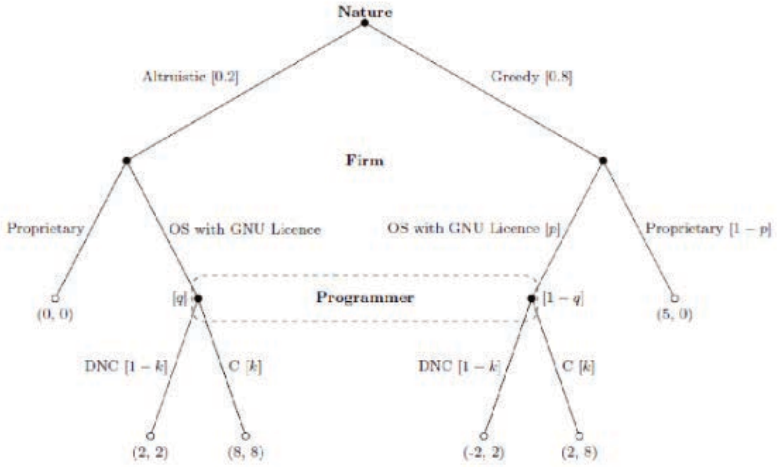

Figure 2: Game with GNU GPL Licence

The separating PBE for the game in Figure 2 is:

1. Firm's Strategy: If altruistic, choose OS with GNU Licence with probability 1. If greedy, choose Proprietary with probability 1

2. Programmer's Strategy: Always choose C if given the opportunity

3. Programmer's Beliefs: If the Firm chooses OS with GNU Licence, it is

altruistic with probability 1. If the Firm chooses Proprietary, it is greedy- with probability 1

If the Firm is altruistic, it is optimal to always pick OS with the GNU Licence because it gives a higher payoff than Proprietary. If the Firm is greedy it is optimal to always pick Proprietary because it gives a higher payoff than OS with GNU Licence. The Firm's strategy is thus optimal and Programmer's beliefs are consistent. The Programmer's strategy is optimal because he will only get to play when the Firm is altruistic and always gets a higher payoff from choosing C in this case.

This is very interesting because it shows that a simple and plausible alteration to our original game can yield a separating PBE where it is optimal for the Programmer to always Contribute.

Game 2: Which Open-Source Projects Attract Contributions?

Game Setup

In this game a Founder has an idea for a new open-source project and Nature then determines whether this project will be Useful or Useless for society. Only the Founder knows the outcome of Nature's choice and he then tries to get an unpaid volunteer Programmer to work on his idea. The Founder chooses Promote or Do Not Promote for the project. Following this choice, the Programmer chooses Contribute (C) or Do Not Contribute (DNC).

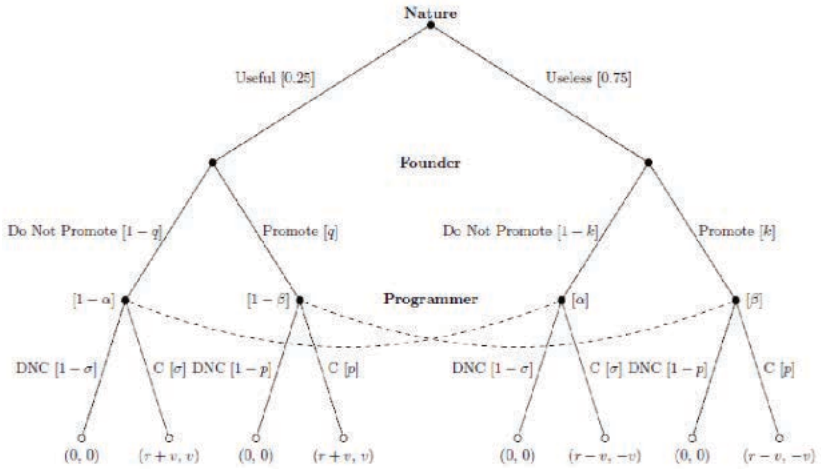

Figure 3: Which Open-Source Projects Attract Contributions?

The Founder is quite egotistical and he derives a private benefit of $r > 0$ if the Programmer contributes to his project, regardless of whether it is Useful or Useless. This is because he likes to be popular and to attract attention. If the project is Useful then both the Programmer and the Founder get a payoff of $v > 0$ which is the value created for society. If the project is Useless they both incur a cost of -v which is the opportunity cost of not being involved in projects which actually created value for society. The game and subsequent is based on the 'Defensive Medicine' in Harrington (2009) and is shown in sequential form in Figure 3 above.

Equilibria

For equilibirum 1, a pooling PBE of this game is:

1. Founder's Strategy: Promote the project whether it is Useful or Useless

2. Programmer's Strategy: Ignore the Founder's message and always choose DNC

3. Programmer's Beliefs: Project is Useful with probability 0.25 and Useless with probability 0.75

The Programmer's beliefs are consistent because they are equal to the prior beliefs as the Founder's action is uninformative. The Programmer's strategy is optimal because the expected payoff for DNC is greater than that for C:

$$\overbrace{0}^{\text{Payoff of DNC}} > \overbrace{(0.25)(v)+(0.75)(-v)}^{\text{Payoff of C}}$$

$$0 > -0.5v \qquad \text{(because } v>0\text{)}$$

The Founder's strategy is also optimal because his payoff is 0 whether he chooses Promote or Do Not Promote because the Programmer always chooses DNC.

For equilibrium 2, a separating PBE is given by:

1. Founder's Strategy: Promote the project if it is Useful. Do Not Promote if it is Useless.

2. Programmer's Strategy: Contribute if the Founder promotes the project. Do Not Contribute if the Founder does not promote the project

3. Programmer's Beliefs: If the Founder promotes the project its Useful with probability. If the Founder does not promote the project it is Useless with probability 1

The Programmer's beliefs are consistent because only a Useful project is promoted by the Founder and a Useless project is never promoted. The Programmer's strategy is optimal because he only Contributes when it is Useful. The Founder's strategy for a Useful project is optimal because if he Promotes he gets a payoff of r + v (as the Programmer will Contribute) which is strictly greater than 0, the payoff from choosing Do Not Promote. If the project is Useless, the Founder's strategy of choosing Do Not Promote is optimal as long as:

$$\overbrace{0}^{\text{Payoff of Do Not Promote}} > \overbrace{r-v}^{\text{Payoff of Promote}}$$

$$v \geq r$$

For equilibrium 3, a final semi-separating PBE is given by:

1. Founder's Strategy: Promote the project with probability 1 if it is Useful. Promote the project with probability k if it is Useless

2. Programmer's Strategy: Contribute with probability p if the project is promoted. Do Not Contribute if the project is not promoted

3. Programmer's Beliefs: Using Bayes' Rule the Prob(Useless | Promote)= $\beta = 0.75k0.25 + .75k$ and the Prob(Useless | Do Not Promote)= $\propto = 1$

This equilibrium is not very interesting and will only occur in the special case where r = v and k = 1/3 as shown in Appendix B. In our analysis we will focus on Equilibrium 1 and 2.

Analysis of the Game

The assumptions and setup of the game seem reasonably realistic because it is often very difficult for programmers to predict which open-source projects are actually useful ex-ante. However, it is probably a bit unrealistic to assume that the Founder knows whether the project is useful if the Programmer does not. It might also seem unrealistic that the Founder could be motivated by egotistical concerns. However, as the open-source advocate Eric Raymond (1999) commented 'The 'utility function' [of open-source programmers]

is not classically economic, but is the intangible of their own ego satisfaction and reputation.'

The predictions of the game are quite interesting. In Equilibrium 1, the Founder always promotes the project and the Programmer always ignores this uninformative message and chooses not to contribute. This is undesirable for society because the Programmer never contributes even though in some cases it is a Useful project.

Equilibrium 2 is desirable for society because the Founder only promotes the project if it is Useful and the Programmer only contributes if it is promoted (and thus Useful). However, we showed above that this equilibrium can only exist if $v \geq r$. The intuition is that when $r = 0$ the Founder has no ego and has the exact same payoffs as the Programmer. However, when $r > 0$ the interests of the two players start to diverge and as r increases the Founder gets relatively more and more concerned about this own interests and less concerned about, v, the value for society. As long as $v \geq r$ the Founder is not 'too' ego-driven and still cares about the value created by the open-source project and the separating PBE can exist. However, when $v < r$ the ego of the Founder is too large and this separating PBE cannot exist.

A policy implication of this is that to ensure the desirable separating PBE exists the government could try to boost v, the value created for society. If v depends on the number of users of the software, for example, the government may provide subsidies encouraging people to switch to the open-source software. Alternatively, the open-source community itself may discourage ego-driven behaviour to lower the value of r. We could also extend the game by adding more stages such as a stage where the Programmer can punish the Founder if he promoted a Useless project to boost his own ego.

References

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Appendix A

A.1 Game 1 Beliefs and Ruling Out Other Equilibria

Let q equal the Programmer's belief that the Firm is Altruistic given that is has chosen OS. Then we derive the Programmer's expected utilities of choosing C and DNC given q:

$$EU\_p\ (C \mid q)=8(q)+(-2)(1-q)=10q-2$$

$$EU\_p\ (DNC \mid 1-q)=2$$

Therefore:

If $q > 0.4$ the Programmer will choose Contribute

If $q < 0.4$ the Programmer will choose Do Not Contribute

If $q = 0.4$ the Programmer is indifferent between Contribute and Do Not Contribute

The Programmer will prefer to choose Contribute if:

$$10q-2>2$$

$$q>0.4$$

If the Programmer observes OS what should it believe about the type of the firm? Using Bayes' rule:

Prob(Greedy | OS)= (Prob(Greedy)Prob(OS | Greedy))/(Prob(Greedy)Prob(OS |Greedy)+Prob(Altruistic)Prob(OS | Altruistic))

= 0.8p/(0.8p+0.2)

Therefore 1-q=08p/(0.8p+0.2) and q=0.2/(0.8p+0.2)

If the Programmer observes Proprietary what should it believe about the type of firm?

Using Bayes's rule:

$$\text{Prob(Greedy} \mid \text{Prop)} = \text{(Prob(Greedy)Prob(Prop} \mid \text{Greedy))/(Prob(Greedy)Prob(Prop} \mid \text{Greedy)+Prob(Altruistic)Prob(Prop} \mid \text{Altruistic))}$$

$$= 0.8(1-p)/(0.8(1-p)+(0.2)(0))=1$$

Case 1: q > 0.4

When $q > 0.4$ we can derive the value of p from:

$$q>0.4$$

$$0.2/(0.2+0.8p)>0.4$$

$$0.12>0.32p$$

$$p<0.375$$

Since $q > 0.4$ the Programmer always plays Contribute. But if the Programmer always plays Contribute then the greedy Firm will to always play OS at the initial stage. Thus $p = 1$ which violates the condition $p < 0.375$ and this cannot be an equilibrium.

Case 2: q < 0.4

When $q < 0.4$ then $p > 0.375$. Since $q < 0.4$ the Programmer always plays Do Not Contribute. But if the Programmer always plays Do Not Contribute the greedy Firm always wants to play Proprietary at the initial stage. Thus $p=0$ which violates the condition $p > 0.375$ and this cannot be an equilibrium either.

Case 3: q=0.4

When $q=0.4$ then $p=0.375$. Since $q=0.4$ the Programmer is indifferent between Contribute and Do Not Contribute. If $p=0.375$ the greedy firm is mixing between Proprietary and OS. The greedy Firm will only do this if it is indifferent between which can only be the case if the Programmer is mixing. If the Programmer chooses Contribute with probability k and Do Not Contribute with probability $1 – k$ then the greedy Firm will mix if:

$$[\underbrace{5}] \_\underbrace{(\text{Payoff from Proprietary})} = [(k)(8)+(1-k)(-2)] \_(\text{Payoff from OS})$$

$$k=0.7$$

A.2 Pooling PBE for Game 1

Consider a pooling PBE for the game in Figure 1:

1. Firm's strategy: If altruistic then choose OS and if the Programmer chooses C then choose OS. If greedy choose OS and if the Programmer chooses C then choose Proprietary

2. Programmer's Strategy: Choose C if given the opportunity

3. Programmer's Beliefs: Prior Beliefs

The Firm's strategy if it is altruistic is optimal because it always prefers to choose OS no matter what the Programmer does. The Firm's strategy if it is greedy is also optimal because the Programmer always chooses C. The Programmer's beliefs are consistent because the action of the Firm provides no information so prior beliefs are used. Letting γ denote the probability of an altruistic firm, the Programmer's strategy is only optimal if:

$$2 \leq (\gamma)(8)+(1-\gamma)(-2)$$

$$\gamma \geq 0.4$$

Thus we will only have a pooling PBE where the Programmer always chooses C if the probability of the firm being altruistic is greater than or equal to 0.4.

Appendix B

Consider the semi-separating equilibrium in Game 2:

1. Founder's Strategy: Promote the project with probability 1 if it is Useful. Promote the project with probability k if it is Useless

2. Programmer's Strategy: Contribute with probability p if the project is promoted. Do Not Contribute if the project is not promoted

3. Programmer's Beliefs: Using Bayes' Rule the Prob(Useless | Promote)= $\beta = 0.75k/(0.25+0.75k)$ and the Prob(Useless | Do Not Promote)= $\propto = 1$

If the project is Useful the Founder's strategy will be optimal as long as:

$$p(r+v)+(1-p)(0)\geq 0$$

$$p(r+v)\geq 0$$

This is true because $r > 0$ and $v > 0$.

If the project is Useless the Founder's strategy dictates that he randomises between promoting and not promoting and the Founder will only be willing to do this when:

$$0=(0)(1-p)+(r-v)(p)$$

$$0=(r-v)p$$

This will only hold when $r = v$.

If the project is promoted the Programmer will only be happy to randomise between contributing and not contributing when:

$$0.25/(0.25+0.75k)\,(v)+\ 0.75k/(0.25+0.75k)\,(-v)=0$$

$$k=\ 1/3$$

If the project is not promoted then the Programmer will not contribute which is optimal because:

$$0 \geq \text{Prob(Useful} \mid \text{Do Not Promote)(v)} + \text{Prob(Useless} \mid \text{Do Not Promote)(-v)}$$

$$0 \geq (0)(v) + (1)(-v)$$

$$0 \geq -v$$