NORWICH ECONOMIC PUBLICATIONS
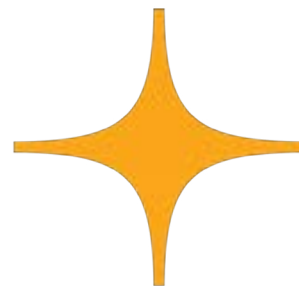
VOLUME 28

NORWICH ECONOMIC PUBLICATIONS

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01 NEP EDITOR'S FOREWORD

> "I would also like to wish the future board all the best in continuing the NEP name and reputation. The NEP is such a great project to be part of, so I hope you all have as much fun as I did. "

Daisy Janneke Groet

Dear all,

It gives me great delight to introduce you to the 28th volume of the Norwich Economic Papers (NEP). Since our last publication, we have continued with our podcast series, this time with an interview with James Branch (UEA alumni) about his experiences with Sky. We have also been able to collect more expectational coursework from econometrics to government, welfare and policy. We have also received some amazing book reviews from students about books that are in line with our three NEP themes for the year.

This year we were also able to celebrate International Women's Day with an event held in Elizabeth Fry celebrating women in economics. We were able to find out about research and initiatives addressing gender balance and gain valuable insights about the work of economists at the UEA.

I am very pleased to share a statement from our Head of School, Emiliya Lazarova, which rounds up our year as a School and shines a light on some amazing achievements. I would like to thank Emiliya for her constant support of the NEP. She has reminded us how important the work of the NEP is for our school, and that we should be proud of what we accomplished this year.

As this publication marks the end of the academic year, I would like to thank all the students that have taken part in competitions and supported and engaged with the NEP as much as they could this year. I would also like to thank the students who have inspired and helped me and my team through the year, we all have appreciated the extra support! I would also like to wish the future board all the best in continuing the NEP name and reputation. The NEP is such a great project to be part of, so I hope you all have as much fun as I did.

Once again, much thanks and appreciation go to our academic editor, Liliana Harding. We have had a tremendous amount of help and backing this year, which has allowed us to get the NEP back on its feet. I would also like to thank the staff in the School of Economics, their support never ceased.

My final word of thanks will again go to my associate editors. Your hard work and determination to get our initiatives implemented has allowed us to accomplish a lot this year. I think we should all be proud of ourselves!

I would like to thank all our readers and wish all students good luck as you continue with your studies, and graduates as you embark on a new journey inside or outside of UEA.

Daisy Janneke Groet
NEP Editor 2023-2024

STATEMENT FROM HEAD OF SCHOOL OF ECONOMICS

ASPIRATIONS ELEVATED, IMPACT EXPANDED

"Our aspiration is to further enhance our reputation, ensuring that the world-leading research conducted by our academics not only inspires a new generation of economists but also drives positive change in the world around us."

Prof. Emiliya Lazarova

At the beginning of this academic year, I reviewed the first five-year report from our Strategic Advisory Board. This board has significantly transformed our teaching practices by steering course development and assessment design to better align with industry needs, thereby opening new employment opportunities for our students. Once again, this year, the members of the Strategic Advisory Board have brought us to the frontier of professional practice, sharing invaluable insights on the rapid spread of AI technology and its impact (or lack thereof) on their businesses. Armed with this knowledge, our goal is to equip our students with the skills and knowledge necessary for success in the job market. We understand that competent use of AI as a powerful resource, combined with a deep understanding of core economic principles and data analysis skills, is crucial for a successful career as a professional economist.

In addition to technical skills, successful economists must also possess strong communication abilities. The rich testimony from mentors and mentees at the Alumni Networking Event in April in London underscored this point. We must remember that learning extends beyond the lecture theatre and seminar room to include networking and dedicated employability events organised by the School throughout the year. The long-term impact of our focus on student employability is evident in the highest ever percentage of our undergraduate graduates achieving positive destinations—88.2% in the most recent Graduate Outcomes survey. With our alumni numbers growing each year, and their professional success expanding far and wide, we are determined to broaden mentoring opportunities

NEP Editorial Board for Academic Year 2023-2024

for our current students through our global alumni community, thereby enhancing career prospects for all our students.

The greatest inspiration for me each year comes from our current students. This year, the NEP Board took our podcasts and publications to new heights, with some pieces being featured on national platforms such as the Royal Economic Society's Women's Committee. Many of our students initiated active fundraising campaigns for notable causes, with their stories gaining coverage in local and national newspapers. ECO was the best-represented School at the UEA's Change Makers Competition, demonstrating that entrepreneurship flourishes among economists. Additionally, ECO received a remarkable six nominations at the TEAs (Transformative Education Awards), winning in four categories. Most of these awards were earned by our students, whose dedication and professionalism have created an empowering environment within the ECO Community and made the student voice a transformative force in School practices. As we adopt the new UEA model of student representation—the School Experience Partnership—our goal is to maintain the strategic and quality assurance roles effectively executed by our course representatives and to enhance the impact students have in integrating and communicating best practices. In doing so, we aim to elevate the Student Voice to a strategic partner in Teaching & Learning, Career Development, Diversity, Equality, Inclusion, and ECO Community Building.

We must also remember that the reputation of our School is closely tied to the research excellence of our academics. This year, ECO academics were awarded EU Horizon funds to work on AI projects supporting policymakers and UKRI funds to develop behavioural interventions to increase vaccination rates. They published their findings in highly impactful economic journals, including Labour Economics, Games and Economic Behavior, International Journal of Industrial Economics, The Econometrics Journal, and Environmental and Resource Economics. We also hosted two international research workshops focused on Time Series and on Diversity and Discrimination, which drew participants from four continents. This growing reputation has led to an unprecedented number of international scholars—Fulbright, Chevening, and GREAT Britain recipients—choosing to pursue an MSc degree at our School of Economics. They are drawn by the global reputation of our degrees and the bespoke training we offer. Our aspiration is to further enhance our reputation, ensuring that the world-leading research conducted by our academics not only inspires a new generation of economists but also drives positive change in the world around us.

Prof. Emiliya Lazarova
Head of School of Economics, UEA

NEP Essay Competition Award Ceremony

EDITORS'
CONTRIBUTION

03

EDITORS'
CONTRIBUTION

Diversity
Sustainability
Creativity and the Role of AI

In this section, our editors contributed an opinion piece
about the future of our labour markets and the incoming AI,
one of the three main themes covered by the NEP this year.

Creativity and the Role of AI

AI and Jobs: Mass Unemployment or The Death of Pencil-Pushing?

Benjamin Seeds

The robots are coming. Slowly but surely, one redundancy after another, they're coming. AI, according to Goldman Sachs, will be responsible for the loss or degradation of 300 million jobs. A rather uninspired spin on The Terminator, if you ask me.

No more uninspired than a lot of the jobs pegged for replacement though. According to a report done by PwC for the department of Business, Energy and Industrial Strategy, there is likely to be a decline in mostly manual routine roles, with administration as a listed example. This sounds like cause for panic. After all, this development means a decimation of an entire industry and the loss of countless jobs.It is indeed a worry, especially for workers in soon-to-be dissolute industries, that jobs which exist now might not later. Those trained in that kind of work will have to re-train or apply their skills elsewhere and will lose the job security they may have had before, and the uncertainty and upheaval will not be fun for a lot of people.

However, there is another headline to be written here: "In 20 years' time, nobody will have to work in administration anymore". Almost by definition, AI can only replace jobs that are menial and repetitive. Aren't these the kinds of jobs we should be working to make obsolete anyway? Don't we want people to be working jobs that are fulfilling, rather than having them perform a given industry's flavour of pencil-pushing all day? This is not to say that the jobs themselves, or the people that do them, are bad or boring, just that, especially in a world where there are overall better ways to get the job done, there is not really a justification for them to exist anymore. It's not even like this is the first time this has happened. We would no longer insist that the fact we now use excavators instead of people with pickaxes in our coal mines is a grave injustice, since the efficiency benefits make it no longer a question. It absolutely is not an easy transition to make, and the loss of many people's then-livelihoods was absolutely a huge problem. But looking back, there are few that would argue that because of those problems the shift should not have been made. In fact, we now see actual pickaxe mining as entirely archaic, and would seriously question any company that thought fit to start it back up again. There is an argument that this will be the case with AI. In future, we may well look

back on admin work and ask "What? They just spent their time shuffling pieces of paper (or excel spreadsheets) around? How pedestrian".

In addition, this all occurs during a time when the workforce is shrinking drastically, squeezed by early retirement and an ageing population. The only real supplement we have for all of this is the influx of immigration that has been keeping "low-level" jobs filled. Now that we seem to be moving towards the sentiment that the immigrants who are almost single-handedly keeping the economy afloat are no longer welcome, the need for a supplement is ever stronger. In some senses, the AI can't come soon enough. I find it a uniquely British kind of irony that the two things that might actually rescue our dire labour market, immigration and AI, are the two things that are purported to be "stealing our jobs" more than any other.

All of this is not to say that we can just sit back and watch the transition happen. It is not acceptable to simply tell entire industries' workers that their jobs are no longer necessary and that they will therefore be made redundant. There is some level of intervention necessary to ensure a smooth transition. Whether that takes the form of investment in education or retraining programmes to make transitioning careers easier, comprehensive unemployment and social benefits, or some other form of support, is up for debate, but the option of doing nothing is unwise and may leave people already struggling even more stranded than they are now.

For more forward thinkers, the arrival of AI could also be an interesting route to the implementation of more progressive socio-economic policies. For example, a world where a lot of work is done by automation and where only a reduced amount of professionals are required to keep large swathes of a now more efficient and thus bigger economy on its feet sounds like it could provide the perfect conditions to implement a universal basic income.

Just like any other major technological advancement, there are wild fears that it will be the end of jobs, and just like any other major technological advancement, there will be a reshuffling of jobs and industries which, after a transitionary period which likely includes some pushback, will broadly restore employment to its former level. The PwC report concluded that, although the exact impact of AI on employment is unclear, it is likely that it will be a neutral one in the long term. There is likely to be increased economic output, people won't have to pencil-push to make ends meet, and there is the potential for more effective and progressive social policy. The oncoming AI-powered future might not sound so bad after all.

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BOOK
REVIEWS

04
NEP BOOK REVIEW COMPETITION
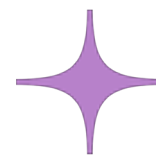
The Norwich Economic Publications called for all undergraduate and postgraduate ECO students to participate in the NEP Book Review Competition.

Participants were invited to review a book in the list below or any book in line with one of the main 2023-2024 NEP themes.

10 BOOKS
TO CHOOSE FROM FOR THE REVIEW.

3 THEMES
CREATIVITY AND AI | DIVERSITY | SUSTAINABILITY

Find these books in the UEA Library or scan this QR Code:
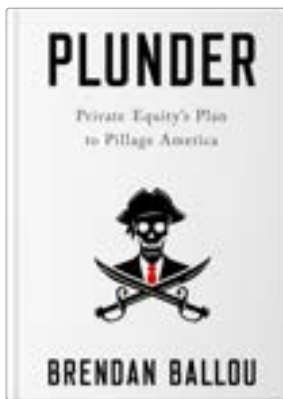
BOOK REVIEW

Reviewed by Gurpreet Singh
MSc International Business Finance and Economics

Plunder: Private Equity's Plan to Pillage America

By Brendan Ballou (2023)
Published by: PublicAffairs

Brendan Ballou, a federal prosecutor and ex-counselor of private equity in the US Antitrust Division of Justice Department, wrote one of the most influential books of all the time; "Plunder: Private equity's plan to Pillage America", which exposed the dark side of private equity firms and how government assists in their functioning. Written in 2009, this book has included multiple case studies of companies losing their existence under ownership of private equity. The book is mainly divided into three parts, where the first part explains how private equity makes their money, i.e. motivation behind acquiring the firms, their working model etc. The second part describes how they can go to any extent to achieve their desired results using various strategies. The book concludes with the third part providing us with steps to stop the dark deeds of private equity.

While defining the meaning of private equity, the author believed that people might confuse them with investment banks or hedge funds, therefore, he defines them first before describing private equities as the entities that buys companies and works with them for their own good rather than good of the company or society. The book claims their working to be similar to money trusts that existed long time ago. Which means that private equity owners are efficient at getting and spending other people's money rather than running the company for its welfare. However, how do they get the funds to do so? The author describes that most of their contracts are assisted by very little the sum of their own and excessive funds from leveraged buyouts, i.e., borrowing money to buy the firms. Interest rates play a huge role in this scenario, with low interest rates, leveraged buyouts emerge, however, the market and interest rates are never stable, thus increases in interest rates depress the private equity. Then who loses the money if they cannot pay back the loan? The answer is acquired firm. Private equity makes the acquired company liable for all the debts so that the maximum amount that they can lose in failure is just their little to no money while the acquired company goes bankrupt and thus loses its existence, no matter how good it was. The author also answers the question why the company lets itself bought by the private equity; it is because company executives rely on the windfall prospect. They let it happen because they can make a good deal from the sale of company. As the amount given by private equity seems attractive and thus with windfall prospects, they make themselves liable for the borrowed amount. Brendan claims that after each crisis, the private equity shines even more than before while giving the example of covid-19 crisis when the interest rates were driven to nearly zero by federal reserves. As a result, the private equity spent $1.2 trillion on acquisition in 2021.

The book keeps the reader invested the entire time because of the suspense it builds. Each case study added by Brendan takes the reader to the filmy world of a detective who is living in a place full of crimes and behind each crime, the villain is always the same but in different form each time, who has ruined the entire city, its retail sector, nursing homes, private homes and even prisons. Private equity's aim is just personal profits; therefore, an acquired company's performance is not a headache for them. The author writes that they are biggest reason why many of the supermarkets in the USA no

longer exist today. In nursing and care homes, due to no supervision in the management, the patients die untimely deaths. When exploring private equity's control over prison services such as catering and phone calling, the author blames lobbying from private equity to the government to be the reason why state did not take prompt actions when the prisoners were being tortured in the cells. He further adds that it was only after Barack Obama becoming president that prison rules in regards to private equity were amended and taken into consideration.

"The book keeps the reader invested the entire time because of the suspense it builds. Each case study added by Brendan takes the reader to the filmy world of a detective who is living in a place full of crimes and behind each crime, the villain is always the same but in different form each time."

"It's just going to get worst. They feel no empathy for us, they feel no guilt over what they are doing…. It's time to take action and do something to stop these horrible business practices." The book suggests multiple solutions to stop the impacts of private equity. The author suggested that we need to restrict the actions of private equity in each sector one by one, for example, ending contracts with private prison health care and cafeteria providers. Further, he talks about changing the incentives that drive the private equity's worst practices, i.e., by making stricter laws, such as stopping firms from loading up the companies they buy via leveraged buyouts. Finally, he suggests the need to reduce the systematic risks that private equity poses to our economy. Along with these major steps, he talks about many other solutions that can protect the economy from going down, however, he ends it saying that this change seems difficult but not impossible, which means he keeps the reader optimist about a bright future or a bright America that has gotten covered under shadow of private equity.

There are some criticisms of this book that merit attention, I believe, the author has made many strong remarks and direct attacks against many individuals without hesitance. For example, in the chapter 'A new gilded age', he talks about lobbying to government officials/politicians by industry and how has it given them employment once their public service came to an end whilst giving a detailed list of many named individuals of USA. In my opinion, it is a direct attack to an individual and thus this form of writing style suits more in newspaper articles rather than books. Additionally, in the chapter 'captive audience', he wrote almost an entire page explaining the luxury private residence home of a private equity owner, including details about his bedrooms, which in my opinion is not ethical and moral.

The book touches many sensitive issues and incidents, terrible accidents that happened to normal people because of private equity, leading to death was way too extreme in detail. The details of patients dying because of ill-treatment in nursing homes, prisoners eating toothpaste and tissue paper regularly to satisfy their hunger and many more. I agree that books are a mirror of real world, however, these incidents mentioned in the book can be disturbing to many readers.

The book does not talk about why companies agree to be bought by private equity in more detail, which is an unanswered question. Also, the solutions to stop private equity given by Brendon Ballou can be argued to be quite unrealistic and are something that will require a long time to be implemented, such as changing reforms and laws is never a straightforward process and specially in a democratic nation, it can take a very long time.

To conclude, I would say that this book is an eye-opener which sheds the light on dark practices and shady-tactics of private equity and the best way to read this book is to feel it like a novel rather than an academic book.
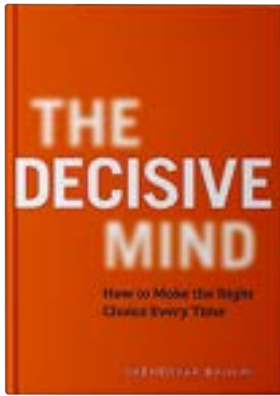
BOOK REVIEW

Reviewed by Mario Servin
MSc Behavioural Economics and Data Science

The Decisive Mind: How to Make the Right Choice Every Time

By Sheheryar Banuri (2023)
Published by: Hodder & Stoughton

All of us have goals whether it is to finish a degree, start a family or climb a mountain, we all want to accomplish things. This fact leads us to the question, why is it that some people achieve those goals and others don't? And the answer is that different people take different actions and when the rewards appear bigger than the costs, we do something, but when it is the other way around the result is to do nothing. But is it all our fault? Are we doomed to follow the same patterns forever? The answer is NO, and in this book the author takes us on a transformative journey to develop a decisive mind.

According to the author a decisive mind is one that when presented with decisions can not only differentiate the ones that contribute or detract from our progress, but also help us start doing things that will get us along the path to our goal. It is likely that we all have encountered options that promise to help us attain our goals, but what truly differentiates this approach is the acknowledgement of the human condition and the use of behavioural insights as tools in this journey. However, like any tool, it cannot work on its own, a hammer will only do its job if you wield and aim it in the right direction.

At its core, the book has 3 main sections, one is "Behavioural insights", where the author makes sense of certain actions we all make that may seem to be irrational, what causes them and what can we do about them. The second section is "The roadmap", here we have a more hands-on approach to how to set up goals and what the common pitfalls are that get in our way to reach them. Finally, the last section is "The decisive framework", where we are hit with the reality that goal setting and behaviour are not isolated factors that happen from time to time, but it is more the way we live, that can be summarised in the immortal words of Martha Beck, "How you do anything is how you do everything". Every decision counts, and we can always decide to start doing things differently.

One of the vital ideas that the book explores in depth is the fact that making a decision is a process that requires effort and depending on the difficulty of said decision that effort will increase accordingly. But what makes a decision hard? The answer is the amount of thought required to carry it out. The human mind, despite its amazing ability to develop and create solutions, craves simplicity and when it is faced with more complex stakes it demands more resources from us. This sounds like an understandable process of any system or organism, and it is maybe in its implications that the secret lies in developing a decisive mind

If it is true that the mind craves simplicity, this reality also coexists with one of the traits that make us humans so remarkable, and that is our willpower. This ability to pursue objectives until completion and restrain our impulses, but as with any other human trait, there is a catch. In this case, it is that there are limits to these capacities and they are reflected in our decisions. It is easy to say today that tomorrow you will eat healthier, but when that day comes you may not have the same drive, then the easy choice will win and you will end up having pizza for dinner, again. As with any other decisions, the process is more complex than this and there are so many factors and biases that play a role.

Nevertheless, the first step to overcome them is to identify them, which the author brilliantly does with the help of real-life stories and the latest research in behavioural science.

Personally, I am a big fan of the genre of books that "The Decisive Mind" is part of, the ones that try to help us become a better version of ourselves since we are and always will be ongoing projects. But what makes this book different to many others that I have read is the acknowledgement of the human condition. The author demonstrates this by exposing how he is also affected by the same pitfalls that affects you and me. For many this could be a discouraging message, where not even the expert can perfectly execute his method, to this I will argue that this is a message of hope, a message of real expectations and attainable results.

The decisive mind offers you a chance to deep dive into human behaviour, to understand what happens in those situations that we all have experienced, that once you look back it feels so evident, but that appears invisible during the moment and not only that, the book offers you a plan to create new roads in your mind that allows you to have better decision-making skills in a clear guide that has the potential to take you to where you want to be and attain your goals.

"One of the vital ideas that the book explores in depth is the fact that making a decision is a process that requires effort and depending on the difficulty of said decision that effort will increase accordingly. But what makes a decision hard? And the answer is the amount of thought required to carry it out."
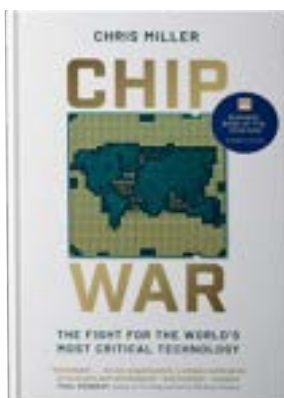
BOOK REVIEW

Reviewed by Toby Pernot

Chip War: The Fight for the World's Most Critical Technology

By Chris Miller (2022)
Published by: Scribner

Chip War, by Chris Miller of Tuft University, recounts the meteoric rise of the semiconductor industry and the world's never fulfilling addiction to them. As with all addictions a complete withdrawal would have dramatic effects on the user, the world economy. Due to chips being so coveted, control of this resource plays out on the world stage.

Most people every day don't realise their interactions and their dependence on semiconductors or "chips." They are needed in everything from your washing machine to your phone and laptop. These chips didn't exist 70 years ago but now are essential to our life and our future. How did this process occur?

In 1947 scientists at Bell Labs devised a device christened the "transistor", which could act as a switch for the flow of electrons, controlling the current. Several of their transistors would be placed on a block of germanium and form an "integrated circuit" or colloquially known as "chips." Blocks of germanium would later be replaced by silicon wafers; Silicon Valley would derive its name from the burgeoning industry developing there.

Moore's Law is a forecast that every few years numbers of components on a silicon chip would double. This would allow for exponential growth in computing power. However, in the original article in Electronics magazine written by Gordan Moore in 1965 he predicted that the trend would occur for at least for the next decade. This law still holds today with a chip able to fit billions of transistors on it.

William Shockley, who laid the scientific groundwork for transistors, founded Shockley Semiconductor in 1955 in the San Francisco suburb of Mountain View, California. Though only a few years later a group of eight engineers employed by Shockley left the company, due Shockley's awful management skills. The eight engineers decided to found their own company, Fairchild Semiconductors. These engineers later known as the 'traitorous eight' are widely credited with the founding of Silicon Valley.

It wasn't only the U.S. interested in chips. In the midst of the Cold War the Soviets too realised the importance of chips and desired them. Shockley's textbook titled "Electrons and Holes in Semiconductors" was translated into Russian just two years after it was published. The Soviets' response to Silicon Valley was Zelenograd, a Soviet city entirely devoted to producing semiconductors. The strategy which was enacted was one of copying American designs, much to the annoyance of Soviet scientists whose scientific understanding was as advanced as the Americans. Due to Moore's Law, they fell behind in semiconductors.

During the early years of the industry U.S. firms offshore the production portion of the value chain to Asian economies such as Taiwan. This was to leverage cost efficiency due to much lower labour costs. This process of globalisation would change commercial relationships to ones of geopolitical

significance incidentally.

In 1987, Morris Chang founded Taiwan Semiconductor Manufacturing Company (TSMC) with the full backing of the Taiwanese government. This company would grow to produce more than 90% of the world's most advanced chips. TSMC only produces chips for other companies and doesn't design their own. This business model was unique as mostly all chipmakers designed and produced their chip in house. This allowed TSMC to focus on efficiency and gain economies of scale, which was needed as chips shrank and costs increased.

China too have been trying to create their own chip industry due to their dependence on the U.S. and its allies, with their ability of "weaponised interdependence." This describes how one country controls a choke point of a value chain and uses it as a geopolitical weapon. This was done by the blacklisting of Huawei in the U.S. under national security pretexts. For example, this stops TSMC from producing chips for Huawei. In the short term this has resulted in delays for Huawei due to chip shortages. However, this will cause China to double down on their efforts to be self-sufficient.

Anyone interested in geopolitics would find Chip War informative. Miller's knowledge of the semiconductor industry exploring its intertwinement with geopolitics is quite revealing. It enables a new insight into US-China relations, allowing you to understand both reasons and effects of contemporary events such as the American's CHIP and Science Act. Miller has a highly engaging writing style allowing the book to read more like a thriller with a whole host of characters than your typical history textbook. Some may argue that the shallowest of technical explanations behind the science of semiconductors is a shortcoming. However, the book is 431 pages long so it would be impossible to cover the history of science behind the invention. Electrons and Holes in Semiconductors alone is 551 pages alone. The main purpose of the book is to provide context to the great power struggle between the U.S. and China and how a little electronic device has an outsized influence in decision making processes.

"*Anyone interested in geopolitics would find Chip War informative. Miller's knowledge of the semiconductor industry exploring its intertwinement with geopolitics is quite revealing. It enables a new insight into US-China relations, allowing you to understand both reasons and effects of contemporary events such as the American's CHIP and Science Act.*"

EXCEPTIONAL COURSEWORK

05
EXCEPTIONAL COURSEWORK
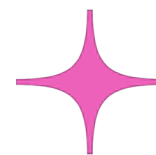
ECONOMETRICS RESEARCH PROJECT

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  Written by: Katie Hale

GOVERNMENT, WELFARE, AND POLICY

- **Is the Paris Agreement working?**

  Written by: Christopher Bebbington

- **Prosperity for all - Reestablish meritocracy**

  Written by: Joel Müller

- **The Ticking Time Bomb: Italy's Pension Landscape**

  Written by: Edorado Bettella

- **Levelling Up or Down? UK's Strategy to Eradicate Inequality**

  Written by: Zaafirah Haider

- **Norfolk Shoreline Management Plan (SMP)** - Infographic

  By: Luana Graça, Zaafirah Haider, Gabrielle Sebastian, Mo Abiodun, Jennifer Kwenda, Toni Egbulefu

BUSINESS AND ECONOMICS OF SPORT

- **The Beautiful Game's Buzz**

  Is Viewership Propelled by Close Competition or the Fear of Losing? A Comparative Analysis across the English Premier League and German Bundesliga for the 2022/23 season

  Written by: Anmol Singh

Online Overload?:
An Econometric Investigation into the Effects of Frequency of Internet Use on General Health

Katie Hale

Introduction

Research states that on average, UK adult internet users spent 3 hours and 41 minutes online per day in May 2023 (Ofcom, 2023). Studies show that internet use has a significant positive impact on all dimensions of health (Han and Zhao, 2021). This research analyses Wave 13 of the "Understanding Society Survey" and aims to investigate the effects of different frequencies of internet use on general health.

The motivation behind this research originates from the increasing access to and use of the internet in the UK (ONS, 2020), which requires frequent updating of the data and subsequent empirical analysis. There is limited recent research on this topic, but some of the existing research focuses on internet use and mental health, especially since the global pandemic in 2020, including papers by Quintana-Domeque, et al. (2022) and Ceylan et al. (2020). Since mental health has been the focus in recent years, there are gaps in contemporary literature on the overall effects of internet use frequency on general health.

In the health economics literature, prominent papers including Jones and Wildman (2008), Lorgelly and Lindley (2008) and Meer et al. (2003), have typically investigated the relationship between income and health. Fewer studies particularly in economics literature, investigate the relationship between internet use and health, although this is more prominent in other disciplines and journals, such as in the Journal of Medical Internet Research.

Some studies focus on a specific age range only, such as older adults and the elderly, (UCL, 2020) (Duplaga, 2021) or younger adults (Hunsaker et.al, 2020). As a result, this investigation aims to analyse the effects of internet use frequency on general health for the full age range seen in the UKHLS data set, between the ages of 16-101. Previous studies have not focused on whether there are significant

gender differences regarding the impact of internet use on general health. Hence, this study aims to provide insights into the potential differences between men and women through the following empirical research and discussion.

Data & Methodology

This study uses data from Wave 13 of the "Understanding Society Survey" (UKHLS), which captures data regarding social and economic characteristics of approximately 40,000 households in the UK, since Wave 1 was released in 2009.

The dependent variable, general health, is often defined in academic research using the World Health Organisation's (1948) definition, stating that health is: a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. In this dataset, this variable is a self-assessed measure of an individual's general health. For the purpose of this investigation, the categories 'Excellent' and 'Very good' are combined to equal 1, and 'Good', 'Fair' and 'Poor' health are combined to equal 0, creating a new binary variable, as seen in Table A2.

The focal point of this investigation is frequency of internet use, where individuals in the UKHLS were asked how often they used the internet for personal use. The variable for frequency of internet use has been used categorically in the regressions, with dummy variables ranging from using the internet 'Almost all of the time' to 'Never', using the 'Never' dummy as the base group. The categories 'Several times a month', 'Once a month' and 'Less than once a month' have been combined into a single dummy variable called 'in a Month', as seen in Table A3, to deal with the small number of observations seen in each of these categories.

This study will utilise several types of regression models, including: the Linear Probability Model (LPM), estimated using the Ordinary Least Squares estimator (OLS), as well as Probit and Logit models, which allow for a binary dependent variable to be used.

The *Linear Probability Model* (LPM) can be expressed as:

$$\Pr(genhealth_i = 1)$$
$$= \beta_0 + \beta_1 Almostall_i + \beta_2 Severaldaily_i + \beta_3 OnceorTwicedaily_i + \beta_4 Severalweekly_i + \beta_5 inaMonth_i + X\delta$$

In the model, X represents our control variables. Some examples of these control variables are place of residence (urban or rural), smoking, alcohol consumption and fruit and vegetable consumption, as seen in Duplaga's (2021) paper. The full list of variables and how they are coded can be found in Table A1. Furthermore, a logarithmic of income has been used to deal with outliers and age categories are used, due to the models seen in Jones and Wildman (2008) and Duplaga's (2021) papers.

The _probit model_ can be expressed as:

$$\Pr(genhealth_i = 1)$$
$$= G(\beta_0 + \beta_1 Almostall_i + \beta_2 Severaldaily_i + \beta_3 OnceorTwicedaily_i$$
$$+ \beta_4 Severalweekly_i + \beta_5 inaMonth_i + X\delta)$$
$$= \Phi(\beta_0 + \beta_1 Almostall_i + \beta_2 Severaldaily_i + \beta_3 OnceorTwicedaily_i$$
$$+ \beta_4 Severalweekly_i + \beta_5 inaMonth_i + X\delta)$$

Where $\Phi(.)$ represents the cumulative (standard) normal distribution.

The _logit model_ can be expressed as:

$$\Pr(genhealth_i = 1)$$
$$= G(\beta_0 + \beta_1 Almostall_i + \beta_2 Severaldaily_i + \beta_3 OnceorTwicedaily_i$$
$$+ \beta_4 Severalweekly_i + \beta_5 inaMonth_i + X\delta)$$
$$= \Lambda(\beta_0 + \beta_1 Almostall_i + \beta_2 Severaldaily_i + \beta_3 OnceorTwicedaily_i$$
$$+ \beta_4 Severalweekly_i + \beta_5 inaMonth_i + X\delta)$$

Where $\Lambda(.)$ is the cumulative logistic function, which can be expressed as:

$$\frac{\exp(X_i \beta)}{1 + \exp(X_i \beta)}$$

When estimating pairwise correlations for the sample, there are no high values >0.8, which indicates that there are no issues of multicollinearity. The full correlation matrix is seen in Table A4. Our Variance Inflation Factors (VIF), seen in Table A5, show no values above 10, also indicating an absence of noticeable multicollinearity in the model, meaning that none of our variables' variances have been unduly 'inflated'.

Descriptive statistics of all of the variables included in the model are provided in Table A6. These results show that around 43% of the sample said that they had Excellent or Very good general health, and around 57% had Good, Fair or Poor general health. The proportion of females to males was around 56% to 44% respectively and on average, respondents participated in moderate activity two days a week.

Figure 1 – Histogram of LPM Predicted Probability Values:
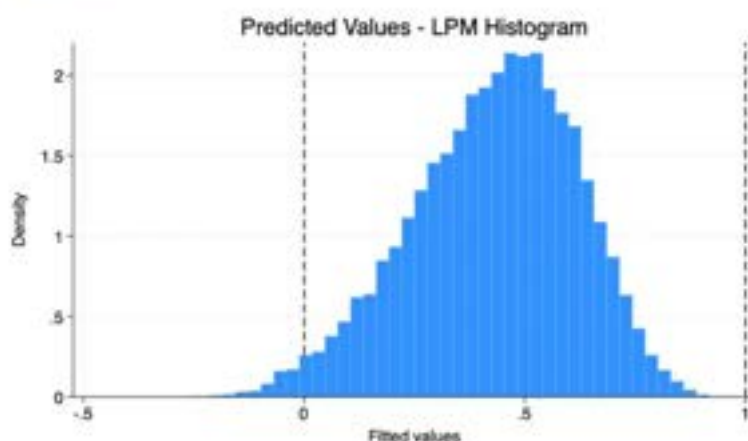
Results

The Linear Probability Model (LPM) which is generated using the OLS can be used for comparative analysis. However, one issue is that it produces heteroskedastic errors, as seen in Table A7, which demonstrates that the error terms are non-constant. We can overcome this by using robust standard errors in our Linear Probability Model regressions throughout the investigation.

Moreover, figure 1 shows that one of the main issues of using the OLS is that the predicted values are not guaranteed to conform to the laws of probability, that is:

$$0 \leq \Pr(genhealth_i) \leq 1$$

However, when using a more suitable Probit or Logit model and estimating them with the Maximum Likelihood Estimator (MLE), all of our predicted probability values lie within the suitable region, between 0 and 1, as seen in Table A7, as well as in figure 2, the histograms and figure 3, the sigmoid-shaped cumulative distribution functions.

Figure 2 – Predicted Probability Histograms: *Figure 3 – Cumulative Distribution Functions:*
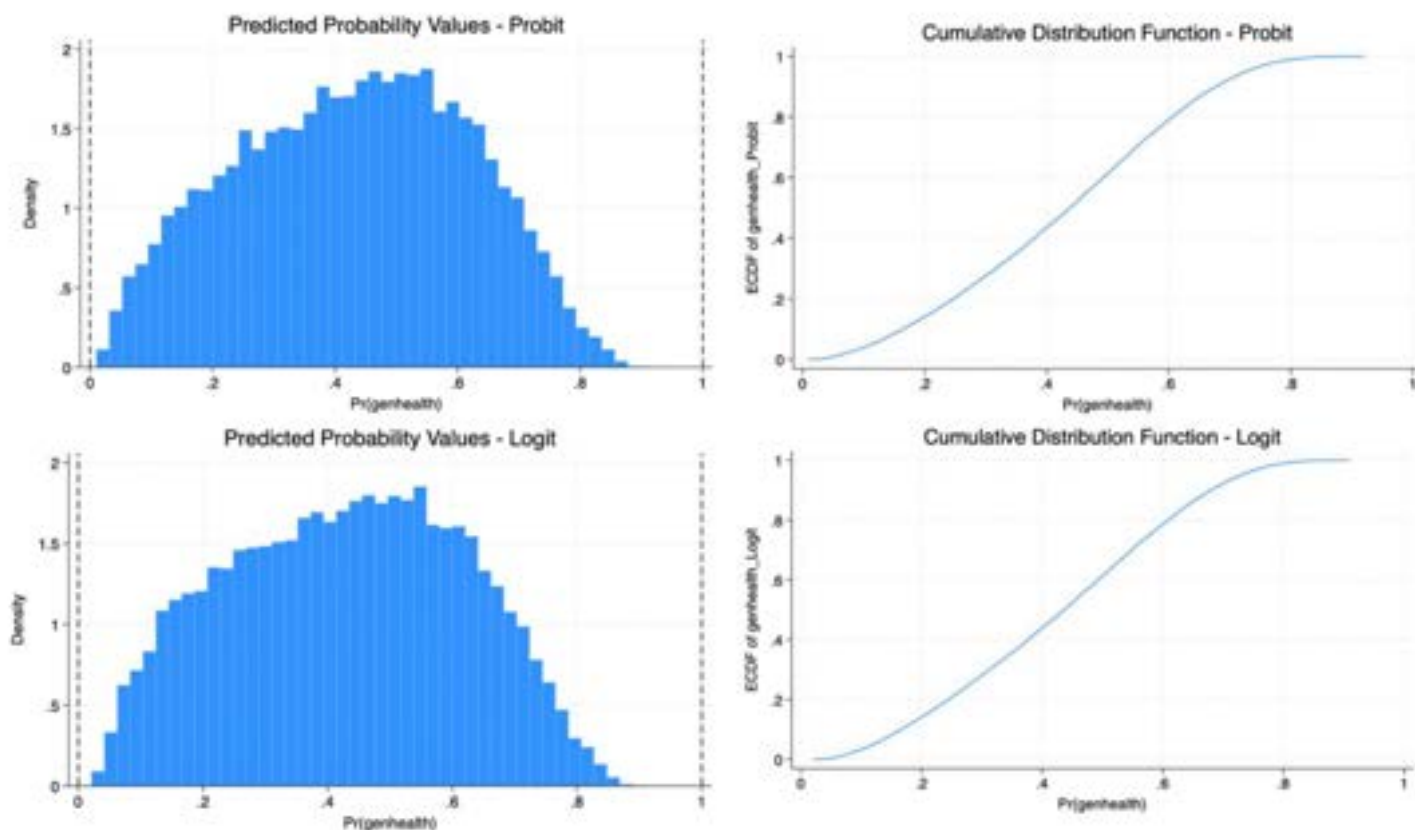
The marginal effects have been calculated for the probit and logit models to enable us to interpret the coefficients and compare them with the LPM. The regression results can be seen in Tables 1 and A10.

The probit and logit models produce similar results, with identical pseudo-R^2s and almost identical count-R^2s. Importantly, when testing the goodness of fit of the models, the count-R^2 values generate

a gain of approximately 9.5% points for both models, compared to our baseline classification, as seen in Table A8. This indicates that there is predictive power associated with these models.

Consistent with empirical research conducted by Han and Zhao (2021) and Hunsaker et al. (2020), the regression results in Table 1, show a positive relationship between the frequency of internet use and general health. When using the logit and probit results, the internet use frequency variable predicts that those who use the internet almost all of the time will be 7.36% points and 6.87% points respectively, more likely to have excellent or very good health, compared to those who never use the internet, ceteris paribus.

These findings imply that a higher frequency of internet use is associated with a predicted higher level of general health, to the 1% significance level across all three models, although these results are only of small magnitude. All of these coefficients are highly statistically significant, except the 'inaMonth' dummy variable, perhaps due to the small number, only 3.15%, of total observations seen in this category.

Table 1 – Regression Results:

	(1) LPM	(2) Logit	(3) Probit
Almostall	0.0443*** (0.0150)	0.0736*** (0.0207) [1.374][a]	0.0687*** (0.0198)
Severaldaily	0.0649*** (0.0143)	0.0959*** (0.0200) [1.506][a]	0.0907*** (0.0191)
OnceorTwicedaily	0.0582*** (0.0155)	0.0891*** (0.0212) [1.465][a]	0.0839*** (0.0203)
Severalweekly	0.0565*** (0.0178)	0.0872*** (0.0239) [1.453][a]	0.0804*** (0.0229)
inaMonth	0.0385* (0.0197)	0.0626** (0.0272) [1.312][a]	0.0579** (0.0260)
Diagnostics			
R^2	0.143		
Pseudo R^2		0.114	0.114
Count R^2 (baseline)		66.54 (57.04)	66.57 (57.04)
Heteroskedasticity Test	317.21 (0.000)		
Predicted Values range	Min -0.2718 Max 0.9756	Min 0.0211 Max 0.9098	Min 0.0103 Max 0.9198
N		24,068	

Notes: Coefficients represent marginal effects. Standard errors in parentheses (robust standard errors for LPM).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity F-test based on using all the independent (explanatory) variables, assuming normal error terms. [a] Odds ratio.
Other variables included in the model but not reported: log income, nownchild, fruitveg, mday and dummies associated with gender, education, age categories, ethnicity, marital status, sleep quality, smokers, alcohol frequency, urban area.

The odds-ratios are referred to as the left side of this expression:

$$\frac{\Pr(genhealth_i = 1)}{\Pr(genhealth_i = 0)} = \exp(X_i\beta)$$

The odds ratios from Table 1 and the full results in Table A10, show that those who use the internet almost all of the time, are 1.374 times more likely, and those who use the internet several times a day are 1.506 times more likely to have excellent or very good health, compared to those who never use

the internet, holding the other variables constant. These results are highly statistically significant and indicate that an individual's general health is predicted to be higher if they are using the internet several times a day, in comparison to almost all of the time, with excessive internet use reducing the positive benefits. Most studies on excessive internet use suggest this has a negative effect on general health, rather than a diminishing positive effect seen here (Weinstein and Lejoyeux, 2010) (Salmela-Aro et al., 2016).

The extent to which frequency of internet use affects general health between males and females in the probit model is explored in Table 2 below. Consistent with earlier results, there is a positive effect between the dependent and focal point explanatory variables. Females who use the internet almost all of the time, are 5.26% points more likely, at the 5% significance level, to have excellent or very good health, compared to those who never use the internet. Whereas males are 8.19% points more likely, at the 1% significance level. These highly significant results for males indicate that a higher frequency of internet use has a larger predicted positive effect on male's general health compared to females.

All of the internet use variables are statistically significant for females (at least to the 10% level), but this is not the case with males who use the internet several times a week or in a month, perhaps due to the smaller number of observations seen in these groups.

Table 2 – Male vs Female marginal effects (Probit):

Variable:	Female	Male
Almostall	0.0526** (0.0266)	0.0819*** (0.0301)
Severaldaily	0.0800*** (0.0257)	0.0967*** (0.0291)
OnceorTwicedaily	0.0705*** (0.0270)	0.0924*** (0.0312)
Severalweekly	0.1009*** (0.0306)	0.0476 (0.0348)
inaMonth	0.0605* (0.0341)	0.0472 (0.0404)

Notes: coefficients represent marginal effects (probit model). Standard errors in parentheses.
$^{*} p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Likelihood Ratio tests can be performed to conduct a joint test of significance in our model, using restricted and unrestricted models. This test is written as:

$$LR \; Test = -2(L_R - L_U)$$

Our results, in Table A9, suggest that for our unrestricted model, we can reject the null hypothesis, due to the very low p-value, approximating to 0, that is seen. Therefore, at least one of the 36 variables has a non-zero effect on the dependent variable.

Although, when using the restricted model, we cannot now reject the null hypothesis, as the p-value is 23.93%. This means that three of the four marital status variables are both individually and jointly insignificant, and we could remove them from the model, however, I have chosen to leave them in, as this is acceptable.

Finally, figures 4-6 provide predicted probability plots for the full sample, separated for females and males too. Here, we use age in its continuous form rather than categorical, and we introduce an interaction term between the frequency of internet use and age, to highlight how general health varies with age, as suggested by (Ross and Wu, 1996), for each internet frequency category.

Figure 4 – Predicted Probability Plot – Overall:

Adjusted predictions of internetuse with 95% CIs - Overall
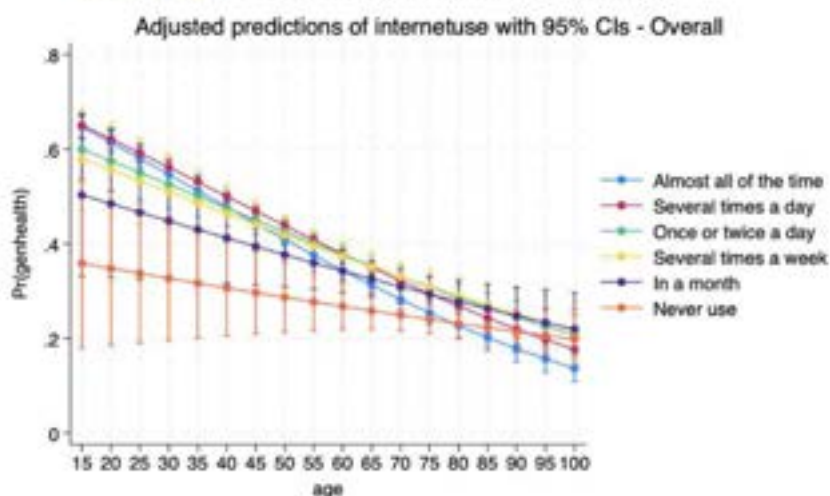
Figure 5 – Predicted Probability Plot – Female: *Figure 6 - Predicted Probability Plot – Male:*
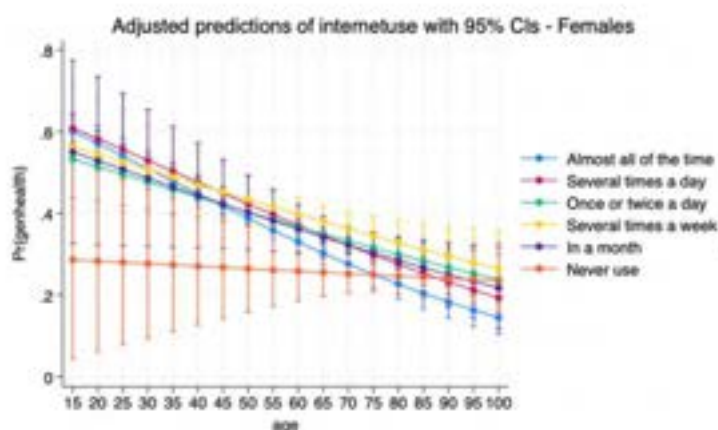
Adjusted predictions of internetuse with 95% CIs - Females

Adjusted predictions of internetuse with 95% CIs - Males
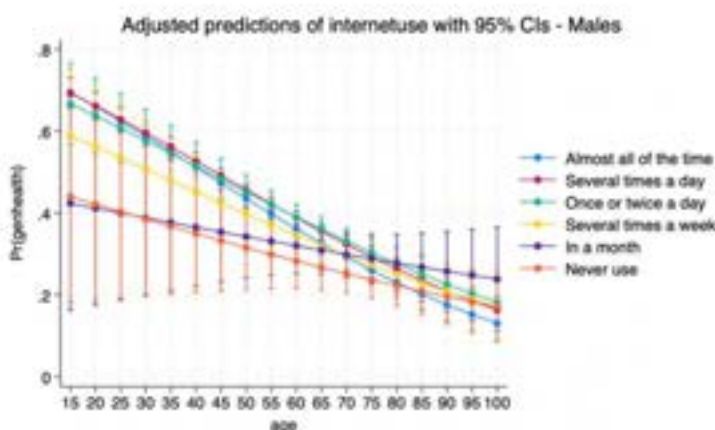
All of the predicted probability plots show downward-sloping curves, indicating that as you age, the probability of you having better health decreases. In other words, as age increases, health decreases. In the overall model, in figure 4, the internet frequency variables have steeper slopes, the higher the frequency of internet use is, with 'Almost all the time' being the steepest, and 'Never use' being the flattest. This analysis implies that more frequent internet use leads to a larger reduction in health as you age, which has not been analysed in previous literature when the full age range is included.

For females, in figure 5, some use of the internet benefits your health until around age 75 when the probabilities of having excellent or very good general health are identical to those who never use the internet. The slope of the 'never use' curve is almost flat for females, indicating that women who never use the internet, are only predicted a 25-30% chance of having excellent or very good health.

For males, in figure 6, there is a higher variation in predicted general health between internet use frequencies, with slightly steeper slopes than seen for females. This indicates that frequency of internet use has a larger effect on men's general health than for women. Similarly to females, some use of the internet benefits your health until around age 80, where the probability of excellent or very good general health lies between 20-30% and is analogous for all internet use frequencies.

Conclusion

This study has found a positive relationship between higher frequencies of internet use and general health, with a larger and more significant positive effect predicted for males. However, as individuals age, the higher the frequency of internet use is, the more rapidly the probability of excellent or very good health reduces.

One limitation of this study is that general health is a self-assessed variable, which some individuals could have exaggerated, introducing the possibility of bias and inaccuracies in the data.

Future studies could consider how individuals use the internet, using data that was not available for this study. For example, using the internet to research health-related information, or communicating with friends may benefit general health. Whereas excessive scrolling on social media could pose a negative threat to one's health. Separating the frequency of internet use by type of internet consumption would give more specific insights on individuals' general health over the full age range and between genders.

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Appendix:

Table A1 – Variable Definitions:

Variable Name:	Definition:
DEPENDENT VARIABLE	
General health (m_scsf1)	=1 if respondent has 'Excellent' or 'Very good' general health; =0 if respondent has 'Good', 'Fair' or 'Poor' general health.
EXPLANATORY VARIABLES	
Frequency of internet use (m_netpusenew)	Frequency of personal internet use
Almostall	=1 if uses internet almost all the time; =0 otherwise
Severaldaily	=1 if uses internet several times a day; =0 otherwise
OnceorTwicedaily	=1 if uses internet once or twice a day; =0 otherwise
Severalweekly	=1 if uses internet several times a week; =0 otherwise
inaMonth	=1 if uses internet several times a month, once a month or less than once a month; =0 otherwise
Neveruse (base)	=1 if never uses the internet; =0 otherwise
GENDER	
female (m_sex)	=1 if respondent is female; =0 if male
HIGHEST QUALIFICATION	
educ (m_hiqual_dv)	Highest qualification, UKHLS & BHPS samples
degree	=1 if degree is highest qualification; =0 otherwise
highdegree	=1 if other higher degree is highest qualification; =0 otherwise
alevel	=1 if A Level or equivalent is highest qualification; =0 otherwise
gcse	=1 if GCSE or equivalent is highest qualification; =0 otherwise
otherqual	=1 if another qualification is highest qualification; =0 otherwise
none (base)	=1 if respondent has no educational qualifications; =0 otherwise
INCOME	
persinc (m_fimngrs_dv)	Total monthly personal income gross
lnpersinc	Log of total personal monthly personal income gross
AGE	
age - continuous form (m_dvage)	Age of respondent
agecat - categorical form (m_agegr10_dv)	Age category of respondent
age10to19	=1 if respondent aged 10-19; =0 otherwise
age20to29	=1 if respondent aged 20-29; =0 otherwise
age30to39	=1 if respondent aged 30-39; =0 otherwise

age40to49	=1 if respondent aged 40-49; =0 otherwise
age50to59	=1 if respondent aged 50-59; =0 otherwise
age60to69	=1 if respondent aged 60-69; =0 otherwise
age70plus (base)	=1 if respondent aged 70+; =0 otherwise
ETHNICITY	
Race (m_racel_dv)	Ethnic group incorp. all waves, coding, modes, and bhps
white (base)	=1 if respondent is white; =0 otherwise
mixed	=1 if respondent is mixed race; =0 otherwise
asian	=1 if respondent is Asian; =0 otherwise
black	=1 if respondent is black; =0 otherwise
other	=1 if respondent is from a different ethnic group; =0 otherwise
nownchild (m_nchild_dv)	Number of own children in household
MARITAL STATUS	
marrystat (m_mastat_dv)	De facto marital status
married	=1 if respondent is married, in registered same sex civil partnership or living as a couple; =0 otherwise
separated	=1 if respondent is separated but legally married or separated from civil partner; =0 otherwise
divorced	=1 if respondent is divorced or is a formal civil partner; =0 otherwise
widowed	=1 if respondent is widowed or surviving civil partner; =0 otherwise
single (base)	=1 if respondent is single; =0 otherwise
sleepqual (m_slp_qual)	=1 if good sleep; =0 if bad sleep
fruitveg (m_fruitamt and m_vegeamt)	Amount of fruit and vegetables eaten per day; inapplicable=0
mday (m_mday)	Number of days a week the respondent does moderate activity
smokes (m_smoker)	=1 if respondent smokes; 0 otherwise
ALCOHOL CONSUMPTION	
pastalc (m_auditc1)	=1 if respondent has had a drink in the last 12 months; =2 otherwise
alcfreq (m_auditc3)	Alcohol frequency past 12 months
Monthlyorless	=1 if respondent drank alcohol monthly or less in past 12 months; =0 otherwise

TwotoFourpermonth	=1 if respondent drank alcohol 2-4 alcoholic times per month in past 12 months; =0 otherwise
TwotoThreeperweek	=1 if respondent drank alcohol 2-3 times per week in past 12 months; =0 otherwise
Fourplusperweek	=1 if respondent drank alcohol 4+ times per week in past 12 months; =0 otherwise
Never (base)	=1 if respondent has not drunk in the past 12 months; =0 otherwise
urban (m_urban_dv)	=1 if respondent lives in urban area; =0 if respondent lives in rural area

Table A2 – Creation of dependent variable 'genhealth':

```
              |    RECODE of m_scsf1
      General |   (General health)
       health | Good, Fai  Excellent |     Total
--------------+----------------------+----------
    Excellent |        0      2,682  |     2,682
    Very good |        0      9,008  |     9,008
         Good |    9,597          0  |     9,597
         Fair |    4,715          0  |     4,715
         Poor |    1,573          0  |     1,573
--------------+----------------------+----------
        Total |   15,885     11,690  |    27,575
```

Table A3 – Creation of focal point variables 'internetuse':

```
Frequency of using |  RECODE of m_netpusenew (Frequency of using the internet new)
 the internet new  | Almost al Several t Once or t Several t In a mont Never use  |    Total
-------------------+-------------------------------------------------------------+---------
Almost all of the tim |  9,147         0         0         0         0         0 |    9,147
 Several times a day   |      0    12,029         0         0         0         0 |   12,029
   Once or twice a day |      0         0     3,011         0         0         0 |    3,011
 Several times a week  |      0         0         0     1,398         0         0 |    1,398
Several times a month  |      0         0         0         0       445         0 |      445
        Once a month   |      0         0         0         0       143         0 |      143
Less than once a mont  |      0         0         0         0       284         0 |      284
          Never use    |      0         0         0         0         0     1,251 |    1,251
-------------------+-------------------------------------------------------------+---------
            Total  |  9,147    12,029     3,011     1,398       872     1,251 |   27,708
```

Table A4 – Pairwise Correlation Matrix:

(obs=24,068)

```
          | genhea-h Almost-1 Seve-ily Onceor-y Seve-kly inaMonth  female   degree highde-e   alevel    gcse
----------+------------------------------------------------------------------------------------------------
genhealth |  1.0000
 Almostall |  0.0442   1.0000
Severaldaily|  0.0611  -0.6064   1.0000
OnceorTwic-y| -0.0363  -0.2405  -0.3201   1.0000
Severalwee-y| -0.0358  -0.1576  -0.2098  -0.0832   1.0000
  inaMonth | -0.0555  -0.1210  -0.1610  -0.0639  -0.0418   1.0000
    female | -0.0204  -0.0243   0.0005   0.0162   0.0028   0.0143   1.0000
    degree |  0.1494   0.0794   0.1006  -0.0762  -0.0884  -0.0921  -0.0075   1.0000
 highdegree| -0.0111  -0.0284   0.0263   0.0184   0.0117  -0.0030   0.0393  -0.2732   1.0000
    alevel |  0.0060   0.0494  -0.0032  -0.0116  -0.0190  -0.0262  -0.0574  -0.3593  -0.2010   1.0000
     gcse  | -0.0577  -0.0217  -0.0190   0.0314   0.0326   0.0291   0.0183  -0.3332  -0.1864  -0.2451   1.0000
  otherqual| -0.0709  -0.0645  -0.0610   0.0521   0.0592   0.0700   0.0006  -0.1987  -0.1112  -0.1462  -0.1356
  lnpersinc|  0.0721  -0.0024   0.0641  -0.0270  -0.0162  -0.0397  -0.1362   0.2142   0.0345  -0.0471  -0.1259
  age10to19|  0.0641   0.1163  -0.0408  -0.0448  -0.0344  -0.0258  -0.0022  -0.1164  -0.0528   0.0898   0.1105
  age20to29|  0.0939   0.2315  -0.0676  -0.1044  -0.0693  -0.0586   0.0143   0.0507  -0.0452   0.1257  -0.0450
  age30to39|  0.0709   0.1502  -0.0031  -0.0908  -0.0625  -0.0548   0.0155   0.1165  -0.0024   0.0030  -0.0439
  age40to49|  0.0268   0.0588   0.0716  -0.0681  -0.0578  -0.0629   0.0014   0.1001  -0.0009  -0.0081  -0.0197
  age50to59| -0.0260  -0.0370   0.0769   0.0092  -0.0132  -0.0315  -0.0055   0.0070   0.0257  -0.0309   0.0335
  age60to69| -0.0353  -0.1318   0.0353   0.0794   0.0682   0.0305  -0.0024  -0.0509   0.0293  -0.0266   0.0166
     mixed |  0.0054   0.0513  -0.0067  -0.0285  -0.0216  -0.0110   0.0078   0.0203   0.0010   0.0075  -0.0016
     asian | -0.0340   0.1112  -0.0573  -0.0442  -0.0323  -0.0036  -0.0058   0.0472  -0.0396   0.0009  -0.0278
```

black	-0.0126	0.0642	-0.0415	-0.0190	-0.0066	-0.0037	0.0292	0.0203	0.0168	-0.0031	-0.0272
other	-0.0116	0.0219	-0.0151	-0.0076	-0.0012	0.0099	0.0030	0.0236	-0.0054	-0.0108	-0.0088
nownchild	0.0641	0.0977	0.0614	-0.0886	-0.0701	-0.0718	0.0136	0.1166	-0.0035	-0.0029	-0.0270
married	0.0410	-0.0852	0.1063	0.0215	0.0029	-0.0114	-0.0952	0.0945	0.0309	-0.0704	-0.0279
separated	-0.0209	0.0111	-0.0095	-0.0033	0.0002	-0.0015	0.0174	-0.0138	0.0135	-0.0020	0.0035
divorced	-0.0665	-0.0533	-0.0013	0.0263	0.0286	0.0223	0.0832	-0.0404	0.0192	-0.0238	0.0193
widowed	-0.0775	-0.1115	-0.0796	0.0514	0.0725	0.0797	0.0966	-0.0923	-0.0023	-0.0446	0.0020
sleepqual	0.2288	-0.0320	0.0135	0.0139	0.0073	-0.0048	-0.0743	0.0276	-0.0044	-0.0033	-0.0090
fruitveg	0.0952	-0.0236	0.0499	0.0126	0.0033	-0.0156	0.0431	0.0707	0.0053	-0.0142	-0.0314
mday	0.1437	0.0026	0.0504	-0.0022	-0.0113	-0.0339	-0.0902	0.0319	0.0091	0.0245	0.0038
smokes	-0.0974	0.0209	-0.0408	-0.0011	0.0094	0.0188	-0.0294	-0.1256	0.0010	0.0256	0.0723
Fourpluspe-k	0.0102	-0.0559	0.0477	0.0204	0.0080	-0.0093	-0.1058	0.0552	0.0223	-0.0293	-0.0185
TwotoThree-k	0.0731	-0.0440	0.0663	0.0031	-0.0060	-0.0227	-0.0663	0.0683	0.0103	-0.0093	-0.0343
TwotoFourp-h	0.0660	0.0123	0.0263	-0.0069	-0.0106	-0.0224	0.0068	0.0231	-0.0080	0.0232	-0.0037
Monthlyor1-s	-0.0271	0.0481	-0.0129	-0.0203	-0.0088	-0.0019	0.0786	-0.0233	0.0159	0.0190	0.0213
urban	-0.0274	0.0801	-0.0342	-0.0372	-0.0159	-0.0136	0.0008	0.0207	-0.0201	-0.0035	-0.0039

	otherq-1	lnpers-c	age10-19	age20-29	age30-39	age40-49	age50-59	age60-69	mixed	asian	black
otherqual	1.0000										
lnpersinc	-0.0559	1.0000									
age10to19	-0.0415	-0.2564	1.0000								
age20to29	-0.0869	-0.0643	-0.0639	1.0000							
age30to39	-0.0639	0.0605	-0.0651	-0.1352	1.0000						
age40to49	-0.0558	0.1143	-0.0769	-0.1596	-0.1626	1.0000					
age50to59	0.0130	0.0566	-0.0855	-0.1775	-0.1809	-0.2135	1.0000				
age60to69	0.0516	-0.0247	-0.0823	-0.1708	-0.1741	-0.2054	-0.2285	1.0000			
mixed	-0.0189	-0.0099	0.0505	0.0569	0.0265	0.0034	-0.0194	-0.0172	1.0000		
asian	-0.0112	-0.0657	0.0398	0.0718	0.0433	0.0742	-0.0192	-0.0628	-0.0412	1.0000	
black	0.0029	0.0055	-0.0011	0.0060	0.0038	0.0157	0.0194	0.0012	-0.0240	-0.0509	1.0000
other	0.0004	-0.0066	0.0106	0.0033	0.0083	0.0139	-0.0018	-0.0097	-0.0092	-0.0195	-0.0114
nownchild	-0.0656	0.0942	-0.0825	-0.0960	0.3425	0.4032	-0.0953	-0.2155	0.0075	0.1064	0.0212
married	0.0126	0.1094	-0.2398	-0.2833	0.0629	0.1380	0.1028	0.0761	-0.0650	-0.0122	-0.0876
separated	0.0015	0.0155	-0.0171	-0.0375	0.0087	0.0240	0.0244	0.0051	0.0010	0.0068	0.0334
divorced	0.0295	0.0252	-0.0477	-0.0938	-0.0762	-0.0283	0.0553	0.0935	-0.0079	-0.0336	0.0219
widowed	0.0670	0.0035	-0.0435	-0.0897	-0.0887	-0.0988	-0.0868	-0.0003	-0.0241	-0.0331	-0.0065
sleepqual	-0.0049	0.0240	0.0190	0.0260	-0.0354	-0.0366	-0.0444	0.0028	-0.0195	0.0107	-0.0063
fruitveg	-0.0065	0.0093	-0.0173	-0.0415	-0.0168	-0.0026	0.0251	0.0455	-0.0101	-0.0068	0.0085
mday	-0.0395	0.0358	0.0158	0.0077	0.0100	0.0317	0.0331	0.0013	0.0034	-0.0312	-0.0084
smokes	0.0271	-0.0297	-0.0111	0.0276	0.0272	0.0263	0.0099	0.0046	0.0270	-0.0226	0.0087
Fourpluspe-k	-0.0090	0.0731	-0.0609	-0.1063	-0.0787	-0.0262	0.0249	0.0919	-0.0214	-0.0922	-0.0413
TwotoThree-k	-0.0174	0.0777	-0.0374	-0.0650	-0.0425	0.0251	0.0507	0.0362	-0.0219	-0.1265	-0.0377
TwotoFourp-h	-0.0151	0.0332	0.0230	0.0637	0.0399	0.0143	0.0031	-0.0371	0.0048	-0.0953	-0.0248
Monthlyor1-s	-0.0160	-0.0227	0.0347	0.0772	0.0662	-0.0075	-0.0298	-0.0489	0.0324	-0.0564	0.0254
urban	0.0030	-0.0048	0.0076	0.0524	0.0392	0.0308	-0.0095	-0.0298	0.0528	0.1649	0.0970

	other	nownch-d	married	separa-d	divorced	widowed	sleepq-1	fruitveg	mday	smokes	Fourpl-k
other	1.0000										
nownchild	0.0225	1.0000									
married	-0.0189	0.2470	1.0000								
separated	0.0132	0.0109	-0.1679	1.0000							
divorced	0.0094	-0.0897	-0.3776	-0.0328	1.0000						
widowed	-0.0083	-0.1110	-0.3442	-0.0299	-0.0673	1.0000					
sleepqual	-0.0143	-0.0516	0.0282	-0.0275	-0.0363	0.0005	1.0000				
fruitveg	0.0064	-0.0026	0.0533	-0.0051	-0.0038	-0.0222	0.0357	1.0000			
mday	-0.0059	0.0352	0.0315	0.0010	-0.0226	-0.0635	0.0586	0.1600	1.0000		
smokes	0.0125	0.0097	-0.0900	0.0159	0.0546	-0.0175	-0.0753	-0.0877	-0.0175	1.0000	
Fourpluspe-k	-0.0170	-0.0640	0.0971	-0.0110	-0.0042	-0.0053	0.0110	-0.0098	0.0204	0.0181	1.0000
TwotoThree-k	-0.0202	-0.0182	0.1016	0.0035	-0.0223	-0.0407	0.0386	0.0369	0.0587	-0.0338	-0.2114
TwotoFourp-h	-0.0075	0.0133	-0.0045	-0.0026	-0.0268	-0.0393	0.0266	0.0149	0.0187	-0.0272	-0.2029
Monthlyor1-s	0.0049	0.0170	-0.0802	0.0036	0.0278	-0.0018	-0.0303	-0.0124	-0.0165	0.0305	-0.1972
urban	0.0315	0.0369	-0.0509	0.0006	0.0127	-0.0202	-0.0244	-0.0058	-0.0457	0.0299	-0.0485

	TwotoT-k	TwotoF-h	Monthl-s	urban
TwotoThree-k	1.0000			
TwotoFourp-h	-0.2740	1.0000		
Monthlyor1-s	-0.2665	-0.2557	1.0000	
urban	-0.0406	-0.0097	0.0043	1.0000

Table A5 – *Variance Inflation Factors (VIF) and the Tolerance (TOL):*

Variable	VIF	1/VIF
Severaldaily	7.58	0.132002
Almostall	7.10	0.140902
degree	4.84	0.206765
alevel	3.68	0.272040
OnceorTwic~y	3.45	0.289782
gcse	3.31	0.302331
highdegree	2.85	0.350626
age20to29	2.47	0.404651
married	2.47	0.404927
age40to49	2.47	0.405135
age30to39	2.33	0.429801
Severalwee~y	2.16	0.462279

```
     age50to59 |    2.01    0.497164
      otherqual |    1.98    0.504886
   TwotoThree~k |    1.82    0.550414
      age60to69 |    1.76    0.568069
   TwotoFourp~h |    1.72    0.580617
         widowed |    1.68    0.594407
        inaMonth |    1.68    0.595843
        nownchild |    1.65    0.607194
    Monthlyorl~s |    1.64    0.610036
    Fourpluspe~k |    1.61    0.620407
       age10to19 |    1.61    0.622434
        divorced |    1.59    0.630491
           asian |    1.23    0.814139
       lnpersinc |    1.19    0.837224
       separated |    1.12    0.894598
          female |    1.09    0.919608
          smokes |    1.06    0.940940
            mday |    1.06    0.943442
           urban |    1.06    0.946613
        fruitveg |    1.05    0.948305
           black |    1.05    0.952591
       sleepqual |    1.03    0.967502
           mixed |    1.02    0.977190
           other |    1.01    0.991886
----------------+----------------------
        Mean VIF |    2.18
```

Table A6 – *Descriptive Statistics:*

Variable	Obs	Mean	Std. dev.	Min	Max
genhealth	24,068	.4296161	.4950316	0	1
Almostall	24,068	.3129467	.4637025	0	1
Severaldaily	24,068	.4466927	.4971605	0	1
OnceorTwic~y	24,068	.1126392	.3161578	0	1
Severalwee~y	24,068	.0516869	.2213987	0	1
inaMonth	24,068	.0311202	.173646	0	1
female	24,068	.5583763	.4965908	0	1
degree	24,068	.3280705	.4695204	0	1
highdegree	24,068	.1325827	.3391302	0	1
alevel	24,068	.2090743	.406656	0	1
gcse	24,068	.1852252	.3884882	0	1
otherqual	24,068	.0747881	.2630546	0	1
lnpersinc	24,068	7.305902	1.16563	-2.813411	10.02046
age10to19	24,068	.0298737	.1702424	0	1
age20to29	24,068	.1171265	.3215776	0	1
age30to39	24,068	.1211152	.3262679	0	1
age40to49	24,068	.1610022	.3675406	0	1
age50to59	24,068	.1919561	.3938469	0	1
age60to69	24,068	.1802393	.3843947	0	1
mixed	24,068	.019071	.1367773	0	1
asian	24,068	.0801895	.2715919	0	1
black	24,068	.028835	.167346	0	1
other	24,068	.0043626	.0659074	0	1
nownchild	24,068	.3839538	.8022821	0	8
married	24,068	.6589247	.4740805	0	1

```
------------+----------------------------------------------------------------
  separated |   24,068    .0143759    .1190372          0           1
   divorced |   24,068     .068722     .252986          0           1
    widowed |   24,068    .0577946    .2333594          0           1
  sleepqual |   24,068    .7590992    .4276391          0           1
   fruitveg |   24,068    4.950972    2.269829          0          39
------------+----------------------------------------------------------------
       mday |   24,068    1.998006    2.419845          0           7
     smokes |   24,068    .1042048    .3055323          0           1
Fourpluspe~k |  24,068    .1353249    .3420774          0           1
TwotoThree~k |  24,068    .2221622    .4157082          0           1
TwotoFourp~h |  24,068    .2082018    .4060303          0           1
------------+----------------------------------------------------------------
Monthlyorl~s |  24,068    .1991025    .3993336          0           1
      urban |   24,068    .7319678    .4429437          0           1
```

Table A7 – Heteroskedasticity and Predicted Value Ranges:

	Linear Probability Model:	Logit Model:	Probit Model:
Breusch-Pagan – Heteroskedasticity	317.21 (0.0000)	N/A	N/A
Predicted Value Ranges	Min -0.2718 Max 0.9756	Min 0.0211 Max 0.9098	Min 0.0103 Max 0.9198
Mean	0.430	0.430	0.429
Standard Deviation	0.187	0.189	0.189
Observations	24,084	24,084	24,084

Note: p-values in parentheses

Table A8 – Classification Tables – Goodness of Fit tests (Probit):

	Logit Model:	Probit Model:
Count-R2 (Correctly classified)	66.54%	66.57%
Baseline Model	57.04% (when classified as 0)	57.04% (when classified as 0)
Difference^^	+9.5% points	+9.53% points
Sensitivity	56.16%	56.19%
Specificity	74.37%	74.40%

Table A9 – Likelihood Ratio Tests:

	Unrestricted sample:	Restricted sample (1):	Restricted sample (2):
Likelihood Ratio test	LR chi2(36) = 3764.93 [0.0000]	LR chi2(4) = 119.25 [0.0000]	LR chi2(3) = 4.21 [0.2393]
Pseudo R2	0.1145	0.1134	0.1144
Log Likelihood	-14,560.945	-14,620.569	-14,563.052

Note: Number of variables in model in parentheses (), p-values in parentheses []

Table A10 – *Full Regression Results* – *Marginal effects:*

	(1) LPM	(2) Logit	(3) Probit
Almostall	0.0443*** (0.0150)	0.0736*** (0.0207) [1.374]a	0.0687*** (0.0198)
Severaldaily	0.0649*** (0.0143)	0.0959*** (0.0200) [1.506]a	0.0907*** (0.0191)
OnceorTwicedaily	0.0582*** (0.0155)	0.0891*** (0.0212) [1.465]a	0.0839*** (0.0203)
Severalweekly	0.0565*** (0.0178)	0.0872*** (0.0239) [1.453]a	0.0804*** (0.0229)
inaMonth	0.0385* (0.0197)	0.0626** (0.0272) [1.312]a	0.0579** (0.0260)
female	0.0158** (0.0062)	0.0167** (0.0071) [1.071]a	0.0165** (0.0070)
degree	0.1206*** (0.0128)	0.1484*** (0.0162) [1.858]a	0.1457*** (0.0157)
highdegree	0.0488*** (0.0137)	0.0712*** (0.0172) [1.358]a	0.0702*** (0.0167)
alevel	0.0413*** (0.0128)	0.0617*** (0.0163) [1.305]a	0.0602*** (0.0158)
gcse	0.0128 (0.0126)	0.0310* (0.0162) [1.146]a	0.0299* (0.0157)
otherqual	0.0126 (0.0144)	0.0283 (0.0187) [1.133]a	0.0274 (0.0181)
lnpersinc	0.0185*** (0.0029)	0.0203*** (0.0032) [1.087]a	0.0197*** (0.0031)
age10to19	0.3971*** (0.0222)	0.4248*** (0.0214) [6.137]a	0.4185*** (0.0216)
age20to29	0.2673*** (0.0144)	0.2912*** (0.0159) [3.389]a	0.2856*** (0.0156)

age30to39	0.2002***	0.2156***	0.2125***
	(0.0139)	(0.0152)	(0.0150)
		[2.497]ᵃ	
age40to49	0.1223***	0.1265***	0.1256***
	(0.0126)	(0.0136)	(0.0135)
		[1.743]ᵃ	
age50to59	0.0810***	0.0801***	0.0798***
	(0.0100)	(0.0112)	(0.0112)
		[1.436]ᵃ	
age60to69	0.0729***	0.0720***	0.0716***
	(0.0100)	(0.0108)	(0.0107)
		[1.387]ᵃ	
mixed	-0.0178	-0.0194	-0.0187
	(0.0218)	(0.0249)	(0.0244)
		[0.923]ᵃ	
asian	-0.0645***	-0.0677***	-0.0672***
	(0.0119)	(0.0134)	(0.0132)
		[0.751]ᵃ	
black	-0.0213	-0.0194	-0.0179
	(0.0181)	(0.0207)	(0.0203)
		[0.923]ᵃ	
other	-0.0722	-0.0737	-0.0709
	(0.0441)	(0.0504)	(0.0493)
		[0.731]ᵃ	
nownchild	0.0113**	0.0135**	0.0132**
	(0.0048)	(0.0054)	(0.0053)
		[1.057]ᵃ	
married	0.0410***	0.0461***	0.0452***
	(0.0097)	(0.0112)	(0.0110)
		[1.211]ᵃ	
separated	-0.0087	-0.0161	-0.0149
	(0.0256)	(0.0301)	(0.0295)
		[0.933]ᵃ	
divorced	-0.0087	-0.0169	-0.0167
	(0.0141)	(0.0170)	(0.0190)
		[0.930]ᵃ	
widowed	0.0234	0.0223	0.0233
	(0.0156)	(0.0198)	(0.0190)
		[1.098]ᵃ	
sleepqual	0.2449***	0.2671***	0.2663***
	(0.0065)	(0.0069)	(0.0069)
		[3.379]ᵃ	
fruitveg	0.0128***	0.0150***	0.01466***

	(0.0013)	(0.0016) [1.064]ᵃ	(0.0015)
mday	0.0191*** (0.0013)	0.0216*** (0.0014) [1.093]ᵃ	0.0211*** (0.0014)
smokes	-0.1009*** (0.0095)	-0.1216*** (0.0109) [0.590]ᵃ	-0.1184*** (0.0108)
Fourplusperweek	0.0842*** (0.0108)	0.0277*** (0.0107) [1.535]ᵃ	0.0272*** (0.0105)
TwotoThreeperweek	0.0989*** (0.0095)	0.0964*** (0.0109) [1.634]ᵃ	0.0949*** (0.0107)
TwotoFourpermonth	0.0806*** (0.0094)	0.1179*** (0.0109) [1.499]ᵃ	0.1157*** (0.0107)
Monthlyorless	0.0185** (0.0092)	0.1024*** (0.0126) [1.127]ᵃ	0.1001*** 0.0123
urban	-0.0185*** (0.0069)	-0.0226*** (0.0079) [0.911]ᵃ	-0.0219*** (0.00774)

Diagnostics

R^2	0.143		
Pseudo R^2		0.114	0.114
Count R^2 (baseline)		66.54 (57.04)	66.57 (57.04)
Heteroskedasticity Test	317.21 (0.000)		
Predicted Values range	Min -0.2718 Max 0.9756	Min 0.0211 Max 0.9098	Min 0.0103 Max 0.9198
N		24,068	

Notes: Coefficients represent marginal effects. Standard errors in parentheses (robust standard errors for LPM).
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Heteroskedasticity F-test based on using all the independent (explanatory) variables, assuming normal error terms. ᵃ Odds ratio.

Is the Paris Agreement working?

Christopher Bebbington

Introduction

Global warming is getting out of control and the future of the world is at jeopardy. To fight this the world teamed up at COP21 in 2015, and the Paris Agreement was born. It represents a landmark global effort of 195 countries to address climate change by committing to reduce greenhouse gas emissions and limit temperature increase to below 1.5°C above pre-industrial levels. There has been criticism of the agreement, but this essay aims to critically evaluate the effectiveness of the Paris Agreement thus far and assess its prospects for achieving its ambitious goals.

The heart of the agreement is based on Nationally Determined Contribution's (NDC) which are where each country outlines their targets for mitigating greenhouse gas emissions and adapting to climate change impacts, as well as defining how they will reach these targets and monitor their progress. For example, the UK's most recent NDC target is to reduce greenhouse gas emissions by 68% by 2030 on 1990 levels [1]. They must update their NDC every five years and each successive NDC is intended to reflect a higher level of ambition than compared to their predecessor through steeper emission cuts and more sizable adaption procedures.

Current Progress
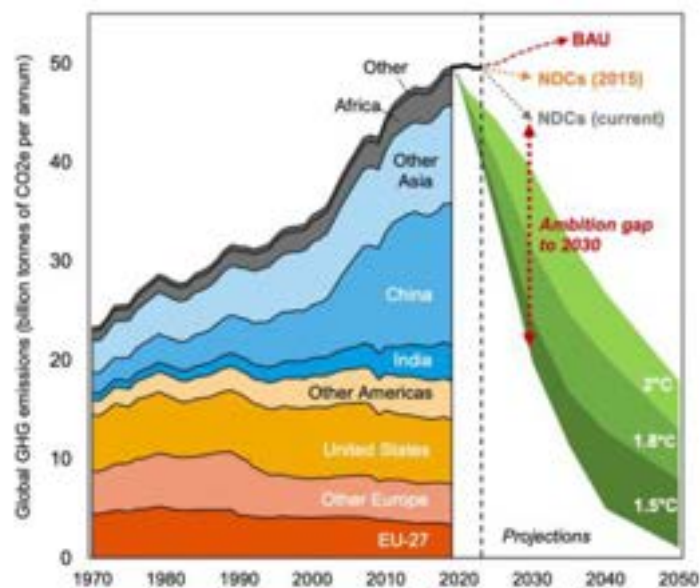
Sources: Intergovernmental Panel on Climate Change 2022; and IMF staff using CPAT. Note: Excludes land use and land use change emissions. BAU = business as usual; GHG = greenhouse gas; CO$_2$e = carbon dioxide equivalent.

Figure 1: IMF, 2023

First, we must analyse the current progress thus far with the Paris Agreement. As shown in figure 1 we can see it is not enough to achieve the 2030 target. Despite countries increasing their ambition towards the reduction of climate change, the current NDCs would reduce global greenhouse emissions by only 11% [2], [3] and [4]. The red business as usual (BAU) line shows the trend for where greenhouse emissions would be without the implementation of the Paris agreement, and the yellow NDC trend line shows where we currently are at. The ambition gap illustrates the distance of where we are from meeting 2030 targets. The figure conveys that although progress has been made, it is not enough to meet the targets.

Unambitious Target Issues
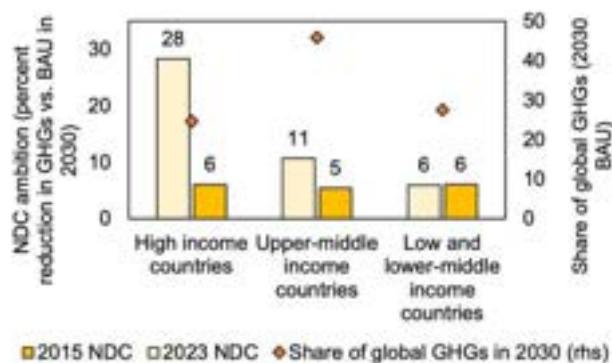
Figure 2: IMF, 2023
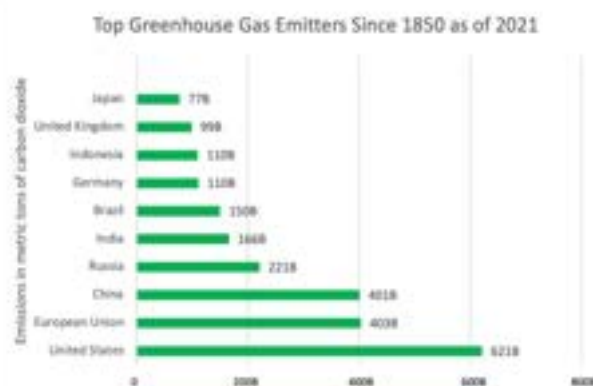
Figure 3: Our World in Data, 2024

The issues lie with developing countries not increasing their NDC's enough. Looking at figure 2, we see that low-income countries NDC's ambition remains the same when comparing 2015 vs 2023. Whereas since 2015 High Income Countries (HICs) have quadrupled their ambition from 6 to 28

percentage points versus the 2030 BAU and Upper-middle income countries (UMICs) have nearly doubled. This aligns with the outline of NDC that each successive NDC aims to have a higher level of ambition, although UMICs should still aim to be more ambitious. Developing countries play a pivotal role in attacking climate change as they account for 69% of the BAU CO2 emission by 2030 [5]. This has been an issue argued since the 1990s over who is more to blame, developed or developing countries. Developing countries have argued that developed countries have cumulatively emitted more emissions than their developing counter parts over time (Figure 3) and that the developed countries should play a stronger role in climate change as they were able to grow their economies without burden.

Developing countries face an opportunity cost whether to invest their money into fighting climate change, where they reap the benefits of doing their part for the world and preventing future damage to the earth but lose out gaining benefits from other investments. Or if they save their money or invest into other projects, they reap the benefits from those but also lose out on the benefits of climate change.

Top Greenhouse Gas Emitters in 2021
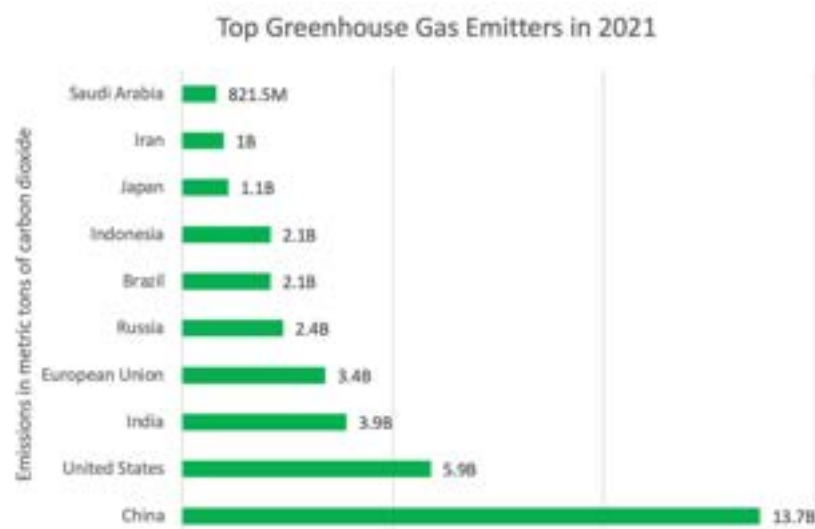
Figure 4: Our World in Data, 2024

Developed countries argue that developing must do more towards climate change as China and India are in the top three countries with the largest amount of greenhouse emissions as shown in figure 4. It is a complex situation to navigate but previous attempts of emissions reductions like the Kyoto Protocol only included developed countries, but it is now recognised that climate change is a shared problem, and all countries must work in unison together.

To solve this issue the Loss and Damage Fund was created at COP27. It aims to limit the difficulty of addressing climate change through financial assistance for poorer countries. Undeveloped countries tend to be those who are most vulnerable to climate disasters and the fund offers various aid from building sea walls to creating drought resistance crop. At COP28 over $700 million was pledged towards the fund [6].

Positive Progress Towards Target

Recently there has been global progress towards cutting methane emissions as they contribute to over 60% of human made global warning due to their high potency and strong ability to capture radiation when compared to CO2 [7]. The largest of methane emissions are from farming and production of fossil fuels. Livestock emissions account for 32% of human caused methane emissions coming predominantly from manure and gastroenteric releases of the livestock the majority from cattle. Paddy rice cultivation contributes to 8% as the flooded fields prevent oxygen entering the soil, providing conditions for methane emitting bacteria to thrive [8]. Oil, gas, and coal mining leak methane either on accident or by design. In operations there can be leaks when equipment fails or mistakes have been made, or sometimes leaks occur on purpose for safety reasons or to protect the machinery.

At COP26 a Global Methane Pledge was introduced which aims to reduce methane levels by 30% from 2020 to 2030. At COP28 oil companies announced they would also cut methane emissions from wells by 30% by 2030, and it included international monitoring to hold the companies accountable [9]. This treaty can reduce global temperature by at least 0.2°C by 2050, preventing 26 million tons of crop loss and 225,000 premature deaths [10]. Farmers can help reduce emissions by feeding livestock healthier and more nutritious food, and paddy farmers should aim to irrigate and drain fields two to three times a season to limit the growth of methane producing bacteria. These are both small but important steps in the right direction towards reaching the targets of the Paris Agreement.

Issues With the Agreement

Game theory helps display the payoffs and losses of your decision, and the decision of another party in particular the prisoner dilemma [11]. In the context of climate change each country has a decision to either invest in costly measures to reduce emissions and mitigate climate change or free ride on the efforts of other countries while avoiding the costs.

The Prisoner's Dilemma is a classic example in game theory where two rational individuals might not cooperate, even if it appears that it is in their best interest to do so. In the dilemma, two prisoners are separately given the option to betray their partner or remain silent. The outcome depends on the choices made by both prisoners. The character of the prisoner's dilemma has often been said to resemble climate change negotiations [12], [13], [14], and [15].

Country A

	Invest	Don't Invest
Invest	(10, 10)	(3, 15)
Don't invest	(15, 3)	(5, 5)

Country B (label on left side)

Table 1: Game Theory Prisoner's Dilemma applied to climate change

If all countries invest in reducing emissions (both prisoners stay silent) then the global community will benefit from the reduced emissions and mitigated climate change impacts. However, if one country decides to free ride (betray) and not invest in climate change while others do, that country may benefit from the actions of others without bearing the cost. If all countries choose to free ride (both prisoners betray), the collective effort to combat climate change is undermined, leading to worsening environmental degradation and negative consequences for all.

In this prisoner's dilemma, the dominant strategy is also the Nash equilibrium which is to betray. This is because the rational choice is for each country to not invest as it offers the highest pay off regardless of the other countries choice. This shows that in the Paris Agreement countries may free ride in order to prioritise short term economic gain over long term environmental benefits, especially if they are concerned other countries won't up their end of the agreement.

Solutions

Nobel prize winning American economist, William Nordhaus wrote a paper in 2015 stating the Paris Agreement was "destined to fail" [16]. His dispute with the agreement was that it "promotes free riding" and the best way to cut global emissions is for all government's globally to negotiate a universal carbon price, and as shown above we can see that his original point may be prevalent. Furthermore, the International Monetary Fund made a proposal in 2021 for the world's largest emitters to pay a floor price of $25-$75 per ton of carbon dependent on their economic level. According to their estimates the floor price would reduce global GDP by 1.5% by 2030 and poorer countries seeing a 0.6% drop, so it has a minor long-term impact but may save trillions over the next 100 years trying to reverse the damage being done now. This proposal is more appropriate than Nordhaus' as rather than having a universal price low-income countries (LICs) have a price of $25 per ton, UMICs have $50, and HICs have a price of $75 [17], therefore there would be less of a need for supplementary payments between countries which have shown to be problematic in the past.

Conclusion

Under the terms of the Paris Agreement, each country pledges its own commitments to control emissions, despite the UN stating the agreement is legally binding the provisions are not binding under international law and countries do not have an obligation to achieve their NDCs. The issue of the non-binding approach is that countries are free to be as ambitious in how they set their commitments. If commitments were fully binding, as they were in previous treaties, notably the Kyoto protocol, then countries will set achievable targets. To resolve this there should be a penalty or punishment in place for countries in order to ensure achievable targets are set and countries are inclined to meet them and not too free ride. In addition, there needs to be additional procedures put in place like carbon pricing to ensure the success of the Paris Agreement.

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Prosperity for all - Reestablish meritocracy

Joel Müller

Wealth inequality has reached historic levels in many Western democracies such as Germany. In the Roman Empire, the largest fortunes were worth around 1.4 million times the average annual income at the time (Scheidel, 2017). In 2023 the wealth of Lidl founder Dieter Schwarz is 1.1 million times the median German annual income (Bornefeld, 2024). In 2023, the lowest 50% of German citizens collectively held only 2.3% of the nation's net wealth, while the wealthiest 10% held 61.2% and the richest 1% held 35% (Bundesministerium für Wirtschaft und Klimaschutz, 2024). While wealth is highly concentrated among a small group of people, the number of people who require help from food banks to feed themselves and their families is rising. In 2022 the German food banks record a 50% increase of people in need (Tafel, 2022).

The unequal allocation of wealth jeopardizes the equality of opportunities, threatens fairness between generations, social cohesion, and political stability. A highly unequal distribution of wealth is the result of a misallocation of resources and can thus be considered as a market failure. One explanation for wealth inequality is inheritance. In Germany half of all inheritances and gifts go to the richest ten per cent of all beneficiaries (Baresel et al., 2021). As a result, inheritances and inter vivo gifts contribute to perpetuating wealth inequality (Palomino et al., 2022). In order to address this issue and the associated problem of a lack of equal opportunities for all citizens, the youth organisation of the German Social Democratic Party called "Jusos" adopted a motion calling for the introduction of a universal capital endowment of €60,000 to be granted to every individual when reaching adulthood. The cost of €45 billion would be financed by a progressive inheritance tax, taxing inheritances above €1 million at 10%, €2 million at 20%, €3 million at 30% up to the maximum rate of 90% from the ninth million.

The following paragraphs will explain why Germany is rich, but many Germans are poor, why the younger generation in particular is suffering from that and whether the Jusos' policy proposal can successfully handle the problem of wealth inequality.

Challenges caused by wealth inequality

A highly unequal distribution of wealth in a society is not desirable for several reasons. First, the cornerstone of our society lies in the belief that hard work yields success; however, the reality about social mobility reveals a stark departure from this ideal. As evidenced by research from Eurofound (2021), parental wealth significantly influences both educational mobility and wealth mobility, undermining the notion of equal opportunity. Wealth helps people to finance their children's education in order to build human capital, which is one fundamental aspect determining future income and therefore future abilities to safe and accumulate wealth. Unequal distribution of wealth therefore has a negative impact on the ability of the unwealthy people to climb the educational ladder. Secondly, unequal distributions of wealth negatively impact economic growth (Islam & McGillivray, 2020). Moreover, the possession of wealth acts as a buffer against unforeseen

economic setbacks and provides individuals and families with financial security to provide basic needs such as food and shelter. Thirdly, because social relationships are built on material foundations, financial insecurity can lead to stress, mistrust, and depression (Wilkinson, 2006). This finding is undermined by happiness survey data showing that a certain amount of wealth can increase an individual's subjective well-being (Hochman & Skopek, 2013). Finally, more wealth is associated with more political influence. The concentration of political power among the wealthy, bolstered by their extensive influence across various spheres including think tanks, media, and political parties, poses a significant threat to democracy, eroding trust in the system and diminishing political stability (Gilens, 2012).

Intergenerational wealth inequality in Germany

In the case of Germany, wealth inequality between generations is particularly pronounced. Older people have generally accumulated more wealth than younger people. As a result of demographic change, wealth tends to be concentrated among older people, because they have had more time to accumulate wealth and are more likely to be in the age bracket where they can benefit from inheritances. Furthermore, rising asset prices can't keep up with income rises, deteriorating the intergenerational inequality. In the years of 2011-2021 net wealth in Germany increased by 73% whereas incomes only increased by 12% in that time span (Eurostat 2021). This means that young people now entering the labour market will find it more difficult than previous generations to buy assets from their after-income savings and are therefore disadvantaged compared to previous generations. Consequently, younger people are more dependent on inherited wealth for their lifetime economic resources. This in turn only benefits the 30% who inherit anything at all (Baresel et al., 2021). The repeated undervaluation of assets such as real estate properties or business values until the late 1990's (Bach 2021) adversely affects younger people until today. Another source of intergenerational wealth inequality associated with rising asset prices is the low homeownership rate, as real estate represents a significant share of people's wealth (Bach, 2021). Germanys homeownership rates among people between 25-34 are particularly low and dropped from 20% in 2010 to 10% in 2019 (Voigtländer et al., 2019). Due to the constant redemption payments, homeowners safe more money and thus build up more assets than comparable tenants. The high amount of equity required to borrow for the purchase of property prevents young generations in particular from becoming homeowners.

Prospects for the future are not promising and won't change the current distribution, as Germany is currently in recession and is unlikely to achieve growth rates that allow for strong income rises. Moreover, high interest rates and rising living costs make asset accumulation more difficult. Simulations of future wealth distributions show that the current situation will deteriorate (Bönke & Bartels, 2023) if no policy intervention takes place.

The proposal and its flaws

The proposal of a universal endowment for people reaching adulthood of € 60000 marks one approach to correct the market failure occurring by the unequal distribution of wealth and tries to reestablish intergenerational fairness and equality of opportunities while stimulating growth and

political stability. The impetus for a policy change is therefore right and necessary. Simulations implementing the underlying policy proposal show that a capital endowment would have a significant impact on the distribution of wealth in Germany over the decade following its implementation (Figure 1). The bottom half of the population would benefit the most and increase their share of total net wealth by 4%, whereas the richest 10% lose about 6% of their total net wealth. Other studies confirm the significant positive effect of a capital endowment on wealth inequality, e.g. on the Gini-Coefficient, as well (Bach, 2021). The policy reform could therefore be a major step towards greater intergenerational equity and greater equality of opportunity.

Figure 1: The wealth simulator – Net wealth change per household with endowment of € 60000
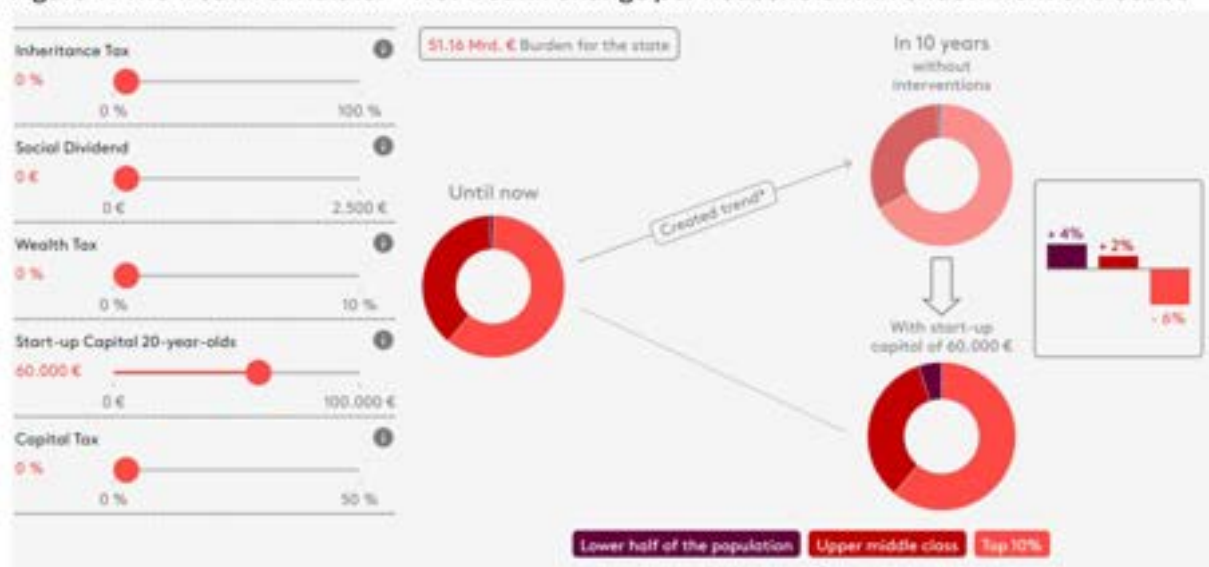
Source: (Bönke & Bartels, 2023)

However, the draft policy lacks detail and is therefore - at this early stage - too vague. In particular, it remains unclear whether the progressive inheritance tax design will be sufficient to finance the high costs of € 51.16 billion. There are several behavioural effects to consider, which can affect the efficiency of the tax. Although inheritance taxes show limited impact on wealthy taxpayers' savings compared to other taxes it remains questionable if this holds for tax rates of 90% from the 9th million. Donors could adapt and reduce their tax burden through tax planning in the form of inter vivo gifts, which threatens horizontal equity. Tax-induced migration, especially of the super-rich, can have an impact on realised tax revenues and therefore has to be considered in the design of the tax. Moreover, inheritance taxes can hinder family business successions based on tax design. At the same time, however, they mitigate the misallocation of capital to less skilled heirs. They provide work incentives for heirs and encourage charitable giving by donors. They also offer administrative advantages over annual wealth taxes. (OECD 2021).

The most important shortcoming of the policy proposal is that it does not take into account several important factors that interact with inheritance tax, such as the behaviour of donors, tax relief for inter vivos gifts and exemptions for the inheritance of business assets. Another flaw of the proposal is that the endowment is not earmarked to specific purposes whereas the calculations presented in Figure 1. are based on the assumption that all the recipients would spend the money for specific

purposes (finance education, acquire property assets, retirement provision). In terms of political feasibility, it may be difficult for politicians to find majorities to support the proposal, given the high price tag of the policy and the fact that the main beneficiaries aren't eligible to vote.

Conclusion

Inherited wealth, unearned through personal effort, is one reason for the perpetuation of wealth inequality, which affects intergenerational fairness, hampers social mobility and equality of opportunities. As wealth in Germany is highly concentrated among a small share of the population whereas a large share of the population goes empty-handed a policy change towards a more equal distribution of wealth is necessary. A capital endowment for people reaching adulthood can decrease wealth inequality significantly and helps to reestablish intergenerational fairness and the ideal of meritocracy. The Jusos' policy proposal addresses these issues, but there are doubts as to whether the financing of the policy through the proposed inheritance tax reform would be sufficient and efficient, and whether the proposal has a chance of being passed by the legislature.

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The Ticking Time Bomb: Italy's Pension Landscape

Edorado Bettella

GOVERNMENT, WELFARE, AND POLICY

As the population ages and the birth rates drop, the pension system suffers, as the outflows exceed the inflows, creating an intricate scenario where pension funds are drained faster than they can be replenished.

Background

The Italian pensions system follows the pay as you go, PAYG, system, meaning that the current payments by individuals and companies towards social security are used to pay current retirees. There is no accumulation of reserves for the future, and this presents a risk, as there must be a balance between inflows and outflows, otherwise pressures rise on the system, where debt needs to be accumulated to account for missing inflows. This system is heavily dependent on demographics, without any capital accumulation there is no guarantee there will be funds available if inflows are not enough. It has been proven that individuals fail to appropriately factor in the uncertainty of the future by heavily discounting the future needs[1], this reflects in the present savings pattern. It has been proven most individuals do not adjust savings appropriately to ensure an adequate pension to cover consumption needs. To counteract this governments often adopt a paternalistic approach. In economics, paternalism is a concept in which the government can force individuals to act in a certain way for their best interest. For example, in Italy, individuals are required to contribute into social security, ensuring that retirees can maintain a certain standard of living once they stop working and prevent pensioners from being left uncovered.

The Backbone of Italian Retirement

The Italian pension system is divided in three main sections:

- Welfare, a minimum income is guaranteed for everyone, supplied independently from contributions.
- Social Security, a certain standard of living is guaranteed based on the contributions made by the individual.
- Insurance, which mitigates any risk that stops individuals from working with financial support.

Within the system there are several types of pensions:

- Seniority pensions for who reached the minimum contributions to retire, or for old age.
- Disability pensions for who lost the ability to work at any point in life.
- Survivor's pensions, given to the family members who do not necessarily need to ever have worked, but will benefit from the late family member's contributions.
- Welfare pensions, for who does not have any form of income or is unable to work.

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Current Scenario

Pensions in Italy are managed by the INPS[2], a government run body that directly pays out pensions using current contributions of workers, with no capital accumulation.

Italy has one of the oldest populations in the world, mainly due to high life expectancy and low and declining birth rates, as shown in the graph.

Average age of the population in Italy from 2010 to 2024

Average age of the population in Italy 2010-2024
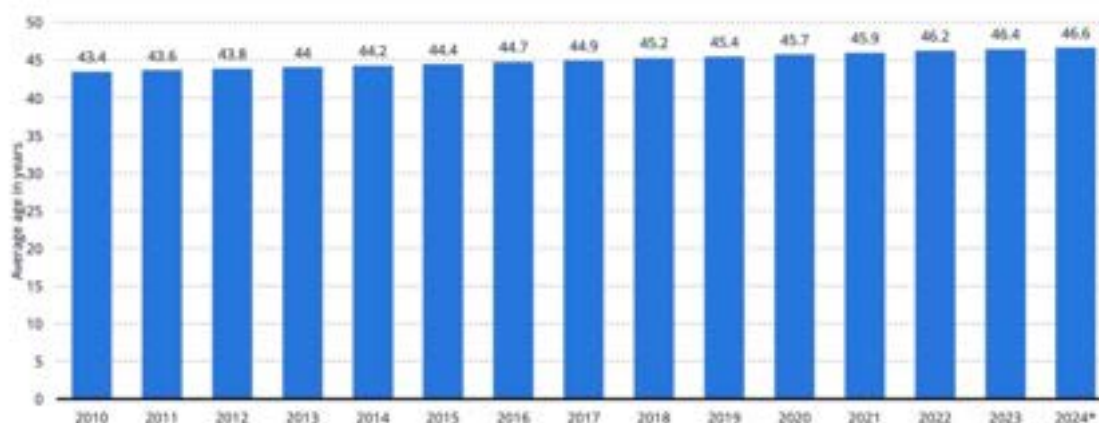
Source: Statista, 2024.

Life expectancy in Italy is amongst the highest in the world, 85 years for women and 80 for men[3]. The latter combined with low birth rates causes the average age of the population to increase overtime, as the graph above shows.

Birth rate in Italy from 2002 to 2023 (per 1,000 inhabitants)

Birth rate in Italy 2002-2023
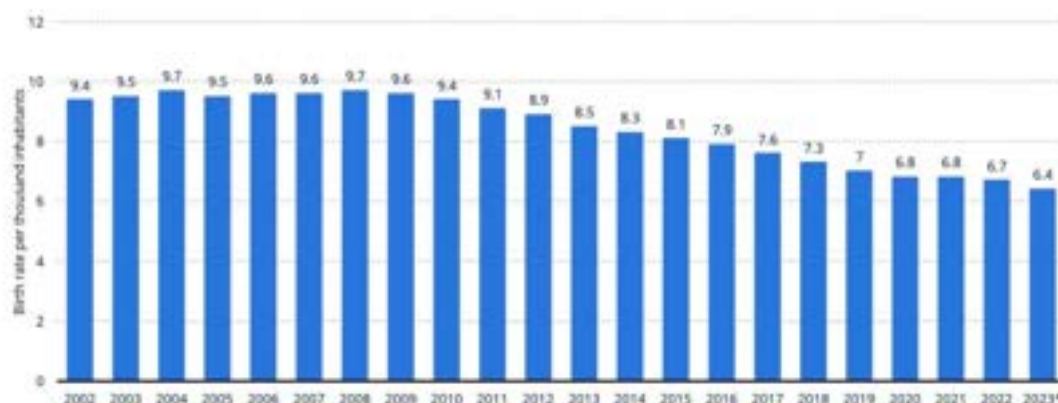
Source: Statista, 2024

This sets a major issue foreseeable in a generation's time, approximately 40 working years, as birth rates decrease, there will be a mismatch between contributors and pension receivers. Workers

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[2] National Institute of Social Security.
[3] Statista, 2024.

from the 1958 cohort[4] will retire on average in 2023, while the members of the 1998 cohort[5] will start working and contributing[6] in that year, as pensions are paid by current workers and capital is not accumulated, there will be more retirees than active workers, meaning INPS will have to run a deficit to fund the uncovered pensions and this debt will directly be borne by the government.

The Economic Background

The economics of pensions in Italy constantly change, minimum age to retire and minimum years of contributions are often revised, but there are other external factors influencing pensions. Tax evasion in Italy is a huge problem, with the equivalent of a third of total public debt evaded in the last 10 years. This affects the contributions to the PAYG system, and the contributors need to cover for the evaders, worsening imbalances. The economic crises experienced in the last 15 years have increased public debt, hindering the possibilities of more debt to be channelled to pensions. This pressures the government to revise the heaviest components of debt, with pensions accounting for 16% of GDP in 2023, €337Bn, in the last 15 years the government has changed the way people can access pensions. A political factor is also present, governments don't want to be unpopular, as the goal is re-election. This plays against the general long-term goal to reduce debt and make the system more sustainable, but raises satisfaction among electors in the short run, and therefore increases the chances for re-election.

The evolution of pensions over the last 30 years

Since the 1990s there have been a number of reforms to the pension system, shifting from computing pensions on the average income of pre-retirement years to one based solely on contributions, crucially reducing the payments. Reforms such as the Amato in 1992 and the Maroni in 2004 pushed up the retirement age and introduced incentives for delaying it. In 2011 the minimum age has been raised to 66 years by the Monti government, this had changed in 2019 with the introduction of Quota 100, allowing retirement for those who contributed 38 years and are 62 of age. It was a temporary measure to release the pressures created by the previously rigid framework developed by a technical government with the aim to reduce public debt to not send Italy into bankruptcy after the 2008 financial crisis. Although Quota 100 has been proven a failure due to increased debt, notably €30 billion, it had an impact on future policy formation, with the aim to make reforms more flexible. Examples of this are Quota 41, where people with 41 years of contributions can retire no matter the age, a new policy in the works includes being able to retire at 63 years old with at least 20 of contributions, with the caveat of lower payments.

Analysis

Pensions are becoming more expensive as time goes by, with more debt being accrued to meet the outflows towards pensions, yearly slight changes in policy are not a long-term solution. The effect of Quota 100 on debt levels has wiped out all the positive effects of the previous reforms. It has arguably enhanced the quality of life of pensioners, but it will decrease the quality of life of

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[4] With around 870,000 newborns, ISTAT, 1961.
[5] Less than 532,000 newborns, ISTAT, 2024.
[6] Il Fatto Quotidiano, 2023.

future taxpayers that have to cover the increased debt. This points out how there have been swings in the policies implemented, which only pivot around two main pillars, minimum age, and contributions. Another downside of the PAYG system is the difficulty of increasing pension to keep up with inflation, due to increased outflows in Italy's case. Pensions are capped as well, so there is a redistribution of wealth, as low-income individuals can still benefit from it, even though low to no contributions have been made. The major current issue of the PAYG system are the complications brought on by the demographic issues. In order to face these growing challenges, the government should start developing policies around a fully funded system.

A way forward

Adapting to a new policy is a way forward. A fully funded system is built around the contributions made by individuals in a government-controlled fund, which will be responsible for their pensions, therefore higher contributors will earn higher pensions. On top of this, the system counteracts the demographic issue, as it will not matter if there are more retirees than workers, as everyone provides for their pension through contributions. This system does not come without downsides. Inequality issues can arise, individuals with extremely high pensions and individuals with extremely low ones or even people not able to have a pension due to a low income in their working lifetime and therefore low contributions. There is also no guarantee, as PAYG systems provide a minimum pension amount, fully funded ones do not. Every policy has pros and cons, but in this case a fully funded system will be more appropriate to face the current challenges. The introduction of government controlled mandatory fully funded accounts, where current contributions can be gradually transferred in fully funded accounts, will hugely benefit debt levels and contributors. It can start off as a voluntary measure with incentives for early adopters.

Conclusion

The Italian pensions landscape is facing significant challenges created by a combination of several issues. An ageing population and low birth rates means the average age of the country will rise and therefore the imbalance between workers and retirees will increase. Tax evasion remains a huge problem, as it has been for the last century, subtracting precious income that could be channelled in the pension system. In the last 15 to 20 years governments lacked long term planning, significantly exacerbating problems, with prioritisation of short term more popular policies in sight of elections. The PAYG system is heavily influenced by demographics in the last decades, increasing debt and pressure on the government finances. Considering a comprehensive shift to another pension system should an option for Italy. Systems such as the fully funded pension systems are least affected by demographics, therefore eliminating the presence of issues the PAYG system presents, and lowering the amounts of future debt the government has to take on to account for reduced contributions due to the imbalance between workforce and retired. This does not come without other downsides, such as the risk of increased inequality, which should be thoroughly considered before implementing a new framework. Overall, a shift in policy for the long term is a must, as the chances of the next generations having a pension are lowering day by day.

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Levelling Up or Down?
UK's Strategy to Eradicate Inequality

Zaafirah Haider

Introduction

In the ever-changing field of economic advancement, countries continuously strive to bridge inequality gaps in society by fostering growth and development and cultivating new opportunities for their citizens. The United Kingdom is one of the most globalised economies in the world, with its multicultural population, free national health care service, and internationally recognised educational institutions [1]. However, only some benefit equally from the UK's success. Deep-seated disparities that permeate various aspects of society, such as pay, employability, education, healthcare, housing, and opportunity still exist today [2].

Following the aftermath of the Covid -19 pandemic, the Brexit referendum, and the energy crisis because of the Russia-Ukraine war, the UK was in recession and inflation was increasing. As a result of these crises and shocks, the UK was severely impacted, making it difficult to reduce inequalities and address social and economic issues [3].

"Levelling up" is a strategy that confronts this unfairness and challenges to reduce it [1]. It's the government's flagship mission to decrease regional inequality and address the fact that "while talent is spread equally across our country, opportunity is not" [4]. This agenda was put forth with the hope to reduce regional disparities for people to have a higher standard of living across the UK.

In this essay we examine the UK's "Levelling Up" strategy, by analysing its objectives and underpinning missions. We mainly focus on objective 1 that deals with four missions: improving pay, employment and boosting productivity, investing in research and development (R&D), and bettering the transport and digital connectivity of areas in the UK that are lagging behind by 2030. Following this we investigate some of the barriers to achieving these targets and some considerations that government needs to consider when designing policies that cater to both the central and local government. Lastly, based on these considerations we make some policy recommendations.

The Policy

In February 2022, the government released "Levelling up the United Kingdom," a white paper that outlined the importance of giving weightage to local governments and rural areas that were falling behind in order to level up the standards of the UK as a whole.

This strategy set out 4 objectives [1]:

1. "Boost productivity, pay, jobs and living standards by growing the private sector, especially in those places where they are lagging."
2. "Spread opportunities and improve public services, especially in those places where they are weakest."
3. "Restore a sense of community, local pride and belonging, especially in those places where they have been lost."
4. "Empower local leaders and communities, especially in those places lacking local agency."

Our focus is on objective 1 which is hoped to be achieved through the following four missions [5] [1]:

- By 2030, **living standards (pay, employment and productivity)** should rise throughout the UK. Each area should have a globally competitive city. The gap between top performing and low performing areas should be bridged.
- By 2030, domestic investment in **research & development** outside of the Greater Southeast (GSE) area of the UK should increase by 40% and over the spending review period by 1/3. This would leverage at least twice as much investment from the private sector to promote productivity growth and innovation in the long run.
- By 2030, **transport infrastructure** should improve with local public transport connectivity standards being closer to London's, alongside having better quality of services, simpler fares, and an integrated ticketing system.
- By 2030, digital **connectivity** will improve with nationwide gigabit-capable broadband and 4G coverage, and 5G coverage for most of the population.

Limitations

Levelling up identifies the fact that solving regional disparities in the UK is a complex problem and there isn't one way of solving it [1]. That's why the policy itself is so vast. The sheer number of

policies demonstrates that the government aware of the fact that for levelling up to be successful, the policy needs to be cross-sectoral [6]. However, some of the missions are ill-defined and lack clarity [4].

The mission on **living standards** sets the goal for every region of the UK to have a "globally competitive city" (GCC) by 2030. While the technical annex sets out 3 metrics to measure living standards : GVA per hour (gross value added, estimated by the volume of good and services produced by an industry in the UK per hour), median weekly pay and employment rates for 16 – 64-year-olds, it doesn't set out a clear framework for the definition of it [7]. Also, how they intend on achieving this is every region of the UK is not mentioned either.

We consider the definition of a GCC as that stated by the Centre for Cities since it encapsulates the essence of the levelling up strategy. According to it, for a city to be globally competitive, it needs to have more than 959,000 people and GDP per worker to be higher than $95,000. Based on this the UK lacks in GCCs and currently has only 1: London [8]. Hence to meet the targets of this mission, the government needs to first establish the number of cities that have the potential to compete globally and secondly be aware of the risks of having unreasonably high goals with limited amount of time and money.

The targets for **productivity and pay** are least driven as they are bound to reach regardless of any intervention. If the goal is set in nominal terms (which is unclear), then nominal output per hour worked has increased across all industries since 2004 and this trend is likely to continue unless there are any unusual economic occurrences [4].

Lastly, having **transport connectivity** standards in all regions of the UK the same as London's is easier said than done. The technical annex [7] of the white paper states that some cities can't replicate London. Instead, they are compared to similar sized European cities to achieve this goal. Therefore, it is more difficult for the government at the local level and stakeholders to appropriately invest their time, allocate resources and track progress without having a clear picture of what success would look like in terms of improved public transport [4].

Policy recommendations:

The levelling Up strategy emphasizes on the **devolution** of government – a process by which power and resources are transferred from the national to the local level. This encourages better policy making by prioritising community empowerment, increasing accountability, and catering to the specific interests of the local authorities [9]. But devolution is quite difficult as UK is one of the most centralised economies in the world according to the OECD [6]. So, levelling up has turned into another centrally designed programme which is partly delivered by the local government. Hence more emphasis should be given to the 12th mission focussing on "empowering local leaders and communities, especially in those places lacking local agency" and make it the central theme for the agenda.

The levelling Up strategy has a complicated money distribution system. It requires the centre to make agreements with nearby communities and to fund projects through competitive bidding. Those in local government detest this strategy since it is inefficient. Inequality may worsen because the locations most suited to bid and strike deals aren't always the ones that require levelling up. Rather, funds ought to be distributed using a reliable funding model that gives priority to areas that most need them [9].

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Norfolk Shoreline Management Plan (SMP) - Infographic

By: Luana Graça, Zaafirah Haider, Gabrielle Sebastian, Mo Abiodun,
Jennifer Kwenda, Toni Egbulefu

GOVERNMENT, WELFARE, AND POLICY

Norfolk Shoreline Management Plan (SMP)

UEA University of East Anglia

Introduction

The Norfolk shoreline is eroding due to:

- Geology of cliffs:
  - silts
  - sand
  - clays
- Rising sea levels due to global warming
- Sinking lands since the Ice Age

⚠ No action means 1,030 properties in north Norfolk could be lost to erosion by 2105

⚠ The tourism industry is estimated to incur a £16.5m loss over the next 20 years; this sector accounts for 37% of the area's employment

⚠ Beach levels are reducing, in turn, exposing coasts to increased erosion

What are SMPs?

Set of shared strategic approaches to manage the coastlines from coastal flooding and erosion risks

Aim: reduce the risks to people, properties and monuments, and the natural environment

Costs £

- Visually displeasing coastal defences may affect tourism
- Building and maintaining defences have labour and material costs
- Lack of defence resources causes allocation problems leading to certain coastlines being disadvantaged

Benefits

- Protecting properties and lives from the risk of damage
- Safeguarding local businesses and promoting tourism
- Fostering biodiversity by creating rich habitats for wildlife

Efficiency

- **Macro-efficiency:** while the Council receives grants, funding is limited and competitive
- **Micro-efficiency:** more funding is allocated to urban coastal societies who better justify the benefits recieved from more funding

Equity

- **Poverty relief:** erosion prone communities are protected from losing their houses and livelihoods
- **Promotes vertical equity:** prioritises protecting locations prone to the most risk

What to do in the future?

- Increase funding to maintain existing sea defences in north Norfolk
- Collaborate with stakeholders at different levels to mitigate flood risk areas
- Regularly monitor the shoreline to adapt SMPs based on the latest data and scientific insights
- Include flexible management approaches such as "Hold the Line" that allow for tailored responses to specific coastal sections

Conclusion

CAUTION

SMPs aim to mitigate the adverse effects of coastal erosion by implementing management strategies. The efficiency of SMPs is challenged by budget constraints and evolving environmental conditions. Equity considerations involve protecting vulnerable coastal communities. Thus, increasing funding, collaborative initiative, and adapting management strategies will ensure the effectiveness of SMPs in protecting Norfolk's coastline and livelihoods.

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May 2024

The Beautiful Game's Buzz

Is Viewership Propelled by Close Competition or the Fear of Losing? A Comparative Analysis across the English Premier League and German Bundesliga for the 2022/23 season

Anmol Singh

Introduction

A frequently discussed topic of this research area is the correlation between the level of certainty regarding the outcome of a match/fixture and how spectator demand varies. The inquiry arises: do spectators exhibit a preference for a closely contested fixtures, where both teams are evenly matched? Alternatively, is there a preference for a more predictable outcome, where one team holds a significantly higher chance of success?

Rottenberg (1956) and Neale (1964) proposed the uncertainty of outcome hypothesis (UOH), suggesting that attendance tends to be higher when there is greater uncertainty about the match outcome, leading to a convex relationship between matchday attendance and home win probability. Loss aversion, supported by empirical evidence (Humphreys & Zhou, 2015), posits that attendance is elevated when the match outcome is nearly certain, as seen in contests between high and low-quality teams. This suggests a convex relationship between matchday attendance and home win probability.

Numerous studies have explored the correlation between match attendance and diverse indicators of match outcome, spanning various sports leagues like Major League Baseball (Coates et al., 2012), English football leagues (Peel & Thomas, 1992), and international cricket (Sacheti, Gregory-Smith & Paton, 2014). While Peel & Thomas find evidence of loss aversion in English football, Coates et al. argue for loss aversion dominance due to mixed empirical support for UOH, highlighting higher attendance in fixtures with greater outcome certainty. The study on international cricket indicates a UOH presence, revealing a correlation between short-term attendance and fixtures with increased uncertainty.

Studying matchday attendance is an important research area, with numerous studies aiming to identify its true determinants. Comprehending spectator behaviour and attendance is crucial for sports governing bodies and teams, as it impacts fan engagement, league competitiveness, economic outcomes, revenue generation, and overall decision-making. By uncovering the factors influencing matchday attendance, sports organisations can optimise profits and enhance their overall dominance.

This study comparatively analyses spectator behaviour in the German Bundesliga and the English Premier League (EPL). The EPL stands as one of the world's premier football leagues, boasting immense popularity and widespread global viewership, with cumulative audiences reaching 3.25bn during the 2018/19 season. Moreover, the EPL's extensive reach extends to 188 out of 193 countries. As of 2024, the EPL holds a market value exceeding £9bn, surpassing that of any other football league globally (Transfermarkt, 2024).

The German Bundesliga, established in 1963 by merging regional leagues, emerged as Germany's premier football division. Despite having a lower market value of £3.8bn compared to the EPL, the Bundesliga is globally recognised as one of the top football leagues. Its rich history, passionate fan culture, and distinctive 50+1 ownership model contribute to its unique appeal. The 50+1 rule mandates that clubs must own at least 50% plus one additional share in the football, granting clubs and their fans unparalleled decision-making authority without external influences or investor control. This ownership model sets the Bundesliga apart and allows for a distinctive comparison with leagues where fan involvement may be less pronounced, such as the EPL.

Methodology

This study examines how home probability influences attendance, investigating whether attendance peaks with uncertain fixture outcomes or when there is relative certainty.

Attendance figures for the 2022-2023 football season in the English Premier League (EPL) and German Bundesliga were collected from FBref.com (2024). Win probabilities for the home team were derived from Bet365 betting odds, sourced from Football-data.co.uk (2024). It's crucial to note that Bet365 odds include a profit margin, resulting in a variance between actual win probabilities and those constructed. However, given the uniform source of betting odds, we assume consistent differences across fixtures, ensuring accurate inferences, albeit with slight magnitude discrepancies.

The EPL featured 379 fixtures in the season, while the Bundesliga had slightly fewer (306) due to variations in the number of competing teams in both top-flight divisions. This particular season was selected as it is the most recent complete season, offering up-to-date insights into spectator behaviour in football.

Model - Base

$$LogAttendance = \alpha + \beta_1 Hprob_i + \beta_2 Hprob_i^2 + u_i$$

The base model in this study considers match attendance as the dependent variable, presented in logarithmic form to mitigate outlier impact. It incorporates $Hprob_i$ as the probability of the home team winning, along with $Hprob_i^2$, acknowledging the quadratic relationship between $Hprob_i$ and Attendance, as suggested by literature (Forrest & Simmons, 2002).

This model is applied in both leagues. As mentioned earlier, the computation relies on Bet365 betting odds, entailing the reciprocal of the home team's win odds divided by the sum of the reciprocals of the win, draw, and loss odds for the home team:

$$Hprob_i = \frac{(Win_i\ Odds\ for\ Home\ Team\ )^{-1}}{(Win_i + \ Draw_i + Loss_i\ Odds\ for\ Home\ Team)^{-1}}$$

Constructing the $Hprob_i$ variable in this way acknowledges bookmaker overround and ensures the probabilities equal one. Additionally, it facilitates the consideration of relative quality, allowing for the evaluation of differences in quality and form between the two teams in a specific fixture concerning attendance.

Model – Control

$LogAttendance_{EPL}$
$$= \alpha + \beta_1 Hprob_i + \beta_2 Hprob_i^2 + \beta_3 Distance_i + \beta_4 Weekend_i + \beta_6 Distance50_i$$
$$+ \beta_7 Evening_i + B_8 Top6_i + \beta_9 BigGame_i + \beta_{10} TMV4_i + \beta_{11} Top6vsTop6_i + u_i$$

$LogAttendance_{Bundesliga}$
$$= \alpha + \beta_1 Hprob_i + \beta_2 Hprob_i^2 + \beta_3 Distance_i + \beta_4 Weekend_i + \beta_6 Distance50_i$$
$$+ \beta_7 Evening_i + B_8 Top4_i + \beta_9 BigGame_i + \beta_{10} TMV4_i + \beta_{11} Top4vsTop4_i + u_i$$

These models use control variables to address confounding effects and isolate the specific impact of home win probability from other determinants.

Distance & Distance50

The Distance variable represents the distance (km) between the home and away team's stadiums (Footballteamnews.com, 2024). It serves to quantify potential challenges for supporters attending away fixtures, including factors like ticket prices, travel duration, and ticket availability and considers the spectator's opportunity cost of time (Peel & Thomas, 1992). Literature suggests that increased travel expenses may decrease stadium attendance (Forest, Simmons & Szymanski, 2004). Distance50, a dummy variable, equals one if the distance between teams is less than 50km and zero otherwise.

Weekend

This indicates whether a fixture occurs on a weekend (coded as one) or not (coded as zero). Higher attendance during weekends is expected due to the common weekday working hours of most spectators, allowing for weekend travel (Allan, 2004). In the 2022-23 season, 76% of EPL's 380

fixtures were on weekends, while the Bundesliga had 84% of its 306 fixtures on weekends. Contrary to expectations, average attendance on weekends versus weekdays showed marginal differences. Weekend attendance was 6% lower in the Bundesliga and 1% lower in the EPL. This might be attributed to high demand for live spectatorship, near-maximum attendance for most games due to stadium capacity constraints, and the practicality of attending weekday evening games for individuals with regular work schedules and reasonable proximity. For both divisions, the influence of the day of the week on lower league games could be more significant due to quality disparities leading to varying demand for live viewership.

Evening

Evening is a binary variable, taking the value of one for fixtures after 17:30 and zero otherwise. It also acknowledges spectator availability and the potential opportunity cost of attending an evening fixture. Many studies examining both live attendance and TV viewership have utilised a binary indicator for the game's time (Besters, van Ours & van Tuijil, 2019; Baimbridge, Cameron & Dawson, 1996).

TopX & TopXvsTopX

The TopX variable indicates the presence of a "big" team in a fixture. In the EPL, it assigns a value of 1 if the fixture involves any team finishing in the top six positions (Man City, Arsenal, Man United, Newcastle, Liverpool & Brighton). For the Bundesliga, teams finishing in the top four positions (Bayern Munich, Dortmund, RB Leipzig & Union Berlin) are considered, due to differing competitiveness. This allows for the assessment of absolute quality. TopXvTopX is a similar variable but applies when both teams in the fixture are among the top four/six.

BigGame

This signifies fixtures with heightened anticipation, driven by factors like historical and geographical rivalries. Its inclusion accommodates high-attendance one-off games. EPL "Big Games" encompass Liverpool vs Everton, Arsenal vs Tottenham, Manchester United vs Manchester City, Liverpool vs Manchester City, Liverpool vs Manchester United (ESPN, 2018). Included fixtures for Bundesliga are Borussia Dortmund vs Schalke, Bayern Munich vs Borussia Dortmund, and Cologne vs Borussia Monchengladbach (Bundesliga, 2023). "Big games" return a value of one, with others being zero.

TMV4

This is a dummy variable using Transfermarkt valuations of each club at the start of the 2022-23 season. If the fixture involves the four highest-valued teams in the Bundesliga/EPL, the value is one; otherwise, it is zero.
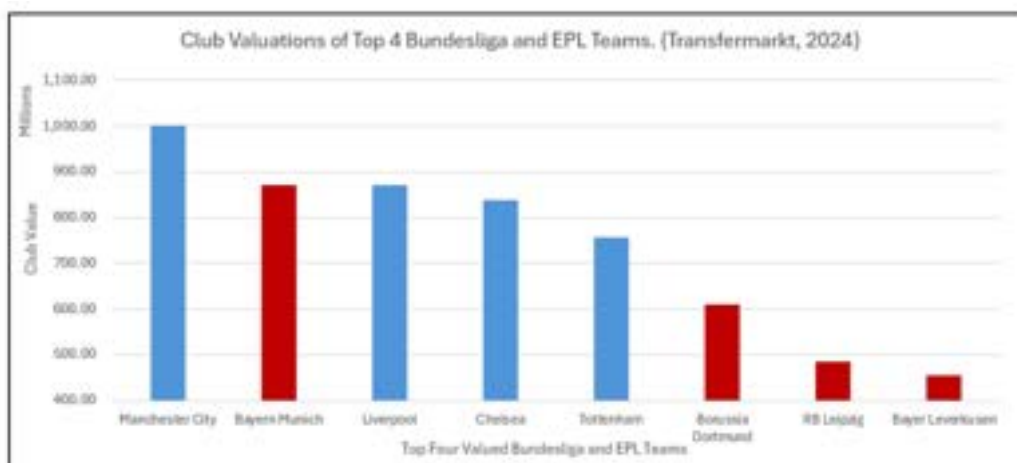
Figure 1: Clubs Valuations of Top 4 Bundesliga & EPL Teams (Transfermarkt, 2024).
Note: Red teams are from Bundesliga and Blue teams are from EPL

Considering club values accounts for market power in attracting top players and differences in facilities and opportunities. Clubs with higher values are likely to attract better players, as club value is generally positively correlated with performance (Pereira, 2018). While rare cases exist where underdog teams succeed, the prevailing trend is that those with greater resources perform significantly better than others. The EPL holds a considerably higher value (£9.33bn) than the Bundesliga (£3.7bn). Figure 1 shows that only Bayern Munich's value can be compared to the top four EPL teams. The fourth EPL team is worth approximately 1.5 times more than the fourth Bundesliga team. This has causal effects on performance and consequently, the demand for live stadium spectatorship.

All estimations will use the OLS estimator with robust standard errors to account for heteroscedasticity. This minimises bias in standard errors, ensuring efficient estimates and valid inferences.

Findings

Initial analysis included variables like *Top6H* & *Top6A*, dummy indicators for the presence of a top-six team as the home or away team. Additionally, *LastHomeAttendance* was considered to capture inertia/momentum effects on attendance based on team form. *Top6H* & *Top6A* variables were omitted, using *Top6* instead to avoid a dummy variable trap and perfect multicollinearity. While *LastHomeAttendance* was highly significant, it substantially reduced significance for other variables, particularly $HomeProb_i$. Appendix A presents estimations with and without *LastHomeAttendance* for the EPL.

Summary Statistics

Table 1 - Descriptive Statistics for variables (EPL 2022/23)

Variable	Obs	Mean	Std. Dev.	Min	Max
LogAttendance	379	10.505	.47	9.208	11.232
HomeProb	380	.437	.191	.079	.894
HomeProb^2	380	.228	.179	.006	.8
Distancekm	380	189.892	113.783	3	474
Weekend	380	.742	.438	0	1
Distance50	380	.153	.36	0	1
Evening	380	.329	.47	0	1
Top6	380	.521	.5	0	1
BigGame	380	.026	.16	0	1
TMV4	380	.195	.397	0	1
Top6vTop6	380	.079	.27	0	1

Source: (Football-data.co.uk, 2024; Transfermarkt, 2024)

All variables, except attendance, have 380 observations, corresponding to the fixtures in the 2022/23 EPL season. This is because attendance data for Brentford vs Manchester City was not available. The average attendance is 36,316, with a maximum of 75,508. The average home win probability is 47.3%, while the maximum is 89.4%, almost doubling the average. This maximum value is from the Manchester City vs Bournemouth fixture, as expected, as Manchester City were EPL champions, and Bournemouth were relegated.

Table 2 - Descriptive Statistics for Variables (Bundesliga 2022/23)

Variable	Obs	Mean	Std. Dev.	Min	Max
LogAttendance	306	10.589	.404	9.741	11.307
HomeProb	306	.448	.17	.056	.855
HomeProb^2	306	.229	.163	.003	.731
Distancekm	306	376.739	186.564	14	804
Weekend	306	.84	.367	0	1
Distance50	306	.039	.194	0	1
Evening	306	.297	.458	0	1
Top4	306	.405	.492	0	1
BigGame	306	.02	.139	0	1
TMV4	306	.314	.465	0	1
Top4vTop4	306	.039	.194	0	1

Source: (Football-data.co.uk, 2024; Transfermarkt, 2024)

In Table 2, mean average attendance is similar, with the Bundesliga having 3,198 more attendance per fixture. Maximum match attendance is very similar, while minimum match attendance is higher in the Bundesliga by 7,024. Average home win probability also rises compared to the EPL, albeit

marginally (-1.1%). The maximum home win probability is lower than the EPL probability by about 4%, suggesting similar relative competition between the two leagues.

In the Bundesliga, the distance between two teams for a given fixture is nearly double the EPL's average distance. This is anticipated due to Germany's larger size than England, with implications mentioned when introducing the variable.

English Premier League

Table 3 – Regression Results For EPL		
Y = LogAttedance	Base (Without Controls)	Including Controls
HomeProb	0.515	2.420***
	(0.492)	(0.627)
HomeProb^2	0.715	-1.398**
	(0.480)	(0.643)

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3 presents estimations for the EPL, both with and without controlling variables (Appendix B). The Base coefficients indicate a more linear relationship between attendance and the home probability of a win, with both *HomeProb* & *HomeProb^2* coefficients being positive. The *HomeProb* coefficient suggests that a unit increase in *HomeProb* results in an average attendance increase of 51.5 (52), ceteris paribus.
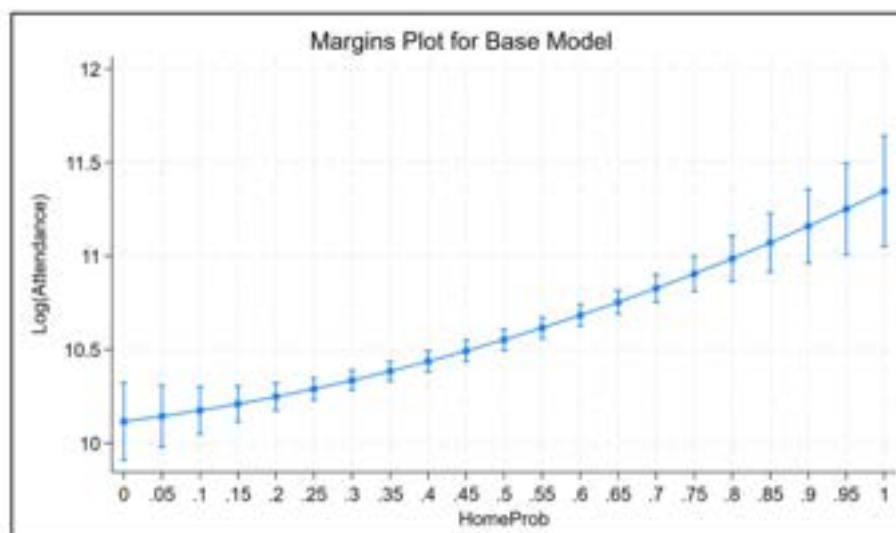
Figure 2: EPL Margins Plot for Base Model with Log(Attendance) vs (HomeProb). Linear Prediction with adjusted predictions with 95% confidence levels

Considering the turning point of -0.36 and the *HomeProb^2* coefficient being greater than *HomeProb*, attendance increases at a faster rate after the turning point as *HomeProb* approaches one. Graphically plotting this (Figure 2) aligns with the above inferences. However, it's crucial to

note that both coefficients in the base estimation lack significance at an acceptable level, potentially compromising the validity of the inferences.

With controlling variables, *HomeProb* remains positive and highly significant (1%), while *HomeProb*^{2} becomes negative and significant at the 5% level. This implies that attendance is maximised at the turning point of 0.86, decreasing afterward. The *HomeProb* coefficient indicates that a unit increase in *HomeProb* results in an average attendance increase of 242.
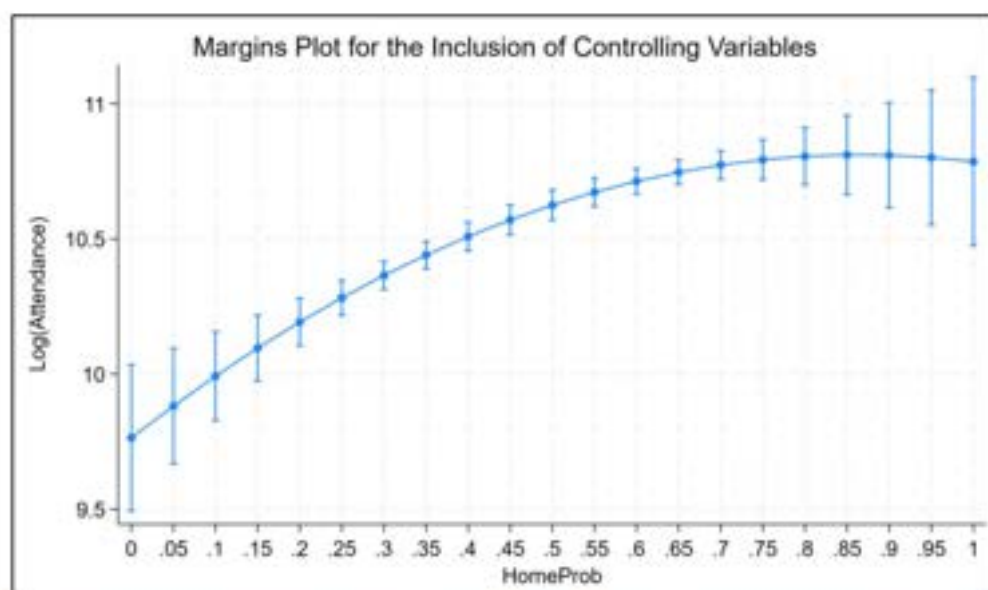
Figure 3: EPL Margins Plot for Model including controls, with Log(Attendance) vs (HomeProb). Linear Prediction with adjusted predictions with 95% confidence levels

Figure 3, with additional factors controlled for, suggests that EPL spectators may align more closely with the UOH than loss aversion. Attendance is lower before and after the turning point, implying a preference for uncertain outcomes over certainty. The relatively high turning point at 86% suggests EPL fans prefer some indication of the outcome but not almost certainty. This finding contradicts general literature, where regression results often show alternate signs, with both *HomeProb* and *HomeProb*^{2} being negative. The literature typically associates football fans attending fixtures with characteristics linked to loss aversion (Besters, van Ours & van Tuijil, 2019: Buraimo & Simmons, 2008).

Bundesliga

Table 4 – Regression Results For Bundesliga

Y = LogAttedance	Base (Without Controls)	Including Controls
HomeProb	-1.527***	-1.401**
	(0.498)	(0.638)
HomeProb^2	2.554***	2.411***
	(0.482)	(0.652)

Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 presents regression estimations for *HomeProb* and *HomeProb^2* with and without additional explanatory variables. All variables are highly significant at the 1% level, except *HomeProb* in the model with explanatory variables, which is significant at a 5% level. This provides confidence in the inferences. Unlike the EPL results, controlling for additional explanatory variables has a negligible impact on the coefficients, suggesting that coefficients are slightly inflated when not considering effects caused by other variables. This suggests that *HomeProb* exerts a stronger influence on matchday attendance in the Bundesliga compared to the EPL. The direction of the coefficient also differs from the EPL, as with and without the inclusion of controls, there are negative *HomeProb* and positive *HomeProb^2* coefficients. Recall that for the EPL, the coefficients for *HomeProb* were positive and *HomeProb^2* was negative.
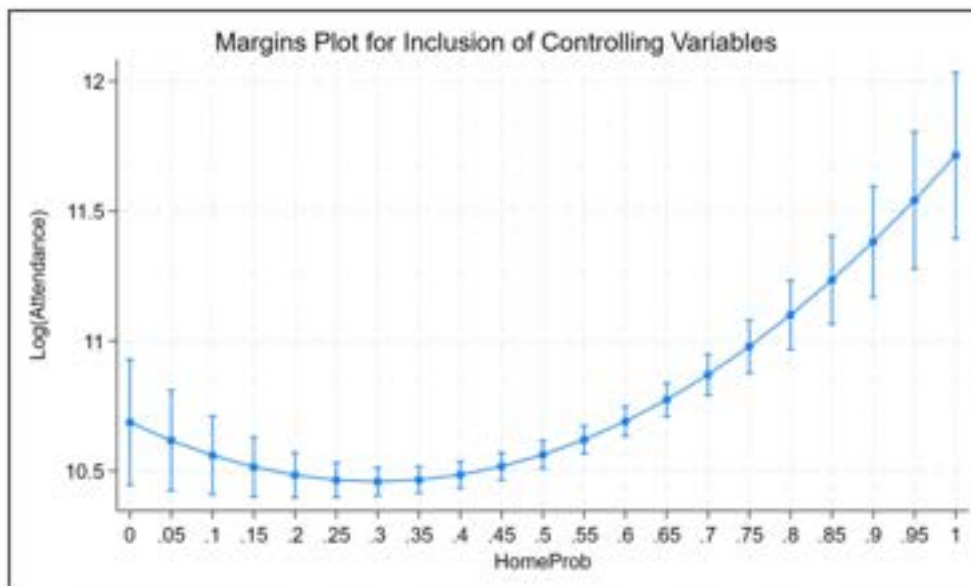

Figure 4: Bundesliga Margins Plot for Model including controls, with Log(Attendance) vs (HomeProb). Linear Prediction with adjusted predictions with 95% confidence levels

Given the immaterial differences in coefficients across the two models, the margins plot will also exhibit negligible variations. Therefore, this study will discuss the plot when including controls, and the margins plot for the estimations without controls is included in Appendix D. Figure 4 illustrates

the quadratic relationship between *HomeProb* and Attendance. Unlike the EPL, this suggests a different hypothesis where attendance decreases until the turning point of 0.29 (*HomeProb* = 29%) and increases after this point. This aligns with loss aversion behaviour, indicating that matchday attendance is highest when the outcome is certain, such as when the probability significantly favours the home or away team. This implies a difference in spectator behaviour for matchday attendance between the EPL and Bundesliga, consistent with general findings in literature across similar leagues (Buraimo & Simmons, 2008: Czarnitzki & Stadtamann, 2002: Martins & Cró, 2018).

Control Variables

Appendix E contains control variable estimates for comparative purposes.

Evening

Evening is highly significant in the Bundesliga but not in the EPL, indicating that the time of the game is a more impactful factor for attendance in the Bundesliga. The coefficient suggests a 24.63% higher attendance for evening games compared to those before 17:30 when controlling for other variables. Cox's (2018) paper noted that fixtures on bank holidays and evenings outside traditional working hours have higher attendance, aligning with the findings from the Evening variable.

Top6/Top4

As mentioned earlier, the variable differs between leagues due to competitiveness variations. Top6 is highly significant (1%) in the EPL, while its Bundesliga counterpart is not statistically significant. Similar to Evening, the Top6 coefficient indicates that EPL fixtures with a Top 6 team have 35.65% higher attendance than those without a Top 6 team, holding other variables constant. This may be largely attributed to a positive correlation between stadium size for top six teams and higher attendance on average. The lack of significance for Top4 in the Bundesliga could be due to the dominance of Bayern Munich, which has a greater market value than the sum of the remaining three teams (Transfermarkt, 2024). Consequently, Top4 may not strongly influence attendance as only Bayern Munich stands out in terms of quality, while the other three teams may be closer in quality and finances to teams outside the top four.

BigGame

BigGame differs with league due to rivalry variations. In the EPL, the coefficient is marginally significant at 10%, indicating that "big games" have 24.63% higher attendance than non-big games. In the Bundesliga, the coefficient is highly significant at 1%, implying a 40.35% attendance increase for "big games." The comparison suggests a greater impact on attendance in the Bundesliga. The lack of significance for the EPL coefficient may compromise the accuracy of inferences. Additionally, the EPL variable includes five fixtures compared to three for the Bundesliga, potentially affecting inferences due to relatively low number of observations for "big games".

Conclusion

The comparative analysis of matchday spectator behaviour in the EPL and the Bundesliga reveals distinct patterns. EPL estimations notably differ with the inclusion of control variables, while the Bundesliga experiences little to no change. This suggests that *HomeProb* has a more significant impact on Bundesliga matchday attendance compared to the EPL, where other variables play a more influential role.

Additionally, the EPL indicated that its matchday spectators exhibited behaviours akin to UOH. The evidence suggests that uncertainty in fixture results led to higher attendance, with diminishing returns on attendance for changes in *HomeProb*. While not conclusively UOH, as the turning point was very high (*HomeProb* = 0.865), attendance decreased with changes in either direction from this point (Figure 3). This finding contradicts the typical correlation between matchday attendance and win probabilities. The Bundesliga showed contrasting results, with matchday spectator behaviour resembling loss aversion. Attendance was higher with *HomeProb* associated with greater certainty in fixtures, favouring the home team slightly (Figure 4). In this case, attendance increased on either side of the turning point (*HomeProb* = 0.2904), unlike the EPL where it decreased. This finding aligns with the general consensus in the literature.

Based on the findings, EPL matchday attendance is influenced by spectator behaviour partially resembling UOH, while the Bundesliga exhibits a different pattern, suggesting that loss aversion is a more suitable explanation for attendance.

However, this study has limitations that raise questions about the validity of the inferences. It solely focused on league fixtures, neglecting considerations for competitions beyond the traditional league, such as international and domestic club tournaments. This narrow scope may provide an incomplete picture of attendance determinants and spectator behaviour. Additionally, the study did not account for TV viewership alongside matchday attendance, potentially leaving a significant aspect of spectator behaviour unexplored, as literature suggests UOH is more prevalent in TV viewership (Schreyer, Torgler & Schmidt, 2018: Buraimo & Simmons, 2009). Watching a live fixture on TV serves as a substitute for attending in person, and excluding this factor might limit the comprehensiveness of the conclusions. Furthermore, the study's focus on matchday attendance alone may not fully capture the true demand for live football experiences, especially considering stadium capacity constraints. This lack of variation in attendance figures relative to stadium capacity could pose challenges in assessing the genuine determinants of attendance (Czarnitzki & Stadtmann, 2002).

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Appendix A: EPL Estimations with and without LastHomeAttendance variable

English Premier League Regression Results (Robust Standard Errors)

Y = log(Attendance)	Controls		With LHA	
HomeProb	2.420***	(0.627)	0.369	(0.227)
HomeProb^2	-1.398**	(0.643)	-0.411*	(0.234)
Distancekm	-0.000311	(0.000227)	-0.000162*	(0.0000890)
Weekend	0.0129	(0.0677)	-0.00971	(0.0243)
Distance50	-0.0109	(0.0745)	-0.0404*	(0.0237)
Evening	0.00417	(0.0664)	-0.00427	(0.0240)
Top6	0.304***	(0.0492)	0.00300	(0.0168)
BigGame	0.211*	(0.116)	-0.0498	(0.0351)
TMV4	0.0606	(0.0637)	0.0573**	(0.0234)
Top6vTop6	0.166**	(0.0648)	-0.0308	(0.0231)
LastHomeAttendance			0.0000276***	(0.000000762)
Constant	9.626***	(0.160)	9.362***	(0.0637)
R^2	0.360		0.915	
N	379		359	

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix B: Full Regression Results for EPL, with and without controlling variables.

Y = LogAttedance	Base (Without Controls)	Including Controls
HomeProb	0.515	2.420***
	(0.492)	(0.627)
HomeProb^2	0.715	-1.398**
	(0.480)	(0.643)
Distancekm		-0.000311
		(0.000227)
Weekend		0.0129
		(0.0677)
Distance50		-0.0109
		(0.0745)
Evening		0.00417
		(0.0664)
Top6		0.304***
		(0.0492)
BigGame		0.211*
		(0.116)
TMV4		0.0606
		(0.0637)
Top6vTop6		0.166**
		(0.0648)
Constant	10.12***	9.626***
	(0.114)	(0.160)
R^2	0.230	0.360
N	379	379

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix C: Full Regression Results for Bundesliga, with and without controlling variables

Y = LogAttedance	Base (Without Controls)	Including Controls
HomeProb	-1.527***	-1.401**
	(0.498)	(0.638)
HomeProb^2	2.554***	2.411***
	(0.482)	(0.652)
Distancekm		-0.000199*
		(0.000119)
Weekend		0.0810
		(0.0732)
Distance50		-0.158
		(0.109)
Evening		0.211***
		(0.0571)
Top4		0.0850
		(0.0616)
BigGame		0.339***
		(0.112)
TMV4		-0.0702
		(0.0553)
Top4vTop4		0.107
		(0.142)
Constant	10.69***	10.59***
	(0.119)	(0.183)
R^2	0.183	0.271
N	306	306

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix D: Bundesliga Margins Plot for Base Model with Log(Attendance) vs (*HomeProb*). Linear Prediction with adjusted predictions with 95% confidence levels

Margins Plot for Base Model
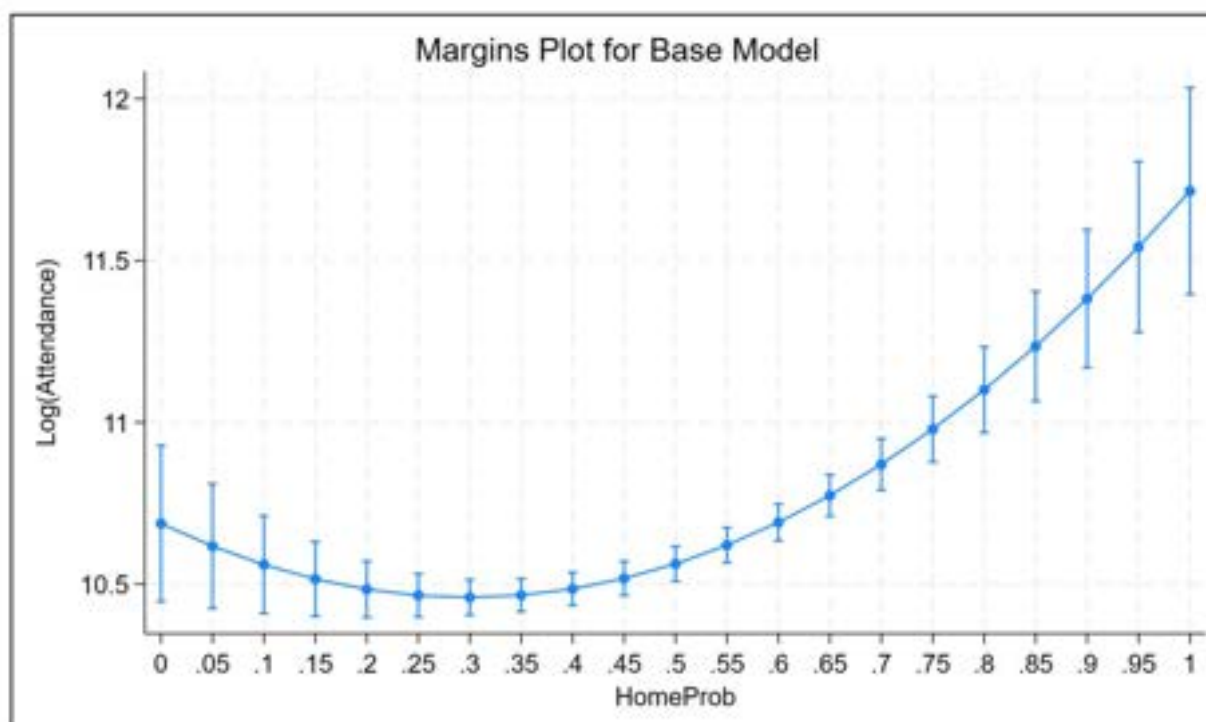
Appendix E: Regression Results for Control Variables - Bundesliga & EPL

Y = LogAttedance	EPL	Bundesliga
Distancekm	-0.000311	-0.000199[*]
	(0.000227)	(0.000119)
Weekend	0.0129	0.0810
	(0.0677)	(0.0732)
Distance50	-0.0109	-0.158
	(0.0745)	(0.109)
Evening	0.00417	0.211[***]
	(0.0664)	(0.0571)
Top6/Top4	0.304[***]	0.0850
	(0.0492)	(0.0616)
BigGame	0.211[*]	0.339[***]
	(0.116)	(0.112)
TMV4	0.0606	-0.0702
	(0.0637)	(0.0553)
Top6vTop6/Top4vTop4	0.166[**]	0.107
	(0.0648)	(0.142)
Constant	9.626[***]	10.59[***]
	(0.160)	(0.183)
R^2	0.360	0.271
N	379	306

Robust standard errors in parentheses. [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$

Note: The coefficients mirror earlier estimates, with a modified format for easier comparison.

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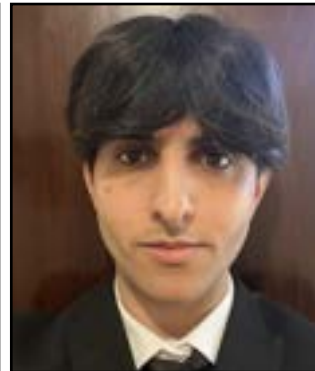## PUBLICATIONS
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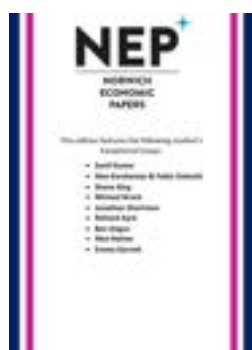
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