NEP
NORWICH ECONOMIC PUBLICATIONS

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VOLUME 31

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CHIEF EDITOR'S FOREWORD

FROM **THE NEP CHIEF EDITOR**

Dear all,
It is my greatest to welcome you to the 31st volume of the Norwich Economic Publications (NEP). This year we continued to advance the publication's commitment to making economics accessible, engaging and relevant to real-world issues.

Our 2025–26 themes, Dynamics, Innovation and ESG, were chosen to reflect some of the most pressing challenges and opportunities facing the global economy today. These themes also mirror the areas students increasingly engage with, both within the classroom and in wider debates shaping society. In selecting them, we aimed to build on NEP's mission of making economics accessible and relevant by focusing on issues that students are actively studying, debating and preparing to encounter in their future careers.

Over the past months, the NEP team has worked actively to expand our reach and strengthen our engagement with students. Our regular LinkedIn bulletins broadened our dialogue considerably, turning our page into a more vibrant forum where students could share ideas, contribute feedback and help shape the direction of future publications.

Alongside this outward engagement, the NEP team also took on a more outward-facing role this year by documenting and highlighting the many employability events hosted by ECO throughout November and December. Our aim was not only to record these events, but also to create a lasting and accessible knowledge bank for students, ensuring that valuable career insights remain available to anyone who wishes to revisit them. Students can access the full coverage through NEP's LinkedIn page.

The NEP podcast has also played an important role in expanding this engagement. Edited and developed by our Podcast Editor, the podcast series has featured regular episodes exploring different aspects of student life and the study of Economics. So far, episodes have been recorded and released on topics such as placement years, year abroad experiences, postgraduate study, behavioural economics and data science, student experiences, and comparisons between A-Level and degree-level Economics.

Alongside these outward initiatives, we collaborated closely with staff across ECO, whose contributions and guidance enriched the academic depth of this volume. This partnership between students and staff remains an essential part of NEP's development and continues to support the high standard of work we aim to uphold.

This volume brings together both selected coursework from across the School of Economics and submissions to the NEP Essay Competition. The coursework included in this volume showcases the analytical strength and creativity of students across the School of Economics, ranging from rigorous econometric analysis and programming-based research to policy-focused essays engaging with contemporary economic debates. In addition, the NEP Essay Competition entries showcase a wide range of original perspectives on the themes of technological change, economic governance, sustainability and the evolving structure of modern economies. Together, these contributions reflect the depth, creativity and intellectual curiosity within our student community.

I would like to express my appreciation to the entire NEP board for their dedication throughout the year. Their consistent effort and professionalism have played a central role in bringing this volume to life. I am also grateful to staff across the School of Economics for their collaboration, and to our academic editor, Liliana Harding, for her continued support and guidance. Finally, thank you to all the students who shared their work, ideas and perspectives with us. Your contributions are what make NEP a meaningful and evolving platform.

It has been a rewarding experience to help lead this work, and I look forward to seeing how NEP continues to develop over the rest of the year.

Violeta Bollano – NEP Chief Editor 2025 - 2026

EDITORS' CONTRIBUTIONS

NEP 31

Economic Systems
Innovation
Environmental, Social and Governance

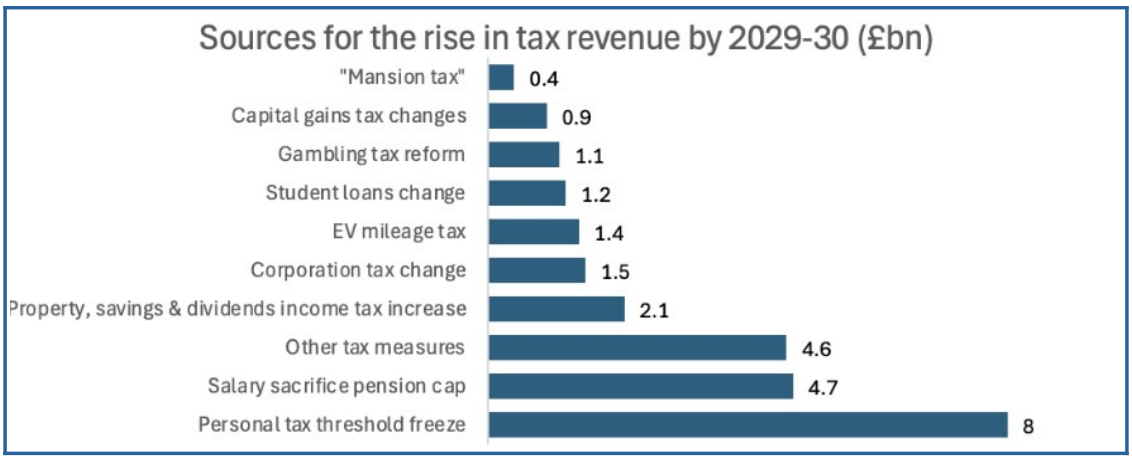
In this section, we have our editors' contributions to the publication.

From political events to finance and programming, this section presents a mixture of essays incorporating our chosen themes, experiences from employability events, and reflections on UEA activities, all from an economic perspective.

Economic Systems

Key Takeaways From the UK November Budget

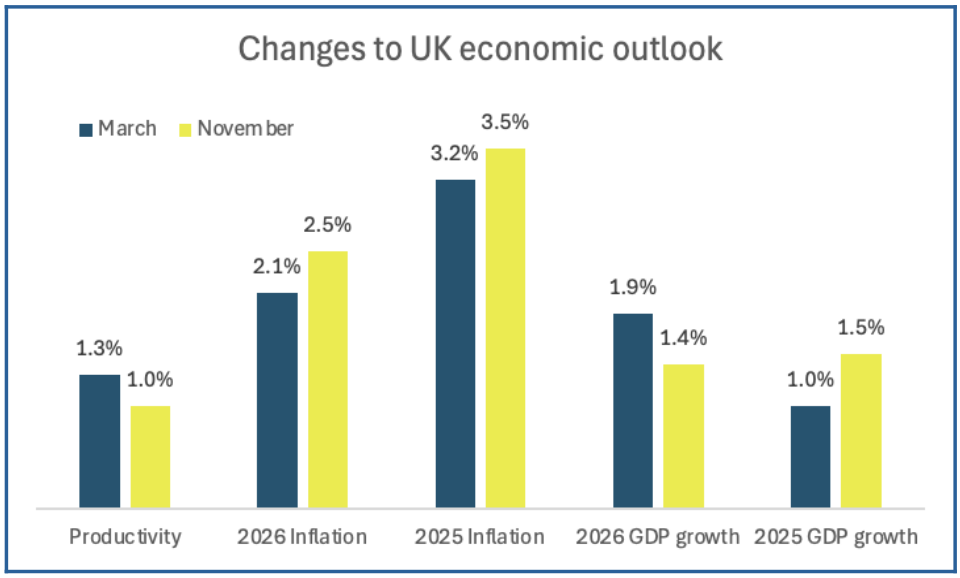
Madeleine Lewis



Rachel Reeves unveiled her second budget on Wednesday 26th November after the Office of Budget Responsibility (OBR) mistakenly released the key details early, which weakened the pound temporarily. Reeves said that her aim with the announced changes is to improve the cost of living and bring stability to public finances. This budget will raise taxes by £26bn and see an increase in spending by £11bn in 2029-30. The graph below illustrates how the extra £26bn in tax revenue will be generated. This will bring the tax take to an all-time high of 38% of GDP in 2030-31, however the UK will still have a lower tax burden than many European countries.

A key change to personal taxation includes the annual £12,000 cap for cash ISAs, which is a 60% decrease, this will dampen saving rates for consumers. It is also important to note within personal taxation changes that extending the income tax threshold for an extra 3 years until 2031 will generate more tax revenue. This is because over time wage growth will cause more people to be dragged into higher tax bands. These measures form the basis for the government's plans to expand fiscal headroom.
This increase in tax revenue will raise fiscal headroom from the £9.9bn which was forecast in March to £22bn. According to OBR, this will make it more likely that Reeves' fiscal rules will be met without further policy changes. Despite this expansion, it will still be below the £31bn average headroom left by previous chancellors from 2010 to 2022. The rest of the increase in tax income will fund the £11bn rise in government spending. Scrapping the two-child benefit cap will cost the government about £3.5bn alone. Another £6.3bn is predicted to be spent on SEND funding as it was announced that the central government will be taking responsibility for it from councils. This change hopes to alleviate stress on councils' books.

The key change for university students is the change in loan repayments. From April 2027 students on "Plan 2" schemes will have their loan repayment threshold frozen for 3 years at £29,385. This will generate an extra £400mill a year for the government. At the same time in April 2027, the legal minimum wage will rise 4.1% to £12.71/hr for over-21s and £10.85 for 18-20 year olds. This could be significant as the OBR forecasts that national minimum wage will reach £28,995 by 2030. Consequently, in the next 5 years a full-time salary on minimum wage will be just under £400 away from the repayment threshold. This could push some low-paid into repaying their student loans soon after finishing university.
For international students, there are plans to introduce a flat annual fee of £925 per student that will be implemented from August 2028. Whilst this is forecast to generate £445mill in its first year, which is intended to fund domestic students' maintenance grants, it is also anticipated to cause a 14,000 reduction in student enrolments that same year. This has stoked fears that this new policy will worsen the financial stresses already existing in universities.



The OBR's outlook changes since the previous budget in March are shown in the graph below. The UK's average GDP growth is expected to stay around 1.5%, this is 0.3% lower than the March forecast figure. OBR cited lower productivity forecasts for this cut. Whilst many businesses from across the UK raised concerns for the lack of impact the budget will have on improving growth and investment levels, the UK's biggest banks gave a positive response after being spared from tax increases in the sector. Announcing over £90bn in investment into the UK, including greater lending for smaller businesses and first-time buyers.

Innovation

A Student Guide to Smart Estimates and Market Forecasts

Lia Alsayed

When we think about what moves financial markets, the first things that come to mind are usually breaking news or media hype, right? But that's only part of the story. What really drives prices is expectations. Markets don't just react to what a company did, they react to whether it did better or worse than investors were already expecting!

That's why today we see more innovation in finance centered on better understanding expectations through data, instead of relying solely on headlines or gut instinct.

Simultaneously, markets adjust not just to events, but to the gap between what happened and what people thought would happen.

Why does this matter?
Markets are ultimately about people, they reflect the choices, motivations, and incentives of the individuals participating in them. Models and historical data can guide us, but it's human behaviour that determines how those forces actually play out.

We focus on how innovation can make us understand market sentiment more clearly in a world where information is constant, noisy, and fast-moving. Rather than treating market reactions as unpredictable, we look at how financial innovation is trying to make expectations easier to track and interpret, especially through tools that summarise and organise what professional analysts are predicting.

This discussion builds on a recent webinar hosted by the London Stock Exchange Group (LSEG), where the concept of Smart Estimates was highlighted. Now let's look at a broader shift in financial markets, where the emphasis is increasingly on smarter, more data-driven ways of tracking expectations and investor sentiment. This article summarises what Smart Estimates actually are, in simple terms, and explains why they provide a practical bridge between economic theory and the way markets behave in the real world.

Starting with what is an analyst estimate?
When people say, "the market expected better," they're usually referring to analyst forecasts. Sell-side analysts (the ones working at investment banks and research firms) regularly publish estimates of how companies are likely to perform. The most common figure is earnings per share (EPS), but they also forecast revenue, sales, and a range of other operating metrics collected by major data providers.
These forecasts matter because they make expectations visible. Instead of vague sentiment, they provide a public, trackable benchmark for what investors think is going to happen. When a company releases its results, the first question isn't just "Were the numbers good?", it's "Were they better or worse than expected?" Research shows that when companies surprise the market, whether in earnings or revenue, stock prices tend to react around the announcement (Jegadeesh & Livnat, 2006).
Over time, analyst forecasts have gone beyond just earnings. As markets have become more sophisticated, analysts have started issuing projections for operating cash flow as well, especially when cash flow helps clarify whether reported earnings are sustainable or reflect real financial strength. In other words, expectations have become broader and more detailed, reflecting a deeper attempt to understand a company's underlying performance. (DeFond & Hung, 2003)

The problem with a simple average.
If you look up estimates on a terminal or data feed, you often see a consensus number, usually the mean (average) of all forecasts. It's easy to read and easy to explain, which is why it's used so widely. But the simplicity hides two practical weaknesses.

First, not all forecasts are equally good. Analysts differ in skill, resources, and how closely they follow a company. Second, not all forecasts are equally timely. A forecast from months ago may be less informative once new guidance, new sector news, or new macro information arrives. Research on analyst timing shows that “lead” (more timely) forecasts can move prices more than delayed forecasts, and that timeliness shapes how the market absorbs information (Shroff et al., 2014).
In other words, while the consensus average is helpful, it assumes every forecast deserves equal weight. In practice, some estimates are more reliable and more relevant than others, and that difference can matter.

What Smart Estimates Change?
This is the gap “StarMine” Smart Estimates are designed to fill. Instead of treating every analyst forecast as equally important, Smart Estimates take a more nuanced approach. LSEG describes it as a “smart mean”, one that gives more weight to forecasts that are both more recent and produced by analysts with stronger accuracy records.
The process itself is fairly intuitive. First, it filters outdated estimates and obvious data errors. Then, among the remaining forecasts, it assigns greater weight to analysts with better track records and to estimates that reflect the most up-to-date information.
Rather than asking, “What’s the average forecast?” Smart Estimates ask a more realistic question: “What would expectations look like if we placed a little more trust in the analysts who’ve been more accurate, and in the forecasts that reflect the latest information?” (LSEG, 2025).

Predicted Surprise: the key output to interpret.
Once you have both numbers, the regular mean estimates and the Smart Estimate, you can compare them. LSEG calls this difference the Predicted Surprise. Essentially, when the Smart Estimate diverges from the simple average, it signals that the more accurate or up-to-date forecasts aren’t fully aligned with the consensus.
LSEG offers a handy rule of thumb for students: when the Predicted Surprise is ±2% or more, Smart Estimates have historically been directionally correct about 70% of the time in predicting whether a company will beat or miss the average forecast.
It’s important to keep this in perspective. This isn’t a guarantee and it’s not financial advice. Think of it as a signal, a prompt to investigate why expectations are shifting and what’s driving those changes, using your own judgment and additional evidence. (LSEG, 2025).

How to use it in a student project?
If you aim for a research-style project that feels “real world” without needing a massive dataset, Smart Estimates offer a neat structure where you can turn a market intuition (“expectations drive reactions”) into a testable question. One direction is to ask whether large positive or negative Predicted Surprises are associated with short-window earnings announcement returns, building on the wider earnings-surprise literature that links surprises in key metrics (like revenue) to stock returns (Jegadeesh & Livnat, 2006).
One way to take the discussion further in an academic setting is through sector comparison. Predicted Surprise can be examined across industries to see whether the

signal tends to look different in sectors where expectations are more narrative-driven or where investment cycles are especially large. This line of inquiry can also be grounded in established theory, such as the asset-growth anomaly, which documents that firms with rapid asset growth have tended to underperform subsequently (Cooper et al., 2008). Framed this way, Smart Estimates become a lens for asking whether periods of "investment optimism" (visible in rising expectations) align with, or drift away from, measures that relate to a firm's underlying capacity to generate cash.

Another extension is to widen the focus beyond earnings per share (EPS). The literature shows that analysts issue cash flow forecasts in certain contexts (DeFond & Hung, 2003), which makes it possible to compare how expectations evolve for earnings versus cash flow measures. It also supports a broader question that fits naturally into the earnings-surprise literature: whether surprises in non-EPS metrics, such as revenue or cash flow, are associated with meaningful market reactions around announcements (DeFond & Hung, 2003; Jegadeesh & Livnat, 2006).

A further consideration is access to platforms and data. Even without direct access to LSEG Workspace, the core concepts can still be discussed using publicly available analyst datasets as a proxy, with a clear explanation of what that proxy captures and what it cannot. Some universities provide access to institutional estimates datasets, and LSEG also publishes materials showing how fundamentals and estimates content can be incorporated into valuation-style workflows (Ramchandani, 2025). Any analysis built on proxy data should therefore be presented with transparent limits, a simple consensus series will not replicate Smart Estimate weighting, so results are best framed as illustrative rather than definitive.

If you would like to explore the official institutional details, how Smart Estimates are defined, how Predicted Surprise is calculated, and how the methodology is described by LSEG, see LSEG's Smart Estimates page here:

References

LSEG. I/B/E/S Estimates | Company data. (2025, June 2). Data Analytics. Retrieved February 23, 2026, https://www.lseg.com/en/data-analytics/financial-data/company-data/ibes-estimates

Jegadeesh, N., & Livnat, J. (2006). Revenue surprises and stock returns. Journal of Accounting and Economics, 41(1–2), 147–171. https://doi.org/10.1016/j.jacceco.2005.10.003

DeFond, M. L., & Hung, M. (2003). An empirical analysis of analysts' cash flow forecasts. Journal of Accounting and Economics, 35(1), 73–100. https://doi.org/10.1016/S0165-4101(02)00098-8

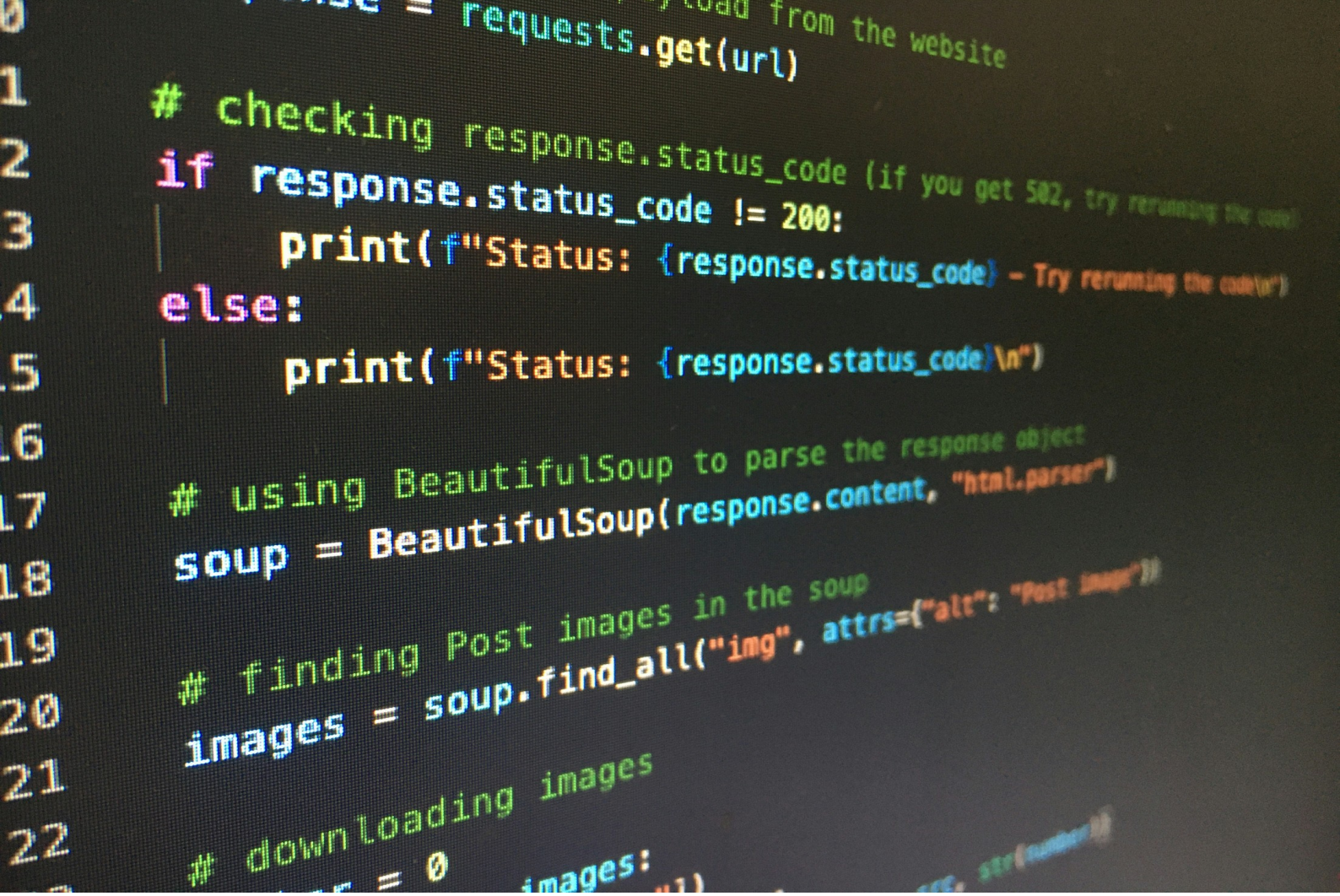
Shroff, P. K., Venkataraman, R., & Xin, B. (2014). Timeliness of analysts' forecasts: The information content of delayed forecasts. Contemporary Accounting Research, 31(1), 202–229. https://doi.org/10.1111/1911-3846.12021

LSEG. (2025, September). Starmine smartestimates. Data Analytics. Retrieved February 23, 2026, from https://www.lseg.com/en/data-analytics/financial-data/analytics/quantitative-analytics/starmine-smartestimates

London Stock Exchange Group. (n.d.). StarMine quantitative analytics (brochure). Retrieved February 23, 2026, from https://www.lseg.com/content/dam/data-analytics/en_us/documents/brochures/starmine-quantitative-analytics-brochure.pdf

Cooper, M. J., Gulen, H., & Schill, M. J. (2008). Asset growth and the cross-section of stock returns. Journal of Finance, 63(4), 1609–1651. https://doi.org/10.1111/j.1540-6261.2008.01370.x

Ramchandani, J. (2025, July). Working with fundamental and estimates data – A DCF example (Last updated July 2025). LSEG Developer Portal. Retrieved February 23, 2026, from https://developers.lseg.com/en/article-catalog/article/fundamentals-estimates-dcf



Innovation

How Python Can Benefit Students: An Interview With Dr Jibonayan Raychaudhuri

Lia Alsayed

On the 12th and 14th of November 2025, an insightful Python workshop was hosted at the UEA, led by Dr Jibonayan Raychaudhuri, Associate Professor in International Economics. Professor Raychaudhuri kindly shared with us his valuable thoughts; from how students can make the most of the workshop and continue developing their Python skills, to his key advice for anyone planning to build a career in programming.

Find the full discussion with the NEP below and discover what he shared with us!

NEP editors: How does the workshop benefit students, and what can they do to further advance their Python skills after attending?

Prof. Raychaudhuri: The “Introduction to Python” workshop is deliberately designed as a first step into computational thinking for economists. We work through the basics of Python that every applied economist increasingly needs in their toolkit. This toolkit includes familiarity with variables and data types, lists and arrays, loops and conditionals, dictionaries and data frames, and then using numpy, pandas and simple plotting tools (like matplotlib and seaborn) to organise and visualise economic data. We finish with simulation exercises that illustrate the Law of Large Numbers and the Central Limit Theorem, which link directly back to ideas that students see in the econometrics modules that we offer in ECO.

There are (at least) three main benefits for students:
First, these workshops build fluency with code. By the end of the workshop, most students are able to read, comprehend and modify short Python scripts, write simple functions, and understand what a loop or a conditional is doing. This is the foundation for any serious work in data science or econometrics.

Second, I feel that these workshops strengthen intuition in economics and statistics through computation. When students create arrays of GDP and population and compute and plot GDP per capita, or plot Cobb-Douglas production functions, or simulate random samples to see sample means converging to a population mean, they are seeing core economic and statistical ideas unfold on the screen. Instead of only “trusting" a formula from a textbook, they can generate artificial data and watch the theory work in practice. As (the modern day transcreation of) the ancient Chinese proverb says: "I hear, and I forget. I see, and I remember. I do, and I understand."

Third, it enhances employability. Many roles that economics graduates move into nowadays assume some ability to work with data programmatically. Recruiters do not necessarily expect you to be a software engineer, but they do expect you to be comfortable handling data using (open source) tools like Python or R, building reproducible analysis, and communicating results clearly. Even a short workshop that gets students into a proper development environment, working with real code and real data, makes them less intimidated and more confident to learn further.

After the workshop, there are several practical steps students can take to advance their Python skills. I would like to suggest the following:

Continue to practise on small, concrete tasks. For example, replicate some of the examples from the slides, then change the data or the parameters. Try a different sample of countries (like our GDP example), alternative functional forms for production functions, or new plots.

Begin to link Python with your coursework. If a module uses an empirical paper with a simple regression or a simulation, ask whether the core idea can be implemented/replicated using Python. Even basic OLS or simple Monte Carlo experiments are very good practice.

Make use of structured resources such as the official Python tutorial and beginner-friendly online courses but always bring the focus back to economic questions and data, rather than abstract programming puzzles.

Learn basic workflow habits early. That includes keeping code in organised files, commenting clearly, and saving work in a way that can be reproduced later. Students who go on to dissertations (or projects) will find that this discipline pays off.

NEP editors: For students planning to build a career in Python or programming, what is one piece of advice you would like to share?

Prof. Raychaudhuri: My main advice to economics students is this: Treat Python as a powerful instrument in your toolkit, but remember that you are economists first and programmers second. The real value you bring to your workplace comes from your ability to pose good economic questions and to think rigorously about identification and causality. Python, R, or any other language for that matter, is there to help you implement that reasoning at scale.

I will add here that in recent years there has been an explosion of tools from machine learning and data science that are of genuine interest to economists. Double machine learning methods, causal forests, targeted regularisation, heterogeneous treatment effect estimation and broader “causal machine learning” approaches allow economists to handle high dimensional controls, complex non-linearities and large data sets, while still focusing on causal questions which are relevant for policy evaluation or for isolating treatment effects. These are exciting developments, and Python is one of the main environments in which such methods are implemented.

However, there is a temptation for students to drift too far into generic data science for its own sake, learning many libraries and buzzwords without a clear sense of purpose. My advice is to resist that temptation. Build a strong core in microeconomics, macroeconomics, probability and econometrics, and then learn Python in a way that serves that core.

I have found it helpful to ask a few simple questions whenever I encounter a new method and want to decide whether it deserves an investment of time and effort:

- What is the economic question here?
- What is the data generating process that I am assuming?

- Does this technique help me move from correlation to causation, or is it mainly predictive?
- How does it compare with more traditional econometric tools?

I think that if you keep these questions in view, you will naturally gravitate toward the parts of programming that matter most for economists.

From a practical employability perspective, it is also wise to learn some basic professional practices around programming. Version control with Git, clear project structure, readable code, and good documentation all matter. Yet even these should be framed as tools that enable you to deliver high quality economic analysis, not as ends in themselves.

To summarise, if as an economist, you want a career that makes use of Python or programming, focus first on becoming a good economist! Then cultivate Python as the language that allows you to test your ideas, to implement modern econometric and causal methods, and to communicate your findings in a transparent and reproducible way. This combination will make you distinctive in the job market.

Environmental, Social and Governance

The 2025 Climate Summit And What It Means For Economics

Violeta Bollano

COP30, the United Nations' annual global climate conference, took place in Belém, Brazil, in November 2025. The summit brings together governments, researchers, businesses and civil groups to discuss how the world responds to climate change. This year felt especially significant because climate risks are increasingly shaping markets, investment decisions and everyday behaviour. The outcomes of COP30 reflect not only environmental priorities but also the future direction of global economic systems.

Why COP30 Matters for Students

For students in economics, development, business or policy, COP30 is directly relevant. It shows how climate change is reshaping the global economy in real time. Clean energy

transitions, adaptation finance and Environmental, Social and Governance (ESG) expectations will influence future careers and the skills employers value. Students entering finance may work with green bonds or transition risk assessments. Those entering policy may focus on adaptation planning or climate budgeting. Students in economics will analyse how climate shocks affect inflation, labour supply or productivity. These examples illustrate how COP30 will shape the types of roles, tools and analytical approaches that graduates need to succeed.

The summit also emphasises the need for systems thinking. Climate change interacts with trade, inequality, migration, public health and innovation. No single discipline can capture these dynamics. COP30 shows why future economists and policymakers must combine economic insight with behavioural understanding and ethical reasoning. For UEA students and Norwich Economic Publications (NEP)'s 2025–26 focus, the summit reinforces the importance of fair, resilient and future focused economic systems.

The Growing Importance of ESG in Global Markets

The summit reinforced the growing influence of Environmental, Social and Governance (ESG) principles. Announcements on clean energy investment and sustainable industry were closely watched by investors, and several sectors reacted immediately. Renewables and climate resilient technologies gained attention, while fossil fuel dependent industries acted more cautiously. This contrast highlights how markets are adjusting their expectations based on climate related policy signals.

This shows that firms increasingly recognise that climate risk is economic risk, meaning innovation has become essential for competitiveness. ESG considerations have shifted from voluntary branding tools to core strategic factors that shape investment flows and long-term economic resilience. In other words, ESG now determines which sectors attract capital and which face declining investor confidence.

Clean Energy Innovation as a Central Theme

Clean energy innovation was a central theme. Countries committed to increasing renewable capacity and improving energy efficiency. These commitments influence markets by attracting investment, reducing uncertainty and shaping technological pathways. This matters because expectations about future policy create momentum for clean technology even before implementation begins.

The Belém Political Package also plays a role here. It encourages countries to expand renewable energy, strengthen adaptation and support cleaner industrial systems. By signalling that adaptation finance will triple by 2035, the package directly supports innovations such as early warning systems, resilient infrastructure and climate smart agriculture. These examples demonstrate how financial commitments can accelerate technological development in areas where private investment has historically been slower. These developments align with the broader clean energy transition and reinforce expectations that production systems will shift, even if slowly.

Even though countries did not agree on a full fossil fuel phase out, public pressure and market expectations show that global production systems are moving towards cleaner energy regardless of political hesitation. This outcome links back to the theme of innovation because market momentum is often stronger than political consensus.

Unevenness of Climate Impacts and the Just Transition

COP30 highlighted how unevenly climate impacts are felt. Many countries in the Global South called for stronger financial support for adaptation and for compensation linked to climate events. This debate strengthened the focus on the Just Transition, which is the idea that the shift to clean energy must be fair and inclusive.

A fair transition shapes labour markets, industrial policy and innovation strategies while also influencing long term development prospects. These dynamics mirror themes in development economics. Countries differ in institutional capacity, risk exposure and available resources, and behavioural factors such as trust and responsibility further affect negotiations. These examples show that technical solutions alone are not enough because social and political inequalities must also be addressed for climate policy to be effective. Integrating these elements shows that the global transition is not only a technical challenge but also deeply social and political, setting the stage for the limits discussed at the summit.

Limits of COP30

COP30 also revealed clear limits. Many countries refused to commit to a fossil fuel phase out, even though scientific evidence strongly supports one. This gap between what is necessary and what is politically feasible remains a core challenge.

The commitments made in Belém are voluntary and depend on national momentum. Incremental progress risks falling behind scientific recommendations, and national interests and political fragmentation continue to slow collective action. The earlier observation that countries did not fully agree fits naturally here and reinforces why the summit's ambition still falls short of global needs.

Employability

Tofi Balogun
AI and Modelling Associate
PwC

Eloise Tan
Project Manager
Adam Smith International

From Campus To Career : Advice From ECO Alumni

Lucie Mackintosh

The School of ECO invited two former students back to the university in Autumn 2025 to discuss their working experiences since graduating, as well as to offer advice to current students. This year, the two speakers were Tofi Balogun, an AI and Modelling Associate at PwC and Eloise Tan, a Project Manager at Adam Smith International.

The event began with a speech from Tofi, who shared practical advice for students on preparing for the job market and guidance on strengthening career prospects, drawing on his own experience. He emphasised the value of undertaking an internship during your degree, noting that early exposure to the industry is key for students to assess whether a company or a role is a good fit whilst developing networking skills and professional connections. Building on this point, Tofi then highlighted that determination and perseverance are essential; he recounted how the lengthy process of applying for internships taught him resilience, and how rejection ultimately fuelled his drive to

succeed. His key message was that students who actively engage and contribute during their internships maximise the professional and developmental benefits of the experience.

Following Tofi's speech, Eloise delivered a presentation her progression to her current position as Project Manager at Adam Smith International, embedding guidance relevant to key stages of her trajectory. Her career began with a placement year at the Foreign Office as part of her undergraduate degree, an experience she described as pivotal. Echoing many of Tofi's points about the benefits of internships, Eloise noted that the Foreign Office team she once worked with are now her clients - a testament to the value of building professional connections early. Additionally, Eloise raised the point that internships provide students the opportunity to work on projects with real-world impact. This underscores the importance of being able to apply theoretical knowledge to practical contexts when entering the job market.

Next, Eloise discussed her master's degree in International Trade, Finance and Development Economics, which she completed in Barcelona. She described the experience as both challenging and highly rewarding, noting that it provided a competitive edge over other candidates. For students considering further study or careers in international trade or finance, Eloise emphasised the importance of studying abroad, arguing that immersion in another country is essential for understanding global perspectives.

Eloise began her career at Adam Smith International as an Assistant Project Manager, a role she secured through a program similar to a graduate scheme. Through persistence and strong performance, she progressed to her current position as Project Manager. Adam Smith International specialises in economic development, governance and stability, and business services. Eloise's responsibilities cover two key areas: project preparation, which involves tasks such as writing project bids, and overseeing day-today project management and decision making. As Project Manager, she is responsible for the smooth operation and all of the outcomes and decisions required by a project.

The next stage of the event was a Q&A session, which focused on three key themes: challenges faced by the speakers, sources of fulfilment in their work, and the aspects of their degrees which proved the most valuable in their current roles. The discussion on challenges revealed contrasting yet complimentary experiences.

Tofi reflected on the difficulties of maintaining work-life balance whilst adapting to a new environment and embedding himself in the company's culture. He emphasised the usefulness of learning how to prioritise tasks and approaching them incrementally to avoid feeling overwhelmed. In contrast, Eloise highlighted the transition from being closely supervised as an intern to assuming full responsibility for projects and making independent decisions. Although initially daunting, she noted that persistence and a willingness to push outside her comfort zone enabled her to overcome these challenges and ultimately

receive a promotion. Both speakers underscored adaptability and resilience as critical skills for success, with Tofi's experience showing how building strong foundational habits are beneficial, and Eloise's experience demonstrating how these habits evolve into leadership and decision-making skills.

Both speakers reflected on what aspects of their roles they find most rewarding, which revealed distinct but meaningful perspectives. Eloise emphasised the human dimension of her work, finding satisfaction in helping people and in the opportunity to travel and directly engage with those impacted by her projects. In contrast, Tofi highlighted the intellectual nature of his role, deriving fulfilment from applying logical reasoning and critical thinking. Developing a sound argument and confidently justifying it to senior colleagues is particularly rewarding to him, and he described this as a moment which "feels really special."

The final theme explored during the Q&A concerned aspects of the speakers' degrees that proved most valuable in their careers. Both speakers pointed to specific modules which provided the theoretical knowledge underpinning their careers, for Tofi this was the derivatives module and for Eloise this was the development economics module. . Eloise noted that her current role rarely involves her carrying out economic calculations directly however, the conceptual knowledge she obtained during her degree continues to inform her approach to her projects. The importance of soft skills cultivated through group projects and presentations was emphasised by both speakers as being critical, despite qualitative differences in their roles.

The Autumn Alumni event provided valuable insights into the realities of building a career after graduation, underscoring the importance of internships for fostering resilience, and the practical application of academic knowledge. Through their experiences, Tofi and Eloise demonstrated that adaptability, persistence and strong interpersonal skills are essential for success in diverse professional contexts. Their advice offered current students both inspiration and actionable advice for navigating the transition from university to the workplace.

ESSAY COMPETITION

Annual NEP Competition

The annual NEP essay competition allows students to answer one of our questions with a chance to win up to £500. Here, students can pick a question they are passionate about or interested in and create a compelling argument grounded in economic theory.
We were pleased with the number of responses and enjoyed reading all submissions. Below, you can see the questions and winning entries for undergraduates and postgraduates.
The questions are structured around the themes established at the start of the academic year. See them for yourself below:

Economic Systems

1. Discuss the way in which technological change is shaping labour markets and economic governance in the 21st century.
2. In what ways do digital platforms and data ownership reshape traditional market structure in modern economies? Evaluate the consequences for competition and consumer welfare.
3. Economic systems are not neutral; they distribute power among consumers, firms, and institutions. How do shifts in economic power influence market behaviour and policy outcomes over time?

Innovation

1. Innovation should not only be viewed as technological but also social and institutional. How could these various forms of innovation transform economic resilience and sustainability?
2. How can innovation be directed toward inclusive and sustainable economic growth?
3. To what extent should governments intervene to steer innovation towards solving global challenges?

Environmental, Social and Governance

1. The rise of ESG-driven investment has changed how markets allocate capital. Does this represent a genuine shift towards sustainable economies or is it mostly a rebranding of traditional capitalism? Discuss.
2. Evaluate the potential of ESG-driven policies to bridge the gap between economic growth and environmental limits.
3. ESG principles are reshaping corporate and financial behaviour. Evaluate how effective such principles are in aligning profit motives with social and environmental goals.

1st PLACE

Integration and Institutional Power: Why Market Access Does Not Guarantee Development

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The Baseline: Why Integration should Deliver Gains

Regional integration is often presented as a neutral mechanism for expanding markets and increasing welfare within economic systems. By enlarging markets, intensifying competition and enabling scale economies, integration is expected to generate efficiency gains and promote convergence across participating economies. Standard trade theory provides strong foundations for this view. In models of monopolistic competition and increasing returns, larger integrated markets reduce mark-ups and lower prices as firms expand output across a broader consumer base (Krugman, 1979; 1980). Empirically, gravity models demonstrate that trade flows increase systematically with economic size and institutional proximity, including preferential trade agreements (Anderson and van Wincoop, 2003).

These gains are real. Market defragmentation can raise productivity, eliminate inefficient firms and increase aggregate welfare. Yet such models primarily explain trade intensity and short-run efficiency effects rather than long-run structural transformation. The assumption that market access alone produces convergence remains analytically incomplete.

If integration expands markets and increases welfare, why does it so often fail to transform economic structures? The question is not whether integration expands exchange, but how it redistributes economic power within economic systems. This essay argues that regional integration is not neutral: its developmental consequences depend on how institutional capacity mediates the relationship between market expansion, regulatory governance and value-chain positioning.

Institutions and the Distribution of Economic Power

Institutional economists have long emphasised that economic performance is shaped not only by resource endowments or market size, but by the rules that structure incentives and allocate authority within societies (North, 1990; Acemoglu and Robinson, 2012). Institutions determine who enforces contracts, how disputes are resolved, whether property rights are credible and which actors influence regulatory decisions. In this sense, economic power refers to the capacity to shape rule-setting, coordinate investment and capture rents within production systems.

State capacity lies at the centre of this institutional architecture. The ability to implement industrial policy, enforce standards and coordinate long-term investment strategies conditions whether firms can exploit opportunities generated by expanded markets (Besley and Persson, 2011). Integration enlarges the arena of exchange, but it does not eliminate the need for domestic coordination. Where regulatory systems are coherent and administrative authority is credible, firms can respond to competitive pressures by upgrading technologically and organisationally. Where such coordination is limited, exposure to larger markets may intensify competition without enabling structural advancement.

These dynamics become particularly salient in an era defined by global value chains. Production is increasingly fragmented across borders, yet control over high-value activities — design, branding, intellectual property and standards — remains concentrated among lead firms (Gereffi, 2018). Participation in trade does not automatically translate into movement toward these segments. Countries frequently enter global production networks through assembly or primary commodity export, and upgrading requires sustained institutional support for learning, technological diffusion and sectoral coordination. Integration, therefore, does not bypass institutions; it amplifies their consequences.

The developmental effects of integration are mediated through this institutional lens. When domestic governance structures can enforce regulatory standards, mobilise investment and sustain industrial learning, market expansion can generate upgrading and enhanced value capture. In contrast, where enforcement is weak or policy coordination fragmented, expanded trade may

increase output while leaving the underlying hierarchy of production intact. The difference is not one of trade intensity but of structural positioning within the international division of labour. Some argue that integration itself catalyses institutional reform — and there is evidence it can. Yet where baseline state capacity is absent, external regulatory pressure tends to produce compliance without capability, deepening dependence rather than building the domestic coordination needed for structural transformation. The mechanism underpinning this divergence is summarised in Figure 1.

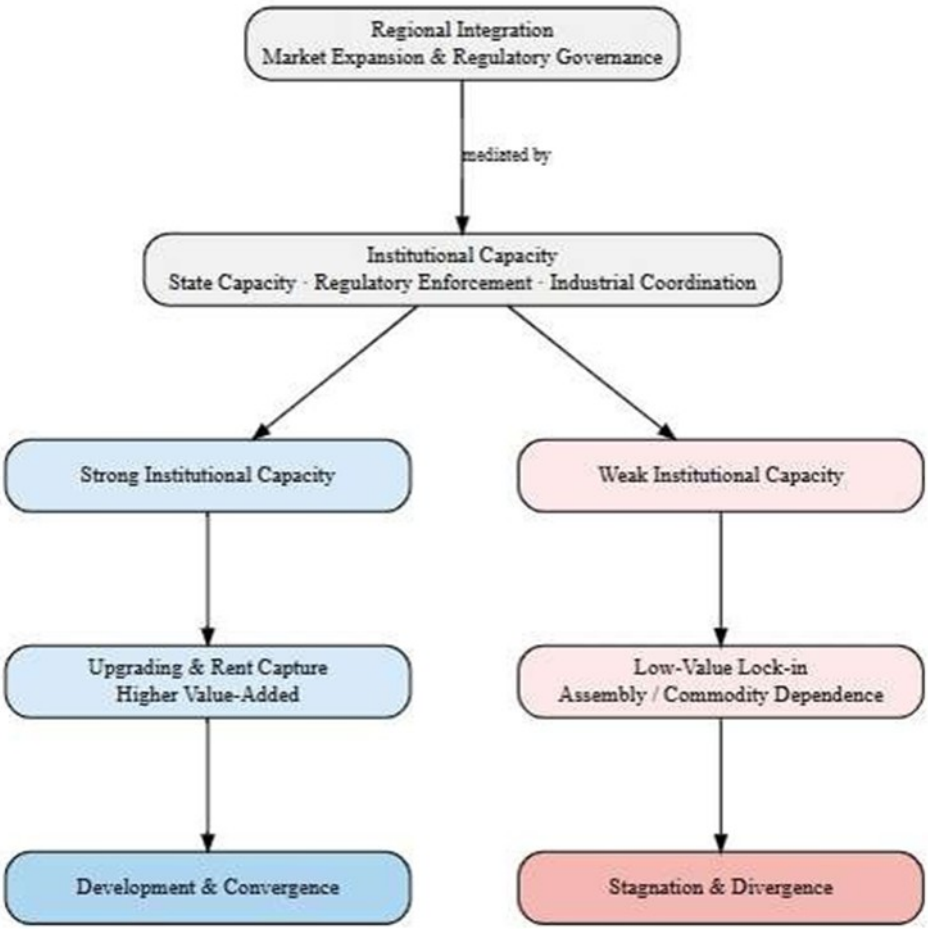

Figure 1: The Conditional Mechanism of Regional Integration — how institutional capacity mediates developmental outcomes within global production networks.

Source: Author's own illustration

Deep Integration, Regulatory Authority and Asymmetric Outcomes

Modern regional integration extends beyond tariff reduction into investment protection, intellectual property, environmental standards and digital governance (Hofmann, Osnago and Ruta, 2019). This "deep integration" embeds economies within complex regulatory architectures that reshape domestic policy space. As Rodrik (2011; 2018) argues, international commitments can constrain the scope for industrial policy and regulatory divergence. Crucially, regulatory authority within these architectures is not

evenly distributed. In a world of fragmented production networks (Baldwin, 2016), control over certification regimes and compliance frameworks becomes a form of structural power — determining which firms can compete and on whose terms. The global value chain literature describes this as an "upgrading trap," in which trade participation stabilises low value-added roles rather than enabling structural transformation (Gereffi, 2018). Recent UNCTAD analyses similarly warn that export growth without institutional coordination may leave value capture unchanged (UNCTAD, 2023). Institutional capacity therefore determines whether integration becomes a mechanism of convergence or divergence.

The divergence between integration outcomes is not merely theoretical; it is historically observable. South Korea's post-1960s integration into global production networks demonstrates how institutional capacity can convert openness into convergence. Rather than accepting permanent specialisation in low value-added assembly, the Korean state combined trade integration with industrial coordination — directing credit, imposing performance requirements and investing in technological capability (Amsden, 1989). Market access provided opportunity, but institutional authority determined trajectory. The shift from labour-intensive production to semiconductors, shipbuilding and advanced electronics was not the automatic result of integration; institutional power shaped what integration became. It should be noted, however, that the economic conditions underpinning this model — directed credit allocation, export performance requirements and protected domestic markets — are largely foreclosed to developing economies today under WTO subsidy disciplines and capital account liberalisation pressures (WTO, 1994), raising questions about its replicability.

Contemporary trade relations between the European Union and African economies illustrate the divergence pathway directly. While Economic Partnership Agreements expand market access, participation often remains concentrated in segments characterised by limited value capture. This reflects a deeper asymmetry: regulatory standards and compliance requirements are largely shaped by European institutions, placing disproportionate administrative and technological burdens on lower-capacity economies. As a result, integration without parallel domestic capacity-building risks reinforcing lower value-added specialisation rather than enabling upgrading. Market access alone is therefore insufficient to alter structural hierarchy when rule-setting authority remains externally concentrated. This dynamic is particularly evident in contemporary regulatory frameworks. For example, the European Union’s Carbon Border Adjustment Mechanism (CBAM) conditions market access on compliance with carbon reporting and pricing requirements, imposing significant administrative and technological burdens on exporters from lower-capacity economies. Rather than facilitating upgrading, such mechanisms risk institutionalising asymmetries by embedding higher compliance thresholds into global market participation.

Collective Integration and Strategic Capacity

The African Continental Free Trade Area (AfCFTA) demonstrates this conditional logic clearly. By creating one of the world's largest single markets among participating nations (African Union, 2018), AfCFTA offers genuine potential for intra-African value chain development and reduced dependence on externally governed trade relationships. Yet its developmental impact will depend substantially on whether member states can build the regulatory coherence, infrastructure capacity and industrial coordination needed to convert market scale into structural upgrading. Scale creates opportunity; institutions determine whether that opportunity is realised.

This mirrors the broader revival of industrial policy that Rodrik (2023) describes as "productivism" — a shift toward prioritising domestic productive capabilities rather than relying on market forces alone. Integration and industrial policy are not mutually exclusive; their interaction determines whether economies move into higher value-added activities or remain locked into existing specialisations. Collective integration that is not accompanied by coordinated industrial strategy risks reproducing internal asymmetries between stronger and weaker member states at a regional rather than bilateral scale.

Geoeconomic Shifts and Structural Power

The institutional dynamics examined above are further shaped by the broader geoeconomic context in which integration unfolds — one in which regulatory authority is increasingly wielded as a form of strategic power. Scholars of "weaponised interdependence" argue that states controlling critical nodes in financial, technological or regulatory networks can convert interdependence into asymmetric leverage (Farrell and Newman, 2019). In such contexts, integration does not eliminate hierarchy; it often institutionalises it.

Contemporary policy instruments make this dynamic visible. The European Union’s Carbon Border Adjustment Mechanism (CBAM), for example, conditions market access on compliance with environmental standards determined within the EU’s regulatory framework. Similarly, export controls on advanced technologies reveal how control over strategic chokepoints can reshape production networks. These measures demonstrate that integration increasingly operates through regulatory authority: participation is contingent not only on tariff reduction but on conformity to standards established by actors with institutional and technological capacity.

Such developments confirm that integration reorganises authority within economic systems, with developmental consequences determined by who holds regulatory power.

Conclusion

Regional integration generates efficiency gains, intensifies competition and expands trade. Standard models rightly emphasise these benefits. Yet integration is not neutral. It redistributes economic power through institutional design, regulatory governance and value-chain positioning. The

distribution of gains depends not only on market size but on the capacity of domestic institutions to capture rents, shape rule-setting and support upgrading.

Trade agreements between asymmetric partners risk entrenching divergence when market access is not accompanied by institutional upgrading mechanisms. Structural transformation requires more than participation in larger markets; it requires institutional capability to govern participation. This has direct implications for trade agreement design: embedding institutional upgrading mechanisms, asymmetric liberalisation schedules and capacity-building provisions as standard features rather than optional annexes would better align integration architecture with developmental reality.

Integration does not determine development outcomes. Institutional power determines what integration becomes.

References

Acemoglu, D. and Robinson, J.A. (2012) *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Crown Publishers.

Amsden, A.H. (1989) *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.

Anderson, J.E. and van Wincoop, E. (2003) 'Gravity with Gravitas: A Solution to the Border Puzzle',
American Economic Review, 93(1), pp. 170–192.

Baldwin, R. (2016) *The Great Convergence: Information Technology and the New Globalisation*.
Cambridge, MA: Harvard University Press.

Besley, T. and Persson, T. (2011) *Pillars of Prosperity: The Political Economics of Development Clusters*. Princeton: Princeton University Press.

Farrell, H. and Newman, A.L. (2019) 'Weaponized Interdependence: How Global Economic Networks Shape State Coercion', *International Security*, 44(1), pp. 42–79.

Gereffi, G. (2018) *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*. Cambridge: Cambridge University Press.

Hofmann, C., Osnago, A. and Ruta, M. (2019) 'The Content of Preferential Trade Agreements',
World Trade Review, 18(3), pp. 365–398.

Krugman, P.R. (1979) 'Increasing Returns, Monopolistic Competition, and International Trade',
Journal of International Economics, 9(4), pp. 469–479.

Krugman, P.R. (1980) 'Scale Economies, Product Differentiation, and the Pattern of Trade',
American Economic Review, 70(5), pp. 950–959.

North, D.C. (1990) *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
Rodrik, D. (2011) *The Globalization Paradox: Democracy and the Future of the World Economy*.
New York: W.W. Norton.
Rodrik, D. (2018) 'What Do Trade Agreements Really Do?', *Journal of Economic Perspectives*, 32(1), pp. 73–90.
Rodrik, D. (2023) 'Productivism: A New Policy Paradigm?', Working Paper. Cambridge, MA: Harvard Kennedy School.
UNCTAD (2023) *World Investment Report 2023: Investing in Sustainable Energy for All*. Geneva: United Nations Conference on Trade and Development.
WTO (1994) *Agreement on Subsidies and Countervailing Measures*. Geneva: World Trade Organization.

2nd PLACE

ESG and Corporate Behaviour: Evaluating the Alignment of Profit and Social Goals

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Abstract

This paper examines whether ESG disclosure (Environment, Social and Governance) influences financial behaviour or primarily operates through reputational incentives. Whilst the reduced asymmetric information between firms and investors is intended to improve the pricing of environmental risk, evidence suggest the real effects of ESG are mixed. This paper therefore explores the extent to which ESG affects capital allocation, pricing, firm behaviour and environmental outcomes, with focus on whether this shift toward sustainability reflects substantive change or simply reputational considerations.

Introduction

Firms are profit making and therefore may not naturally align profit objectives with social goals particularly when sustainable investments involve upfront costs. This fundamental principle of firms mean that negative externalities exist where environmental damages are not fully internalised by the market prices. ESG frameworks intend to resolve this market failure through improving transparency between firms and investors.

ESG criteria refer to non-financial metrics used to evaluate firms' sustainability and ethical impact on society. It is a growing feature in financial markets, with mandatory disclosure requirements and corporate ESG reporting being the drivers to changes in portfolio

allocation and risk premia. As climate-related risks become ever-more important, investors are increasingly incorporating ESG information into valuation models to perform credit analysis on long-term performance.

Increased reporting of ESG is intended to reduce asymmetries in information and encourages investors to better price environmental risk. Consequently, firms are encouraged to use sustainable practices with investors choosing the high-performing firms with low environmental risk. Therefore, ESG is expected to influence firm's decision-making through influence of cost of capital, interest margins and real economic activity. However, the growth of ESG creates a debate as to whether it creates a genuine movement towards environmental goals or simply towards reputational management. There are concerns surrounding greenwashing, where firms may strategically disclose selective ESG information to enhance their perceived performance rather than implement sustainable improvements (Delmas & Burbano, 2011). As a result, the extent to which ESG aligns profit motives with environmental and social goals remains a topic of debate.

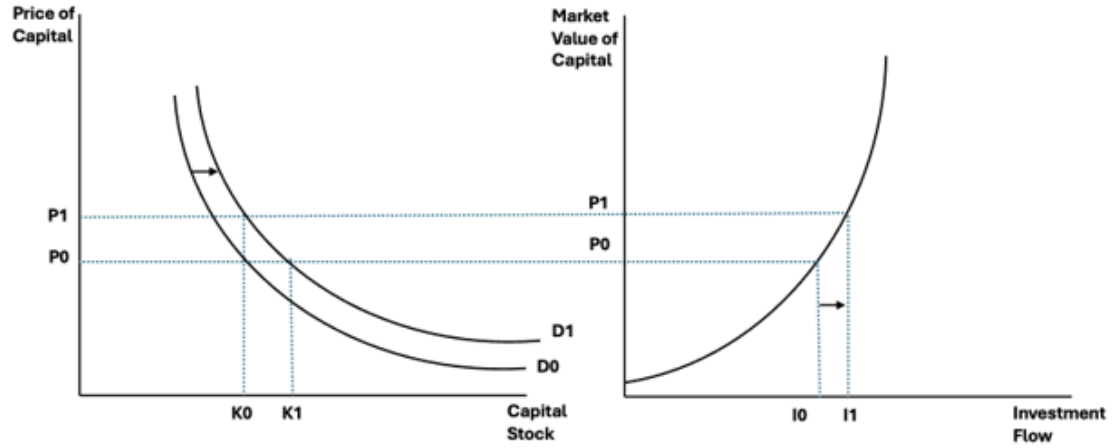
Theory and Previous Literature

The fundamental principle of profit making amongst firms means that negative externalities exist where environmental damages are not fully internalised by market prices (Helbling, 2010) as shown in Figure 1. The diagram shows that in an unregulated free market, firms produce more than socially optimal quantities because their private costs do not reflect the social cost of their actions, such as biodiversity loss. This creates a deadweight loss, representing the net loss to society.

ESG is theorised to reduce asymmetric information, where one party possesses more or better information than the other (Sugianto et al., 2022). This improved transparency enables enhanced pricing of environmental risks, which are crucial to credit assessments and lending decisions, therefore directly influencing financing costs (Tian, 2024). This effect operates through Tobin's Q, defined as the ratio of a firm's market value to the replacement cost of its capital (Equation 1). This is expressed diagrammatically in Figure 1, where an increase in ESG performance is interpreted as an outward shift in demand for capital, through lower perceived risk and reduced financing costs. Consequently, the increased Tobin's Q incentivises firms to invest in these sustainable projects, as the market valuation of new capital exceeds the replacement cost.

$$\textbf{Equation 1: } Tobin's\ Q\ Ratio = \frac{Market\ Value\ of\ Assets}{Replacement\ Cost\ of\ Capital}$$

Figure 1: Tobin's Q with the link between Investment and Capital Stock



Source: Author Drawn

Figure 1 Explanation:
The left diagram shows the relationship between the price of capital (P) and capital stock (K), whilst the right shows how investment (I) responds to changes in Tobin's Q. Increased ESG performance creates an outwards shift in demand for capital, which increases the price of capital (P0→P1) and capital stock (K0→K1). This increases Tobin's Q and leads to higher investment (I0→I1)

ESG therefore affects real investment via capital market mechanisms and can partially reduce the negative externality of environmental costs by changing firms' private financing incentives. Sustainability-linked loans and green bonds demonstrate how this operates in a different market to standard debt or equity. These financial products link borrowing costs directly to a firm's ESG performance (Poggensee, 2025), with better performing firms benefiting from lower margins and therefore creates a clear financial incentive for investors to invest in environmentally successful projects. This negative relationship arises because higher ESG performance reduces perceived reputational, regulatory and climate-related risks, which lowers the risk premium and associated downside drawdowns (Hoepner et al., 2023). This allows lenders to lower the interest margin and demonstrates how the borrowing costs link directly to a firm's ESG performance.

Discussion

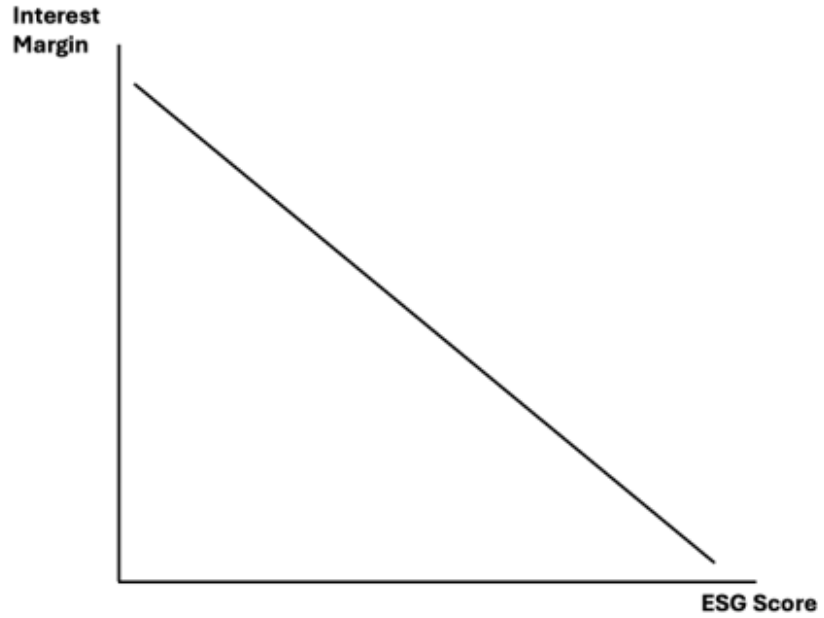
Despite the theoretical explanation of why ESG reporting can align profit motives with social and environmental goals, there are several limitations. Environmental and social costs are difficult to assign monetary value in order to fully internalise the negative externality (Nguyen et al., 2016). The inconsistencies with reporting of biodiversity loss, pollution costs, and climate risks mean that they are inaccurately measured and restrict investors' ability to accurately price these risks.

Furthermore, opportunities to provide inaccurate reporting allows firms to strategically disclose particular information that allow them to appear 'green' (Delmas & Burbano, 2011). This occurs due to the incentivised, enhanced reputation and therefore lower margins especially amongst green assets. Consequently, profit motives are not aligned with meeting social goals, as ESG scores no longer indicate environmental performance but instead act as a reputational measure. This can lead

to greenwashing which is the process of conveying a false impression or misleading information about how a company's products are environmentally sound (Hayes, 2022).

Moreover, participation in sustainable financial instruments such as sustainability linked loans and green bonds remain voluntary and therefore firms with weaker ESG performance will simply avoid these products due to the higher risk and consequential costs (Kim et al., 2025) (Figure 2). This means that they will fail to internalise their negative externalities and therefore the ESG principles are not inclusive for the entire market.

Figure 2: ESG Performance vs Interest Margins



Source: Author Drawn

Figure 2 Explanation:
The figure illustrates the inverse relationship between ESG performance and the interest rate, where firms with higher ESG performance face lower borrowing costs.

These limitations suggest that ESG alone may be inefficient at aligning profit motives with environmental goals and that Government Intervention may play a role in aiding this internalisation of costs. Regulation and standardisation can allow accurate ESG reporting which may otherwise distort the price of environmental risk that investors may take. Furthermore, government subsidies and support to investors in the green asset market allow increased supply of financial instruments like green bonds that can deter firms from withholding ESG data that would skew real performance (Zhang et al., 2023). Additionally, an increase in supply allows for lower prices and encourages firms to participate in this voluntary market. As a result, there are decreased opportunities for greenwashing and an increased quantity of firms internalising their negative externalities of environmental costs. Overall, firms' profit motives can therefore closely align to meeting these social goals.

Conclusion

The growth of ESG and its principles alone are reshaping firms' behaviour through decision-making regarding ESG reporting, whilst also influencing investors' behaviour, through portfolio allocation and risk pricing. Theoretically, ESG allows for reduced asymmetric information and encourages the internalising of negative externalities related to social and environmental costs, via changes in the price margins of investment products. However, this paper reveals that the true effects of these principles remain mixed, with reputational incentives encouraging unethical outcomes such as false reporting. Additionally, the green financial instruments market continues to be voluntary with lower ESG rated firms opting out due to a disincentive of higher interest margins. This means that whilst sustainability-linked finance has a potential to align profit with social goals, it is restricted without broader market participation.

ESG alone therefore cannot sufficiently align profit motives with environmental objectives and may need the use of Government intervention to aid this process. Regulation and targeted subsidies can enhance transparency through reduced distortions of information and increase participation in green financial markets. This allows for more effective reductions in asymmetric information, pushing firms to take accountability for their social costs, which can be internalised as investors accurately price environmental risk. However, as banking and investment decisions are often relationship-driven, financing is not determined solely by cost and therefore targeted subsidies may not achieve their full intended effect. Overall, stronger regulatory frameworks remain essential to influence firms' behaviour beyond reputational signalling and to support progress towards achieving social goals.

References

Chen, J., Yang, Y., Liu, R., Geng, Y. and Ren, X., 2023. Green bond issuance and corporate ESG performance: the perspective of internal attention and external supervision. *Humanities and Social Sciences Communications*, *10*(1), pp.1-12.
Available at: https://doi.org/10.1057/s41599-023-01941-2
(Accessed: 04/02/2026)

Delmas, M.A. and Burbano, V.C., 2011. The drivers of greenwashing. *California management review*, *54*(1), pp.64-87.
Available at: https://doi.org/10.1525/cmr.2011.54.1.64

Hayes, A., 2022. What is greenwashing. *How It Works, Examples, and Statistics, preuzeto s https://www. investopedia. com/terms/g/greenwashing. asp*.
Available at: https://www.innovation-line.com/PDFs/WhatIsGreenwashing2023.pdf
(Accessed: 04/02/2026)

Helbling, T., 2010. What are externalities. *Finance & development*, *47*(4), pp.48-49.
Available at: https://www.imf.org/external/pubs/ft/fandd/2010/12/basics.htm
(Accessed: 04/02/2026)

Kim, S., Kumar, N., Lee, J. and Oh, J., 2025. ESG lending. *Journal of Financial Economics*, *173*, p.104150.
Available at: https://doi.org/10.1016/j.jfineco.2025.104150
(Accessed: 04/02/2026)

Li, S. and Liu, C., 2025. Corporate strategic greenwashing under ESG disclosure uncertainty: Financing incentives and nonlinear effects. *Journal of Environmental Management*, *394*, p.127473.
Available at: https://doi.org/10.1016/j.jenvman.2025.127473

(Accessed: 04/02/2026)

Li Tian (2024) *The Role of ESG Disclosure in Reducing Debt Financing Costs for Chinese Corporations*, *Journal of Electrical Systems*, Vol. 20 No. 10s.
Available at: https://journal.esrgroups.org/jes/article/view/6162/4332
(Accessed: 04/02/2026)

Muhr, Y., 2024. *Exploring the Impact of ESG Ratings on Corporate Financing Decisions: Insights from the COVID and Post-COVID Period* (Master's thesis, Universidade Catolica Portuguesa (Portugal)).
Available at: https://www.proquest.com/openview/063835bbf352b3b6b73515e47bb3b2c8
(Accessed: 04/02/2026)

Nguyen, T.L.T., Laratte, B., Guillaume, B. and Hua, A., 2016. Quantifying environmental externalities with a view to internalizing them in the price of products, using different monetization models. *Resources, Conservation and Recycling*, *109*, pp.13-23.
Available at: https://doi.org/10.1016/j.resconrec.2016.01.018
(Accessed: 04/02/2026)

Poggensee, J., 2025. The pricing of sustainability-linked bonds on the primary and secondary bond markets. *Journal of Asset Management*, *26*(4), pp.411-431.
Available at: https://www.econstor.eu/handle/10419/323680
(Accessed: 04/02/2026)

Sugianto, N.A.P., Riandy, C.N., Zainavy, S.F. and Hartikasari, A.I., 2022. The contribution of environmental, social, and governance (ESG) disclosure to reduce investor asymmetry information. *Proceedings Series on Social Sciences & Humanities*, *7*, pp.56-61.
Available at: https://conferenceproceedings.ump.ac.id/pssh/article/view/472
(Accessed: 04/02/2026)

2nd PLACE

In What Ways Do Digital Platforms and Data Ownership Reshape Traditional Market Structure in Modern Economics? Evaluate the Consequences for Competition and Consumer Welfare

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In market economies, we know that sellers are price takers when they operate in perfectly competitive markets, and that the price at which transactions occur is the price at which consumers are willing to buy and firms are willing to offer, simultaneously. To simplify, we can say that firms use three types of information to design their price strategies: costs of production, rivals' pricing and their consumers' willingness to pay. If we assume that markets are transparent, the first two are relatively easy to observe. The third element requires firms to be able to predict how consumers take their economic decisions.

In traditional, physical markets consumers are quite difficult to observe: they can enter a shop and browse freely without being observed or traced. In most cases, their purchases are also anonymous. How do traditional sellers learn about their consumers' behaviour? And where do they get the data to work on that? They can use their own sales data, request market studies, or for instance, gain some information directly from their customers by offering loyalty programs that collect data on their identity and purchases in exchange for discounts or other promotional offers. But unless customers agree to join these programs and share their personal data, there is little sellers can do to get access to them. And even when they succeed, the data collected is limited to purchases from a single seller, and there is no information on how their consumers behave with respect to

rival products in the same market. Digital platforms changed this game in two fundamental ways: how they use the data shared by consumers to learn more about their shopping habits and predict how much they are willing to pay, and how they leverage on network effects to gain information on their rivals and undercut their competition.

In digital markets, consumers leave footprints when they browse a website: IP address (i.e. location), time spent on each page, where their cursor stands and for how much time, amounts of clicks, products saved on wish lists, products added to shopping cart, and so on. The quantity of data digital firms can collect on their users is way larger than in physical markets. There are indeed benefits in this practice – platforms use our data for targeted advertising, which is more likely to show us products we actually want to purchase, in a similar way in which the algorithms used by social media are more likely to show us the content we want to see. But this all comes with limits and potential risks when we consider the effects this might have on other aspects of the economy.

In recent years, the way platforms exploit these data has gone through a major evolution phase driven by algorithms. They collect consumers' browsing data via cookies and feed them to their proprietary algorithms to automate their pricing strategies (Spann et al. 2025). The better the technology used, the faster is this process, and the more a seller will be able to match consumers' willingness to pay and extract their surplus. This form of algorithm-driven first-degree price discrimination takes the name of personalised pricing or, when the adjustment is in real-time, dynamic pricing.

Dynamic pricing is something we are all recently experiencing when we buy flight tickets, book an Uber or, unfortunately, even when we try to book concert tickets, like it recently happened to those who tried to gain a seat for the long-awaited return of Oasis to the musical scene: concerts tickets seller Ticketmaster, who exclusively sold their tickets, used a dynamic pricing system that adjusted prices in real-time according to the demand flowing to the website. When tickets became available, the huge demand made their prices skyrocket and many people complained about the sudden price increase with no additional benefits compared to the price initially advertised. Ticketmaster has since been investigated by the UK Competition and Markets Authority (CMA, 2024; The Guardian, 2025).

To make this picture even more complicated, generative AI further improved algorithmic mechanism to automate pricing and other strategic decisions, making this process faster and more accessible to platforms that no longer need to develop proprietary algorithms (Cohen et al., 2024).

The potential economic problem in these new pricing strategies is that consumers usually do not have a clear view on their preferences, but they browse precisely because by observing prices they learn how much they are willing to pay for a specific good and eventually decide about their purchase. If platforms use their browsing behaviour to show each consumer a different price, the price they see while they are still learning about products is already influenced by their behaviour, and that price *distorts* their preference formation process. The risk of this system is therefore not just to extract consumer surplus,

but to produce an imbalance in the control that firms have on the economic decisions of consumers.

The evolution of digital markets also changed the way sellers access information on rivals and how they use it. Companies like Amazon or Google today enjoy (and exploit) massive network effects: they use their platforms to sell their own products but also allow many other sellers to join the platform and to face a quite large potential demand of customers, sometimes being in direct competition with them. Acting as intermediaries, they can access and track all the activities of their customers-rivals. This gives them a significant market power with respect to competitors that has already caused concern among competition authorities in the recent past. See, for example, the investigations that the CMA and the European Commission (EC) conducted on Amazon marketplace (CMA, 2022; EC, 2022). This framework led to regulatory responses such as the Digital Markets, Competition and Consumers Act in the UK in 2024 and the Digital Markets Act in the EU in 2022, with the aim of identifying and monitoring those platforms that act as "gatekeepers" in digital markets and prevent the possibility that they will abuse their market power.

Another way the evolution of digital markets is changing the way firms compete is the possibility to (tacitly) collude through algorithms. Many sources explored the extent to which firms use algorithms to elaborate information on rivals' prices into their own pricing strategies, undercutting competitors and eventually leading to higher final prices for consumers (for example, see Calvano et al., 2020 and Asker et al., 2021). Evidence from Brown & MacKay (2023) further shows that the more technologically advanced are the algorithms used, the more quickly firms update their prices and gain a competitive advantage with respect to slower rivals. In the real economy these systems risk to produce distortions in the market, as it was the case for the software company RealPage in the US, accused by the Department of Justice (DOJ) of using the data collected by landlords to artificially inflate and align rental prices and to maintain its dominant position in the market for property management software companies (DOJ, 2024). In the UK, the CMA just launched an investigation into major hotel chains for a similar alleged conduct (CMA, 2026).

In conclusion, the evolution of digital markets and the advancement of data processing technologies allowed platforms to learn more from the data they get from customers and rivals. Their ability to digest this huge amount of data allowed them to see patterns and elaborate complex strategies that are changing permanently the way they interact with us and with their competitors, raising significant challenges for competition authorities and policy regulators.

References

Asker, J., Fershtman, C., and Pakes, A. (2021), Artificial Intelligence and Pricing: The Impact of Algorithm Design, *NBER Working Paper 28535*, https://doi.org/10.3386/w28535

Brown, Z. Y., & MacKay, A. (2023). Competition in Pricing Algorithms. *American Economic Journal: Microeconomics*, 15(2), 109-156. https://doi.org/10.1257/mic.20210158

Calvano, E., Calzolari, G., Denicolò, V., & Pastorello, S. (2020). Artificial Intelligence, Algorithmic Pricing, and Collusion. *American Economic Review*, 110(10), 3267-3297. https://doi.org/10.1257/aer.20190623

CASE AT.40462 - Amazon Marketplace and AT.40703 – Amazon Buy Box. (12 December 2022). European Commission decision. *EUR-Lex*. Available at: https://competition-cases.ec.europa.eu/cases/AT.40462 and https://ec.europa.eu/competition/antitrust/cases1/202310/AT_40703_8990760_1533_5.pdf. Accessed on 2 March 2026.

Cohen, M., Spittle, T., Royer, J. (2024), Assessing Algorithmic Versus Generative AI Pricing Tools. Available at https://awards.concurrences.com/IMG/pdf/09_assessing_algorithmic_versus_generative_ai_pricing_tools.pdf . Accessed on 2 March 2026.

Competition and Markets Authority. *Investigation into Amazon's Marketplace.* Available at https://www.gov.uk/cma-cases/investigation-into-amazons-marketplace. Accessed on 2 March 2026.

Competition and Markets Authority. *Ticketmaster: consumer protection case.* Available at https://www.gov.uk/cma-cases/ticketmaster-consumer-protection-case. Accessed on 2 March 2026.

Competition and Markets Authority. (2 March 2026)*. Suspected anti-competitive conduct in relation to hotel accommodation services* [press release]. Available at : https://www.gov.uk/cma-cases/suspected-anti-competitive-conduct-in-relation-to-hotel-accommodation-services. Accessed on 2 March 2026.

Spann, M., Bertini, M., Koenigsberg, O., Zeithammer, R., Aparicio, D., Chen, Y., Fantini, F., Jin, G. Z., Morwitz, V. G., Popkowski Leszczyc, P., Vitorino, M. A., Williams, G. Y., & Yoo, H. (2025). Algorithmic pricing: Implications for marketing strategy and regulation. *International Journal of Research in Marketing*. https://doi.org/10.1016/j.ijresmar.2025.05.001

The Guardian. (25 September 2025). *Ticketmaster forced to change pricing and sales tactics after Oasis row.* https://www.theguardian.com/music/2025/sep/25/ticketmaster-advertises-tickets-oasis-cma. Accessed on 2 March 2026.

U.S. Department of Justice. (23 August 2024*). Justice Department Sues RealPage for Algorithmic Pricing Scheme that Harms Millions of American Renters* [Press release]. Available at https://www.justice.gov/archives/opa/pr/justice-department-sues-realpage-algorithmic-pricing-scheme-harms-millions-american-renters. Accessed on 2 March 2026.

U.S. Department of Justice. (24 November 2025). *Justice Department Requires RealPage to End the Sharing of Competitively Sensitive Information and Alignment of Pricing Among Competitors* [Press release]. Available at: https://www.justice.gov/opa/pr/justice-department-requires-realpage-end-sharing-competitively-sensitive-information-and. Accessed on 2 March 2026.

3rd PLACE

To What Extent Should Governments Intervene to Steer Innovation Towards Solving Global Challenges?

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The question of government intervention in innovation has acquired renewed urgency given the scale of contemporary global risks. According to the World Economic Forum's (WEF) Global Risks Report 2026, the three significant near-term challenges are geoeconomic confrontation, the rapid and destabilising adoption of AI, and social polarisation. Each illustrates a distinct form of market failure that the private sector cannot resolve alone. This paper argues that targeted government intervention is both economically justified and politically necessary but must be carefully designed to avoid supressing the very innovation it seeks to direct. The appropriate extent of intervention is therefore not a fixed quantity but a function of institutional capacity, democratic legitimacy and the specific nature of the failure being addressed.

Geoeconomic Confrontation

Geoeconomic confrontation has risen to first place in the WEF's 2026 risk rankings, reflecting the accelerating breakdown of the post-war multilateral trading order. Having ranked ninth in 2025, it now commands 18% of expert responses as the risk most likely to trigger a near-term global crisis. The US-China technology rivalry is the defining case study. The US CHIPS and Science Act (2022) committed approximately $280 billion in public funding, including $53 billion in direct semiconductor manufacturing subsidies,

explicitly framed as a response to strategic competition with China. The EU followed with its own European Chips Act, deploying €30 billion to reduce dependence on East Asian supply chains, while Germany extended direct state subsidies to support TSMC's new facility in Dresden.

These interventions demonstrate that in a world of intensifying geoeconomic fragmentation, governments feel compelled to steer innovations for reasons of national security which is rational to an extent. Semiconductor supply chains represent genuine strategic vulnerabilities: the COVID-19 pandemic exposed the economic costs of excessive concentration in critical goods. However, the WEF estimates that 68% of respondents foresee a multipolar or fragmented world order in which major power enforce regional technological norms rather than cooperating on shared challenges. The limitation of security-driven intervention is that it can distort the global innovation ecosystem, making coordinated responses to truly shared problems like climate change, pandemics and AI safety which are structurally harder to achieve. Strategic industrial policy comes with the risk of solving national problems at the expense of global ones. The proliferation of rival subsidy regimes also raises the spectre of an escalating race in which public resources are diverted from socially productive investment toward geopolitically motivated duplication.

AI Adoption

The rapid adoption of AI presents a clearer and more analytically tractable case for intervention, grounded in classic market failure. The IMF estimates that approximately 40% of global employment is exposed to AI-related disruption, rising to 60% in advanced economies. Goldman Sachs projects that up to 300 million jobs could be displaced or substantially transformed by 2030. The WEF's Future Jobs Report 2025, forecasts 92 million job displacements against 170 million new roles created. This is an overall net gain but one that conceals severe transitional costs distributed across skill levels, sectors and geographies. Workers without post-secondary education, women in administrative and service roles and lower-income workers in emerging markets face significantly reduced occupational mobility, while those best placed to benefit are already the higher earners.

The macroeconomic transmission mechanism is direct. AI-driven displacement reduces incomes for affected workers, constraining consumption, aggregate demand and restricting economic expansion even as productivity rises for firms and capital owners. The divergence between private and social returns to AI investment justifies public intervention and the evidence is not merely theoretical. In 2025, approximately 55,000 US job cuts were directly attributed to AI, with major employers like Amazon and Salesforce explicitly replacing human labour with automation. Meanwhile, the IMF estimates that over 40% of workers will require significant reskilling by 2030, yet only half currently have access to training programmes capable of delivering it.

Left to market mechanisms, the gains from AI accumulate disproportionately to high-skilled workers and capital owners while costs fall on those least equipped to absorb them which is a dynamic the WEF terms as the risk of permanently K-shaped economies. If displacement suppresses consumption among a large share of the workforce without adequate redistribution, the result is a constraint on aggregate demand that limits growth even as productivity rises which is a form of demand-side stagnation driven by distributional failure. Government intervention in the form of mandatory reskilling

programmes, portable employment benefits and redistributive taxation of AI-generated productivity gains is not just desirable but economically necessary if AI is to contribute to broad-based growth.

The Case Against Over-Intervention

The case for intervention must nonetheless be tempered by serious engagement with its well-documented costs. The EU Artificial Intelligence Act (2024), the world's first comprehensive binding AI regulatory framework, adopts a risk-tiered approach imposing stringent compliance obligations on high-risk AI applications. Annual compliance costs for medical AI have been estimated at approximately €29,000 per unit, with certification costs between €16,800 and €23,000. Critics argue this burden has deterred investment, widened the innovation gap between Europe and the United States, and contributed to the technological dependency the Act was designed to reduce. The Draghi Report on European competitiveness warned that regulatory overreach, combined with fragmented capital markets and chronic underinvestment in R&D, risks rendering Europe structurally marginal in AI development which was the very outcomes that motivated the regulation.

More theoretically, Hayek's knowledge problem represents a persistent structural constraint on state-directed innovation. Governments cannot aggregate the dispersed knowledge required to reliably predict which technologies will generate the greatest social returns, making prescriptive intervention prone to misallocation. Historical industrial policy is replete with examples of governments picking losers subsidising technologies or incumbent firms that failed to deliver promised returns. These arguments do not undermine the case for intervention in principle, but they do demand that it should be targeted, adaptive and institutionally grounded rather than prescriptive. The question therefore is not whether to intervene, but under what conditions is intervention most effective.

Social Polarisation

The WEF describes contemporary societies as 'on the edge', with rising polarisation intensifying pressures on democratic institutions. Extremist social, cultural and political movements challenge institutional resilience and public trust, while deepening 'streets versus elites' narratives reflect widespread disillusionment with governance structures and scepticism that policymaking can deliver tangible improvements to livelihoods. Inequality was identified as the most interconnected global risk for a second consecutive year, followed closely by economic downturn underscoring how the distributional consequences of technological change are not just economic but systemic threats to democratic stability.

This has direct and underappreciated implications for innovation governance. Governments that deploy innovation strategies primarily in service of geopolitical competition or corporate productivity, rather than broad-based welfare, risk accelerating the disillusionment that feeds polarisation. The legitimacy of interventions is therefore inseparable from its distributional character. If citizens perceive innovation policy as enriching a technological elite while leaving them economically exposed, they are more likely to support movements that reject the institutions through which effective innovation governance must operate. Conversely, intervention perceived as genuinely redistributive such as investing in communities disrupted by automation, funding public-interest research, ensuring democratic accountability over AI deployment can strengthen the social contract rather than erode it. Yet polarisation simultaneously constrains the multilateral

cooperation that global challenges demand. Rising nationalism and democratic erosion make it structurally harder to sustain cross-border coordination on AI safety standards, climate aligned R&D or pandemic preparation especially when such coordination is urgently needed. This is the central paradox of innovation governance in the present moment; the conditions that most demand collective action are the same conditions that make it hardest to achieve.

Conclusion: Towards Adaptive and Accountable Intervention

The three WEF risks examined here collectively demonstrate that markets are insufficient to steer innovation towards solutions to shared global challenges. Government intervention is justified by genuine market failures such as the distributional externalities of AI displacement, the coordination failures embedded in geoeconomic rivalry, and the systemic risk of technological inequality feeding democratic fracture. However, the appropriate extent of intervention depends critically on its design. Three principles follow from this analysis.

First, intervention should target genuine market failures rather than national competitive advantage. The semiconductor subsidies race addresses security concerns but fragments the global innovation architecture needed to address collective problems. Second, intervention should be adaptable and experimentalist rather than prescriptive. The EU AI Act's compliance architecture risks supressing innovation faster than it generates safety benefits. Instead, voluntary but transparent framework, such as NIST's AI Risk Management Framework offer an alternative, however their lack of binding force limits accountability.

Third and most fundamentally, innovation governance must be embedded in inclusive democratic processes. Policy perceived as serving a techno-elite will deepen the polarisation it purports to address. Deliberative mechanisms giving displaced workers, developing- country citizens and future generations a meaningful voice in how innovation is directed are a prerequisite for the political sustainability of any intervention.
The extent to which governments should intervene is therefore considerable. However, scale alone is insufficient. Strategic, democratically accountable and redistributive oriented public steering offers the most credible path toward directing the transformative potential of contemporary innovations toward the global challenges of our time.

References

European Commission, 2024. *The Draghi Report on EU Competitiveness*. [Online] Available at: https://commission.europa.eu/topics/competitiveness/draghi-report_en

World Economic Forum, 2025a. *The Future of Jobs Report 2025*. Geneva: World Economic Forum. [Online] Available at: https://www.weforum.org/publications/the- future-of-jobs-report-2025

Briggs, J. and Kodnani, D., 2023. The potentially large effects of artificial intelligence on economic growth. *Global Economics Analyst*. New York: Goldman Sachs Global Investment Research. [Online] Available at:https://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.html

Cazzaniga, M., Jaumotte, F., Li, L., Melina, G., Panton, A.J., Pizzinelli, C., Rockall, E.J. and Mendes Tavares, M., 2024. *Gen-AI: Artificial Intelligence and the Future of Work*. IMF Staff Discussion Notes, SDN/2024/001. Washington, DC: International Monetary Fund. [Online] Available at: https://www.imf.org/en/publications/staff-discussion-notes/issues/2024/01/14/gen-ai-artificial-intelligence-and-the-future-of-work-542379

European Parliament and Council of the European Union, 2024. Regulation (EU) 2024/1c8S of the European Parliament and of the Council of 13 June 2024 Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act). Official Journal of the European Union, L 1689, 12 July. [Online] Available at: https://artificialintelligenceact.eu

World Economic Forum, 2025b. The Global Risks Report 2025: 20th Edition. Geneva: World Economic Forum. [Online] Available at: https://www.weforum.org/publications/global-risks-report-2025

World Economic Forum, 2026. The Global Risks Report 202c: 21st Edition. Geneva: World Economic Forum. [Online] Available at: https://www.weforum.org/publications/global-risks-report-2026

3rd PLACE

ESG-Driven Policies: A Bridge to Environmental Limits or a Buffer for Business-as-Usual?

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As 2026 is coming through, the global economy faces a great conundrum. Since the advent of the industrial revolution, the dominant economic paradigm has assumed that infinite growth is possible on a finite planet. Now the environmental crisis is intensifying as the tension between Gross Domestic Product (GDP) expansion and the Earth's biophysical limits has become the central challenge for economics. To address this, Environmental, Social and Governance (ESG) policies have been designated to incentivize better environmental practices. Can ESG bridge the gap between growth and limits, or is it simply a more complicated way of navigating the decline?

To evaluate a policy, we must first establish the environmental limits we are trying to adhere to. The most robust guide for this is the Planetary Boundaries framework. This system consists of 9 areas with respective Safe Zones, Zone of Uncertainty (increasing risk) and Zone Beyond Uncertainty (high risk). This framework nine critical processes, stratospheric ozone, aerosols, ocean acidification, nitrogen and phosphorus cycles, freshwater use, land system change, biosphere integrity and climate change, these maintain the Holocene conditions in which human civilizations have thrived in the past 12,000 years (Johan Rockström and Gaffney, 2021).

These boundaries interact through complex feedback loops. Surpassing the threshold in one are, such as land-system change, can accelerate the transgression of others, like biosphere integrity or climate change. As of the most recent comprehensive assessments, six of the nine boundaries have already been transgressed. We have moved from the “Safe Zone” into the Zone of Uncertainty” and into the “Zone Beyond Uncertainty”. Proponents of this framework argue that staying within a safe operating space requires radical shifts such as large-scale diet changes like reducing meat consumption, drastic increases in water usage efficiency and ambitious air pollution policies. Most notably, it suggests that without a reduction in material consumption levels, reaching the safe zone again may be physically impossible (Johan Rockström and Gaffney, 2021).

ESG began as a voluntary movement. Under the jurisdiction of the UK it is now becoming mandatory. The “E” in ESG suffers from a design flaw, which stands out as measurement bias. Most ESG ratings measure Financial Materiality, which includes how climate change can hurt a company’s profit rather than environmental impact which is how the company hurts the planet. A tech giant can achieve an “AAA” rating by having a diverse board and energy-efficient offices, while its supply chain remains dependent on water-intensive semiconductor manufacturing and rare-earth mining.

To reflect reality, a Double Materiality approach must be adopted. This requires companies to report their bottom-line risks and external environmental footprints. Without standardized data, high polluters can “green-crowd”, claiming they are “better than the industry average”, while still increasing their emissions.

Additionally, ESG policies fall victim to the Rebound Effect or the Jevons Paradox. When a company uses ESG-driven AI to increase resource efficiency, the resulting lower costs often lure consumers into buying more of the product. Unless resources use is strictly capped, the efficiency gains are offset by increased consumption, leading to a net increase in environmental degradation.

A central theme in modern economics is decoupling. ESG policies currently support relative decoupling, where GDP grows faster than environmental impact. A company that might increase its waste output by 2% while its revenue grows by 10%. While this may look progress. The earth’s limits are absolute, not relative. A “cleaner” unit of growth is still an additional unit of stress over an already over-exploited ecosystem.

While some nations have successfully decoupled GDP from territorial CO2 emissions, they have largely failed to decouple form their total material footprint. The Global North is outsourcing its extractions to the Global South. To respect planetary boundaries, we require absolute decoupling, where the total resource impact trends toward zero or becomes negative, even as economic value increases. ESG is currently a “buffer” that slows the rate of degradation, but it is not yet a “bridge” to this new reality.

In 2026, the UK has taken significant steps to improve the situation. The Sustainability Reporting Standards (UK SRS) are now finalised, and make disclosure mandatory. On top of that, the Sustainability Disclosure Requirements and the “Anti-greenwashing Rule”

enforced by the FCA mean that vague claims like “carbon neutral” or “eco-friendly” are now legally dangerous. Companies can be fined up to 10% of their global turnover for misleading claims, and products often require a full Lifecycle Assessment (LCA) to justify their marketing (FCA, 2023). This regulatory pressure is forcing a shift from “doing less harm” to “doing more good”.

If traditional GDP growth, which measures the speed at which resources are turned into products cannot fit within planetary boundaries, what can? The answer is regenerative and circular economics.

A circular economy aims to eliminate the concept of waste. Products are designed for reabsorption (compost) into the Earth or for endless remanufacturing. Designing a product for decomposition is not just a design choice, it is an economic strategy to decouple value from extraction (Ellen MacArthur Foundation, 2023).

Regenerative economic goes further, treating the economy as a living system. Instead of just “sustaining” a degraded status quo, regenerative practices, such as regenerative agriculture, actively restores the environment. By using no-till farming, cover crops, and diverse rotations, we can turn farmland into a carbon sink. In this model, the goal is not to increase the volume of products sold, but to increase the quality and health of the assets we depend on (Business Case Studies, 2025).

The debate is divided into two groups: green growth proponents who argue that with advanced technology GDP can be grown infinitely while reducing environmental impact to zero (Khan, Razak and Premaratne, 2025); post-growth/degrowth defenders claim that the economy must be scaled down in high-income nations to allow the environment to recover, advocating for thriving rather than growing economies (Walton, Oji and Eldridge, 2023).

Growth and regeneration of the environment can coexist but not in the traditional way growth has been conceived in the last decades. It is important to adjust expectations and choose pragmatic metrics to align with our activities. The evidence suggests that if growth is to continue, it cannot be the growth of the 20th century. We must transition to a model where prices reflect the true cost of restoring the environment. This means extended producer responsibility, where companies remain financially responsible for a product throughout its entire life, ensuring its path back to the earth or to remanufacturing.

The true question is whether we can meet the magnitude of the problem in time. If ESG remains a “check-the-box” exercise for stakeholder, it will fail. To be a true bridge, ESG must be transformed into a framework for restorative practice. We must value natural capital as much as financial capital.

The pollution and system destabilization we are witnessing, from nitrogen imbalances to climate change, threatens to accelerate the arrival of catastrophic tipping points. Our mission is to return these Earth systems to their optimal levels. This may require us to “degrow” certain sectors like fossil fuels or industrial meat, while aggressively growing others like regenerative practices and circular design.

Ultimately, economic growth is not an end, it is a means to an end. If that growth destroys the biospheric integrity that allows us to live, it is not wealth, it is an ecological debt that we cannot afford to repay. The shift from an extractive logic to a regenerative one is no longer a radical preference, it is a biological and economic necessity.

References:

Anderson, K. (2025). *What is financial materiality?* [online] greenly.earth. Available at: https://greenly.earth/en-gb/blog/company-guide/what-is-financial-materiality.

Ayde, O.R. (n.d.). *Jevons Paradox: The Unintended Consequence of Efficiency*. [online] Oh My Econ. Available at: https://ohmyecon.org/journal/jevons-paradox-the-unintended-consequence-of-efficiency [Accessed 2 Mar. 2026].

Business Case Studies. (2025). *What is a Regenerative Economy*. [online] Available at: https://businesscasestudies.co.uk/what-is-a-regenerative-economy/ [Accessed 2 Mar. 2026].

Ellen MacArthur Foundation (2023). *What Is a Circular economy?* [online] Ellen MacArthur Foundation. Available at: https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview.

FCA (2023). *FG24/3: Finalised non-handbook guidance on the anti-greenwashing rule*. [online] FCA. Available at: https://www.fca.org.uk/publications/finalised-guidance/fg24-3-finalised-non-handbook-guidance-anti-greenwashing-rule.

Johan Rockström and Gaffney, O. (2021). *Breaking Boundaries*. Penguin.

Khan, R.Z., Razak, L.A. and Premaratne, G. (2025). Green Growth and Sustainability: A Systematic Literature Review on Theories, Measures and Future Directions. *Cleaner and Responsible Consumption*, [online] 17, p.100274. doi:https://doi.org/10.1016/j.clrc.2025.100274.

Sustainability Directory (2025). *What Is the Difference between 'Relative' and 'Absolute' Decoupling? → Learn*. [online] ESG → Sustainability Directory. Available at: https://esg.sustainability-directory.com/learn/what-is-the-difference-between-relative-and-absolute-decoupling/?__r=1.f7c8392b5259d9cbe9bb9bf967cb947e [Accessed 2 Mar. 2026].

Walton, J.L., Oji, A. and Eldridge, A. (2023). Degrowth and Postgrowth. *openpress.sussex.ac.uk*. [online] Available at: https://openpress.sussex.ac.uk/sustainabilityeducatortoolkit/chapter/degrowth-and-postgrowth/.

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From the Killing Fields to the Exhausted Peace Dividend: Assessing the ‘Triple Trap’ of Governance, Skills and Geopolitics in Cambodia

Sam Clarke

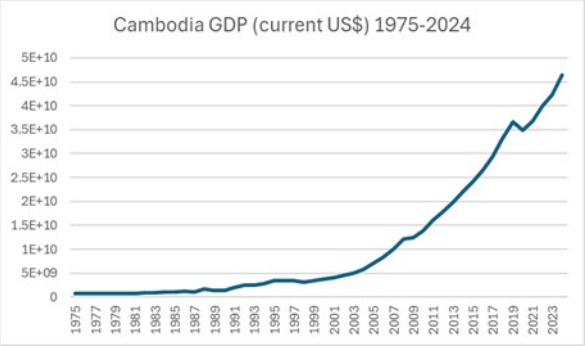
Development Economics 2025 - 2026

Introduction

For two decades, Cambodia was the ‘growth powerhouse’ of Southeast Asia, averaging 7% annual growth through peace, cheap labour, and integrated trade. However, the 2025 Thai-Cambodian conflict has exposed the demise of the ‘peace dividend’. This study argues that Cambodia is entering a ‘triple trap’: of a human capital deficit rooted in genocidal legacies; a governance trap from the dual-track economy of institutional imbalances; and the geopolitical vulnerability from over reliance of conflicting neighbours. Cambodia’s traditional engines of growth are causing diminishing returns, holding back the development of Cambodia’s aspirational ‘Pentagonal Strategy.’ To graduate to upper-middle income status, Cambodia must strategically pivot towards Total Factor Productivity (TFP) growth. This will only be accomplishable through the development of self-sufficient production, digitising the informal economy and achieving energy independence to power its next generation of ‘sunrise industries.’

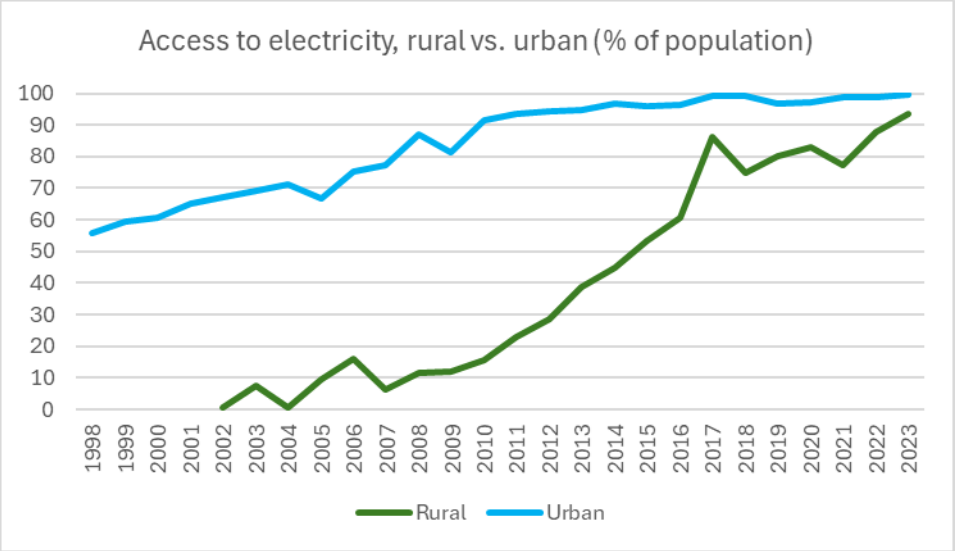
The Transition from Recovery to Resilience

Cambodia’s economic performance has been defined by aggressive expansion and transformative structure for the past two decades. The kingdom has leveraged its ‘Peace Dividend’ to successfully tenfold its economic output. World Bank Data calculates that nominal GDP surged from $3.69 billion in 2000 to an estimated $46.35 billion in 2024. Growth rates have seen historical volatility, peaking to double digits in the early 2000’s before crashing -3.5% with the rest of the world during the 2020 pandemic. Overall, Cambodia’s recovery from its number of hardships have been robust, with growth stabilising at 5.1% in 2022, holding constant since then, reaching 6% in 2024.



Vulnerabilities remain in 2023 trade data (OEC, 2023), with Cambodia’s growth being historically propelled by a narrowed export portfolio. The economy remains reliant on Western consumption and eastern investment; The United States alone makes up for $12 billion (35%) of total exports, dwarfing contributions from neighbours like Vietnam ($1.55Bn) and China ($1.87Bn). Specialisation focuses on the ‘old engine’ of development; labour intensive textile production, majorly knitwear ($2.71Bn) and women’s Suits ($1.93Bn). However, the export of semiconductor devices ($2.65Bn) is the result of a rapidly expanded electrical production market (Seyhah & Vutha, 2019), with growing FDI interest in Cambodia’s technology related industries such as automotive OEM (Lammarino et al., 2024). To transition the economy from labour-intensive to skill-based, the

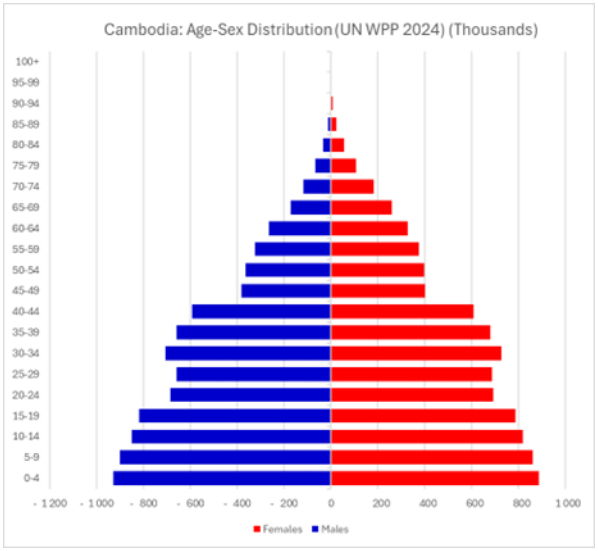
Government launched the Pentagonal Strategy: Phase I in 2023. Building on the previous 'Rectangular Strategy' (Royal Government of Cambodia, 2004), this revised agenda focuses on five major pillars; Growth, Employment, Equity, Efficiency and Sustainability. The key aim of this strategy is to bridge the gap created by the rural-urban divide and foster inclusive equity (Lammarino et al., 2024). This commitment is held through the government's drive towards electrification. While Urban areas have stayed stable since 2010 (The World Bank, 2023), rural power access has skyrocketed from less than 0.8% in 2004 to 93.4% in 2023.

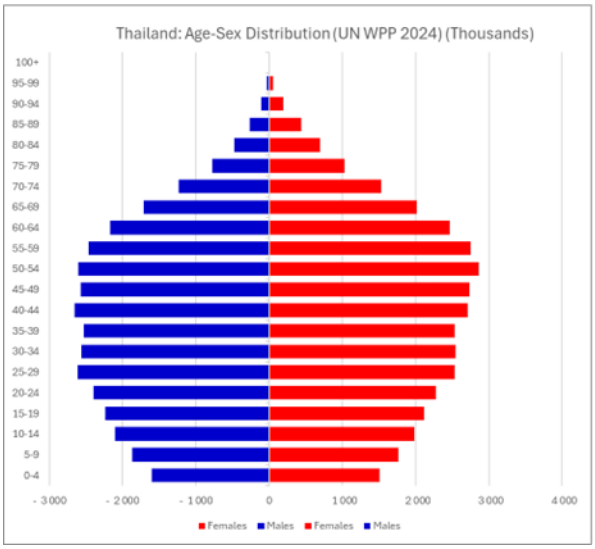


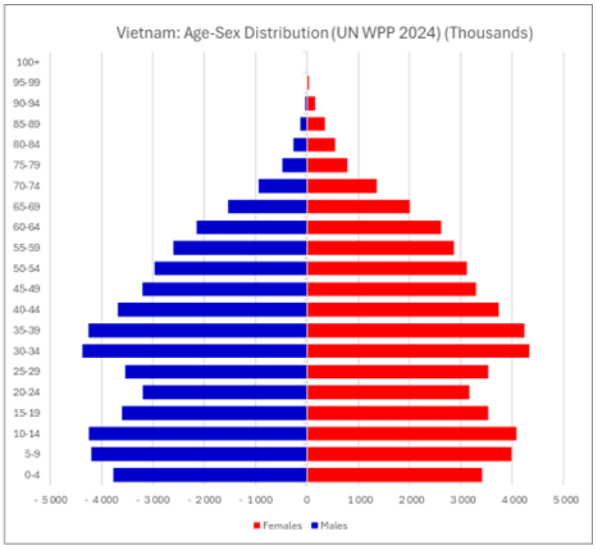
This success in infrastructure developments provide the physical foundation for the Pentagonal Strategy's digital goals, creating new potential for rural SMEs to efficiently integrate into the modern economy. Conversely, subsequent analysis will demonstrate that while infrastructure is improving, the software skills and governance lags; threatening stalls to the transformative growth Cambodia is striving for to reach upper-middle-income status.

The Missing Generation and the Khmer Rouge Regime

The Khmer Rouge regime (1975-1979) resulted in the death of almost 90% of the nations educators, completely dissolving the formal education system (Chigas & Mosyakov, n.d.). This trauma created a distinct 'education vacuum' in the labour market for years to come. The parents of the current working generation were largely denied schooling due to a lack of qualified teaching. Consequently, Cambodia has suffered from a substantially lower intergenerational knowledge transfer; losing out on the exchange of critical knowledge, social cohesion and reducing the capacity for adaptation and innovation (Jeong, 2024). Comparing neighbouring economy Vietnam, a nation that faced economic turmoil at a similar time due to war, educated households nurtured soft skills and critical thinking at home, with post war literacy rates being one of the highest globally (Han, 2022); a luxury Cambodia could not endure as millions of Cambodia's youth entered the workforce with a 'literacy ceiling' as a result of a recovering public school system.







World Bank data highlights the widening regional knowledge gap. Cambodia's literacy rates sharply declined from 88% to 72% in 2021, reverting to early 2000's levels, while Vietnam's rates proved robust growth, growing to 96% in 2022 with rates still high at 90% in 2000. This deficit in education is visible in the Human Capital Index (HCI). World Bank Data from 2024 indicated that Cambodia has an HCI score of 0.49. Cambodia places significantly behind Thailand (0.61) and Vietnam (0.69). Although we see a development in the quality of human capital, it remains stunted.

The Stress Test of 2025

The short-lived but now resurrected (as of December 2025) border conflict against Thailand of July 2025 showcased another notable 'stress test' for the Cambodian economy. Structural weaknesses in traditional growth engines were exposed, as well as highlighting the various constraints facing its future industrial strategy.

Old Engines: Interdependence and Vulnerability

During Cambodia's impressive upheld growth over the past two decades, their strategy relied heavily on open borders and regional integration. The 2025 conflict disrupted this way of operating, revealing a strong over-dependence on Thailand for both consumption (in the form of tourism) and agriculture.

Before the conflict, Thailand was Cambodia's single largest source of tourism. Thailand made up for approximately 32% of all international arrivals in 2024 (Cambodian Ministry of Tourism, 2024). The 'Boycott Thailand' movement and consequential Thai retaliations resulted in a 92.3% plunge in Thai visitor tickets sales to the Angkor Wat in July (Khmer Times, 2025), alongside a 91% total decline in arrivals from Thailand in September (TravelMole, 2025). Unlike the global COVID-19 pandemic, which created a global demand shock, this specific geopolitical shock isolated Cambodia from one of its primary regional markets.

Agricultural markets in Cambodia saw more immediate impacts on the logistics of its trade with Thailand. Cambodia is Southeast Asia's largest exporter of raw cassava, but 35-40% of its annual harvest historically moved to Thailand for processing (Cambodianess, 2025). The closure of the Poipet and Duong checkpoints during the July conflict left vast quantities of perishable cassava and maize stuck at the border. Exporters had to quickly adapt to this roadblock, diverting shipments to the domestic market and Vietnam, creating a shock to supply that ultimately negatively impacted the price farmers received for their produce, falling 43% from $0.09 per kilogram to $0.05 per kilogram (350 riels per kilo to an average of 200 riels) (Nikkei Asia, 2025). This incident has highlighted the need for Cambodia to hold better domestic processing capacity, without said improvements Cambodian agriculture remains hostage to its cross-boarder political cohesion.

New Engines: Assessing the Optimistic Pentagon Strategy

In response to these vulnerabilities, as well as Cambodias over reliance on Chinese FDI, the Royal Government has aimed to accelerate the 'Pentagonal Strategy – Phase I,' which aims to pivot the economy to prioritise the growth of higher value-added activities. While Cambodia is making big steps to close in on these targets, with the World Bank (2025) highlighting a 47% increase in electronic imports, it faces a critical constraint: energy security.

Cambodia's 'sunrise industries' have shown resilience against the recent crisis; focusing on bigger pushes towards high-value assembly, fintech and green energy. In May 2024 Toyota opened their new Tsusho Manufacturing plant in the Royal Group Phnom Penh Special Economic Zone (SEZ), signalling a decisive shift to complex industrial assembly from the dated low-skilled garment stitching. This $36.8 million facility with capacity to produce 1,320 units in 2024 (Khmer Times, 2024) served as a 'proof of concept' for modern industrialisation, demonstrating the potential for further investment to localise production into Cambodia's growing consumer class.

The Bakong Payment System, Cambodia's real-time electronic payment system that was introduced in 2020 has been a significant macroeconomic stabiliser. By 2024, Bakong transaction values grew to over $105 billion, totalling to be three times the Cambodian GDP. This new infrastructure reduced costs for local businesses and allowed for better integration for the rural and agricultural population into the formal economy (Kapronasia, 2025). This rapid adoption rate aids domestic trade in preventing physical cash shortages, while also reducing the friction of cross-border trade.

To become more attractive for foreign, ESG conscious investment, The government has set an aspirational target to have renewable energy generation account for 70% of Cambodias consumption by 2030 (MME, 2024). This economic strategy aims to differentiate Cambodia from neighbours Vietnam and Thailand as the 'Green Factory of the ASEAN,' incentivising corporations to relocate for carbon credit benefits.

However, these industries are energy-intensive. Cambodia's energy costs are some of the most expensive in the ASEAN ($0.13-$0.14/kWh), compared to Vietnam's $0.07/kWh (International Trade Administration, 2025). To become more competitive, Cambodia bought cheap natural gas from the Overlapping Claims Area in the Gulf of Thailand, a negotiation that has been disrupted by political tension, stripping Cambodia's access of 11 trillion cubic feet of gas (Ministry of Foreign Affairs, Thailand, 2025).

Institutional Analysis

Although Cambodia's capital accumulation and growing labour demographics can help to explain potential growth, corruption and institutional quality determines the sustainability of said improvements. The governance landscape has evolved into a 'dual-track economy,' where those stuck in the lower-middle-income trap are threatened most.

The first track in the structure is the 'clean zone,' inhabited by large Multinational Corporations (MNCs) operating within Cambodia's Special Economic Zones (SEZs). Firms such as Toyota are often bound to strict compliance laws in the other nations they operate in; reporting to bodies such as the US Foreign Corrupt Practices Act (FCPA) or the UK Bribery Act. To make this market appealing for established corporations, the Cambodian government introduced SEZs, effectively insulating these firms from the country's usual bureaucratic friction. These SEZs have created their share of good and adverse effects on development. Studies finding benefits of the SEZ zone found evidence in job creation of around 68,000 in 2015 (Warr & Menon, 2015), as well as an increase in female employment and reduced income inequality (Brussevich, 2024). Although SEZs positively effect FDI, research has shown a potentially negative impact on overall foreign investment nationally (Thangavelu et al., 2023); potentially impacting the welfare of those in both rural and urban areas where FDI is overlooked due to better certainty on returns and ease of business in these new zones.

The Second is the economic grey zone most of Cambodia's activity lay under, this track is comprised of small and medium enterprises. These firms do not experience the bureaucratic luxuries like those inside the SEZ; they are challenged with a regulatory environment characterised by asymmetric information and informal taxation loopholes. The

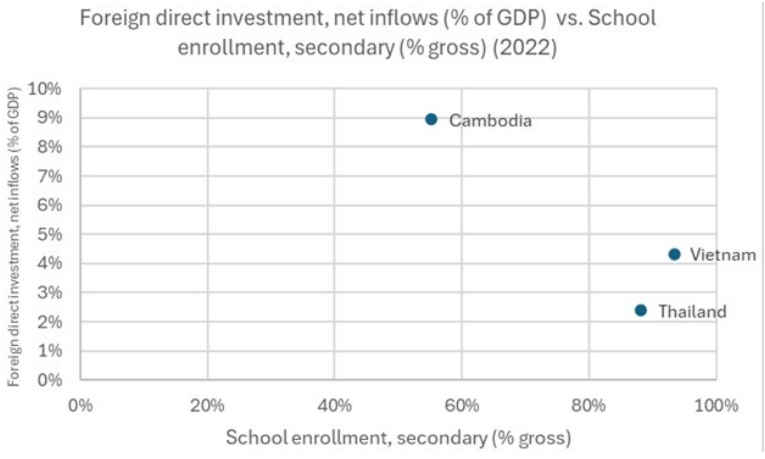
2023 World Bank Survey finds that approximately 11.4% of Cambodian firms reported experiences of at least one bribe payment during transactions with public institutions.

Standard development theory implies that FDI creates a technology ‘spillover’ to the local economy. Corruption in Cambodia acts as a non-tariff barrier that blocks FDI’s full potential. Due to the first track needing well audited, transparent supply chains for ESG standardisation, they cannot procure goods locally from the second track as they operate in an informal, cash-based economy to avoid predatory tax officials. This results in Cambodian FDI remaining an ‘island’ in the SEZ. The Toyota plant may assemble its parts in Phnom Penh but imports the majority if its parts because local suppliers are unable to meet the ‘clean’ standards and certification requirements. This can leave small to medium enterprises trapped in low-value trade, as they are unable to integrate to a global scale (Ali et al., 2023).

There is sufficient evidence proving that the impact of this corruption is severe. The 2024 Corruption Perception Index (CPI) places Cambodia at 158th out of 180 nations, obtaining a score of 21/100; the second lowest score in the ASEAN after Myanmar. With Vietnam achieving a CPI score of 41/100, the ‘corruption premium’ in Cambodia could often outweigh the benefits of lower wages, particularly in the technology industry where intellectual property protection and contract compliance are invaluable to business performance. Evidence of this can be found in a study by Yeh et al. (2023), showing that Vietnam ranked first over Cambodia for real estate investments, with another study finding that Vietnam’s action on anticorruption campaigns has improved investment efficiency, especially for firms that are state-affiliated (Hoang et al., 2022).

Inequality & the ‘Grey Zone’

Although the robust growth, a dangerous economic dynamic is being masked; a strong rural-urban divide with 61.5% of the multidimensionally poor in rural areas. This creates a ‘K-shaped’ recovery where the agricultural sector stagnates while urban services develop (OPHI, 2024). At the same time, this figure shows the ‘FDI paradox.’ Cambodia attracts disproportionately high FDI (9% of GDP versus Vietnams 4%) (World Bank, 2025), despite secondary school enrolment being 55% compared to Vietnam’s 93%. This suggests low wages drive investment instead of productivity, creating risks of capital flight as labour costs increase (EAF, 2025).



Conclusion

To escape the ‘triple trap’ of skills deficits, corruption and geopolitical fragility, the Royla Government of Cambodia just change its current factor accumulation strategy to one of institutional modernisation. Although the Pentagonal Strategy correctly names human capital and digitising as top priority, current institutions are insufficient to overcome the drawbacks of the ‘dual-track’ economy.

The Thai-Cambodian conflicts highlight the risks of over reliance on neighbours for trade access. The government needs acceleration in the expansion of the Sihanoukville Autonomous Port to nurture a brighter future of independence (Slayton & Muniroth, 2015). Relying on cross-border transit is evident in Laos, in which logistical dependence has created significant economic vulnerability and cost increases (The World Bank, 2024). Cambodia must emulate Vietnam’s strategy of domestic port investment, such as Cai Mep-Thi Vai, which was crucial to its rise as a global manufacturing hub (Semenova, 2023).

To avoid the bribery taxes SMEs face, Cambodia must evade the ‘dual-track’ economy. Expansion of the Cambodia Data Exchange (CamDX) would fully automate business licensing and customs clearance; removing human interference from routine approvals. Automated customs clearances have been effective in Vietnam, with significantly lowered informal costs and petty corruption to boost trade efficiency (Nguyen et al., 2022). Digital formalisation is essential for the integration of SMEs into global trade, breaking the island nature of FDI into SEZs.

With stalled Overlapping Claims Area gas negotiations, Cambodia needs to double down on the targeted 70% renewable energy target. Shifting to domestic renewables not only makes ESG conscious FDI more appealing but also helps to define Cambodias self-sufficiency against volatile neighbours. Green advantages have already been proven in the region, with Lego opening its $1 billion carbon-neutral factory in Vietnam (Nikkei Asia, 2022). By marketing itself as the ‘Green Factory of the ASEAN,’ Cambodia will use its energy advantage as a competitive asset.

Through Structural reformation, Cambodia will convert the current fragility recovery into resilience and inclusive growth, ensuring the peace dividend is reshaped for the next generation.

Bibliography

Ali, N., Phoungthong, K., Khan, A., Abbas, S., Dilanchiev, A., Tariq, S., & Sadiq, M. N. (2023). Does FDI foster technological innovations? Empirical evidence from BRICS economies. PLOS ONE, 18(3), e0282498. https://doi.org/10.1371/journal.pone.0282498

Brussevich, M. (2024). The socioeconomic impact of special economic zones: Evidence from Cambodia. The World Economy, 47(1), 362–387. https://doi.org/10.1111/twec.13526

Cambodian Ministry of Tourism. (2024, November). Cambodia welcomes 4.29 million international tourists with Thailand as a top source market for tourism industry. Mekong Tourism Coordinating Office. https://mekongtourism.org/cambodia-welcomes-4-29-million-international-tourists-with-thailand-as-a-top-source-market-for-tourism-industry/

Cambodianess. (2025). Cambodia redirects its cassava and red corn away from Thai markets. https://cambodianess.com/article/cambodia-redirects-its-cassava-and-red-corn-away-from-thai-markets

Chigas, G., & Mosyakov, D. (n.d.). Literacy and education under the Khmer Rouge. Yale MacMillan Center. https://macmillan.yale.edu/gsp/literacy-and-education-under-khmer-rouge

East Asia Forum. (2025, November 28). Cambodia's rising FDI numbers don't add up to quality growth. https://eastasiaforum.org/2025/11/28/cambodias-rising-fdi-numbers-dont-add-up-to-quality-growth/

EuroCham Cambodia. (2024). Skills gap assessment 2024. https://www.eurocham-cambodia.org/uploads/782f9-final-report-skill-gap-assessment-report-digital-3.pdf

Han, P. (2022). The analysis of Vietnam education development: Impacts of Vietnam War perspective. Semantic Scholar. https://pdfs.semanticscholar.org/3a0b/e87341ae9177396102af00c8d0ab70888a35.pdf

Hoang, H. V., Hoang, K., Hoang, V., & Nguyen, C. (2022). Investment under anticorruption: Evidence from the high-profile anticorruption campaign in Vietnam. Emerging Markets Review, 101360. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4184597

Iammarino, S., Muth, S., & Nith, K. (2024). 20 years of FDI in Cambodia: Towards upper middle-income status and beyond. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5277683

International Trade Administration. (2025). Cambodia - Energy; Power generation equipment. U.S. Department of Commerce. https://www.trade.gov/country-commercial-guides/cambodia-energy-power-generation-equipment

Jeong, H. (2014). Legacy of Khmer Rouge on skill formation in Cambodia. Journal of International and Area Studies, 21(1), 1–19. X https://www.jstor.org/stable/43111521

Kapronasia. (2025). Cambodia's Bakong goes from strength to strength. https://kapronasia.com/insight/blogs/payments-research/asia-payments-research/cambodia-s-bakong-goes-from-strength-to-strength

Khmer Times. (2024). Toyota's assembly plant plans to assemble more than 1,300 vehicles in Cambodia. https://www.khmertimeskh.com/501482098/toyotas-assembly-plant-plans-to-assemble-more-than-1300-vehicles-in-cambodia/

Kiernan, B. (1996). The Pol Pot regime: Politics, race, and genocide in Cambodia under the Khmer Rouge, 1975-1979. Yale University Press. https://books.google.com/books?hl=en&lr=&id=l8TVTCJSJKcC&oi=fnd&pg=PR9&dq=The+Pol+Pot+regime:+Politics,+race,+and+genocide+in+Cambodia+under+the+Khmer+Rouge,+1975-1979.+Yale+University+Press.&ots=iumkzLh5zZ&sig=lJ8_eAjn0OreP_ahTihcacbx8ZY

Kiripost. (2025). Poverty gap in Cambodia continues to widen. https://kiripost.com/stories/poverty-gap-in-cambodia-continues-to-widen

Kosalthanan, N. (2025, August). Economic consequences of Cambodia's border conflict with Thailand. Khmer Times. https://www.khmertimeskh.com/501739967/economic-consequences-of-cambodias-border-conflict-with-thailand/

Ministry of Foreign Affairs, Thailand. (2025). Roundtable seminar on "OCA Thailand – Cambodia: Facts and choices". https://mfa.go.th/en/content/ocamediafocus-en?cate=5d5bcb4e15e39c306000683e

Ministry of Mines and Energy. (2024). Cambodia targets 70 pct clean energy by 2030. Lao News Agency. https://kpl.gov.la/En/detail.aspx/detail.aspx?id=87512
Nguyen, H. T., Grant, D. B., Bovis, C., Le Nguyen, T. T., & Mac, Y. T. H. (2022). Digitalization in public sector in emerging economies: The enablers and inhibitors influence electronic customs in Vietnam. International Journal of Data & Network Science, 6(3). https://helda.helsinki.fi/server/api/core/bitstreams/2bb90fcc-49fa-4fbc-966e-126d8767a1ce/content
Nikkei Asia. (2022, November 3). Lego breaks ground on $1bn carbon-neutral factory in Vietnam. https://asia.nikkei.com/spotlight/supply-chain/lego-breaks-ground-on-1bn-carbon-neutral-factory-in-vietnam
Nikkei Asia. (2025, November). Cambodia's cassava farmers, traders struggle in wake of Thai conflict. https://asia.nikkei.com/politics/international-relations/thailand-cambodia-conflict/cambodia-s-cassava-farmers-traders-struggle-in-wake-of-thai-conflict
Oxford Poverty and Human Development Initiative (OPHI). (2024). Global MPI country briefing 2024: Cambodia. https://ophi.org.uk/media/46022/download
Rawlinson, S. (2025, November 25). Stoking nationalism costs Cambodia economic growth. East Asia Forum. https://eastasiaforum.org/2025/11/25/stoking-nationalism-costs-cambodia-economic-growth/
Royal Government of Cambodia. (2004). The rectangular strategy for growth, employment, equity and efficiency. https://commons.lib.jmu.edu/cgi/viewcontent.cgi?article=2184&context=cisr-globalcwd
Semenova, N. K. (2023). Vietnam ports: Becoming a new leader? The Russian Journal of Vietnamese Studies, 7(3), 18–30. https://journals.eco-vector.com/2618-9453/article/view/352575
Seyhah, V., & Vutha, H. (2019). Cambodia in the electronic and electrical global value chains. Cambodia Development Resource Institute (CDRI). https://cdri.org.kh/public/storage/pdf/wp119e_1617247939.pdf
Slayton, T., & Muniroth, S. (2015). Rice sector review: A more detailed road map for Cambodian rice exports (Working Paper No. 98834). The World Bank. https://www.semanticscholar.org/paper/Rice-sector-review-%3A-a-more-detailed-road-map-for-Slayton/c0b4bb9e2bf43aa12a2896695043ff4f63da6e4a
Thangavelu, S. M., Soklong, L., Vutha, H. I. N. G., & Kong, R. (2023). Investment facilitation and promotion in Cambodia: Impact of provincial-level characteristics on multinational activities. Economic Research Institute for ASEAN and East Asia. https://www.eria.org/uploads/media/discussion-papers/FY23/Investment-Facilitation-and-Promotion-in-Cambodia-Impact-of-Provincial-level-Characteristics-on-Multinational-Activities..pdf
The Observatory of Economic Complexity (OEC). (2023). Cambodia (KHM) exports, imports, and trade partners. Retrieved December 10, 2025, from https://oec.world/en/profile/country/khm
The World Bank. (2025). Cambodia - World Bank open data. Retrieved December 15, 2025, from https://data.worldbank.org/country/cambodia
The World Bank. (2023). Enterprise surveys: Cambodia country profile. https://www.enterprisesurveys.org/en/data/exploreeconomies/2023/cambodia
The World Bank. (2024). Lao PDR economic monitor: Accelerating reforms for growth: Key findings. https://www.worldbank.org/en/country/lao/publication/lao-economic-monitor-april-2024-accelerating-reforms-for-growth-key-findings
The World Bank. (2025, June). Cambodia economic update June 2025. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099060925065018354
Transparency International. (2024). Corruption perceptions index 2024. https://www.transparency.org/en/cpi/2024/index/lux
TravelMole. (2025, November). Cambodia-Thailand border conflict tourism. https://www.travelmole.com/news/cambodia-thailand-border-conflict-tourism/
United Nations, Department of Economic and Social Affairs, Population Division (2024). World Population Prospects 2024, Online Edition. https://population.un.org/wpp/
Warr, P., & Menon, J. (2016). Cambodia's special economic zones. Journal of Southeast Asian Economies, 33(3), 273–290. Warr, P., & Menon, J. (2016). Cambodia's special economic zones. *Journal of Southeast Asian Economies*, 273-290. https://www.jstor.org/stable/44132407?

casa_token=GY-Q9o7MU8EAAAAA:jT7Tw04C2YM14c5c6lrSUr9YTanxamFBKINHWvOUyFREqihzZNPvbIXq4tZbF_GB5IaVKNr5aP8_OHkMFbNqBLKYLTX6Wq521G1wiWdv_MNfNoieWfJM

World Economics. (n.d.). Cambodia's informal economy size. Retrieved December 15, 2025, from https://www.worldeconomics.com/Informal-Economy/Cambodia.aspx

Yeh, W. W. K., Hao, G., & Ozer, M. (2023). Real estate investment decisions in underrepresented Southeast Asian countries: Evidence from Cambodia, Myanmar, and Vietnam. Journal of Asia Business Studies, 17(6), 1143–1166. https://doi.org/10.1108/JABS-06-2022-0202

Development Economics Country Report: Vietnam

Tom Collins

Development Economics 2025 – 2026

Located in Southeast Asia, Vietnam is a lower middle-income with a population of just over 100 million (World Bank, 2024a). Since the launch of economic reforms in 1986 (known formally as “Doi Moi” whose literal translation means “renovation”), in order to recover from a distraught economy as a result of war with the US and trade embargos, the country has shifted from a central planned and agrarian economy to one with fast growing services and manufacturing sectors.

Vietnam has achieved high and stable economic growth, reduced poverty, and significant improvement to human development indicators. This report evaluates the development levels using a combination of data from the World Bank, OECD and other related literature in order to examine trends in growth, structural change and performance. Whilst the evidence highlights the success of Vietnam’s export-led model, the analysis also identifies key structural challenges, including wealth inequality, institutional weakness and heavy reliances on FDI. This report concludes by offering targeted policy recommendations with the aim of keeping sustained levels of growth whilst addressing these emerging, middle-income country restraints.

Crisis, Doi Moi and Early Transition

Following reunification in 1975, Vietnam adopted a centrally planned economic model, focusing on state control, collective goods, and price regulation. The economy underwent severe strain, failing to meet basic needs, and experienced declining efficiency and negative productivity growth (Nguyen, 2018). By the mid-1980s, it was in severe circumstances; inflation was at record highs, trade had collapsed, agricultural exports were waning, and the economy was being funded millions a day by the Soviet Union in order to survive (Baum, 2020). To try counter these issues, the 1985 currency reform was introduced where old dong could be exchanged for new dong, which instead triggered severe hyperinflation and further damaged public opinion and the living conditions (Srinivasan et al, 1996). This period was a low point for economic (Miltimore, 2024).

In response to the collapsing economy and struggling population, the Sixth National Party Congress launched Doi Moi in 1986. These reforms were aimed at moving Vietnam towards a market-focused approach whilst also being able to keep socialist politics. This included agricultural privatisation therby allowing farmers to own land, private enterprises and businesses being given more freedom, removing government control on pricing and trade which allowed supply and demand to thrive, and allowing integration into global markets and foreign direct investments (FDI) (OECD, 2025). This policy shift laid the foundations for economic growth, structural solidification and a future in global trade.

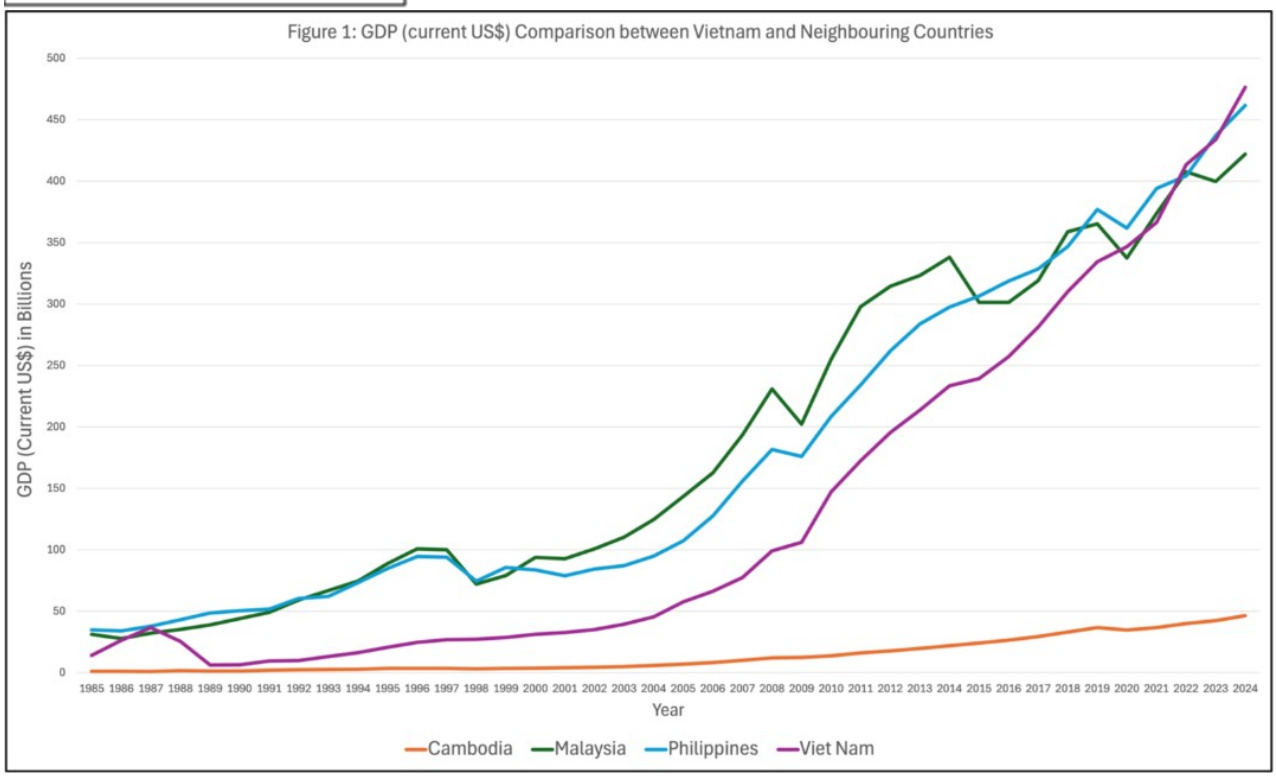
Economic Growth and Development:

Vietnam’s economic growth over the last three decades has been significant. Starting from the policy introduction up until now, figure 1 shows a steady upward trajectory in GDP, with notable jumps moving into the 2000s. As of 2024, Vietnam’s GDP is $476.39 Billion, the highest of its peer countries Malaysia, Philippines, and Cambodia (World Bank, 2024b). Drops in GDP are visible following the initial phases of the Doi Moi reform, with spiralling

inflation from previous years slowly recovering from 400% and an economy “unable to deliver basic consumer goods” (IMF, 2018), before a steady and then sharp increase ensues.

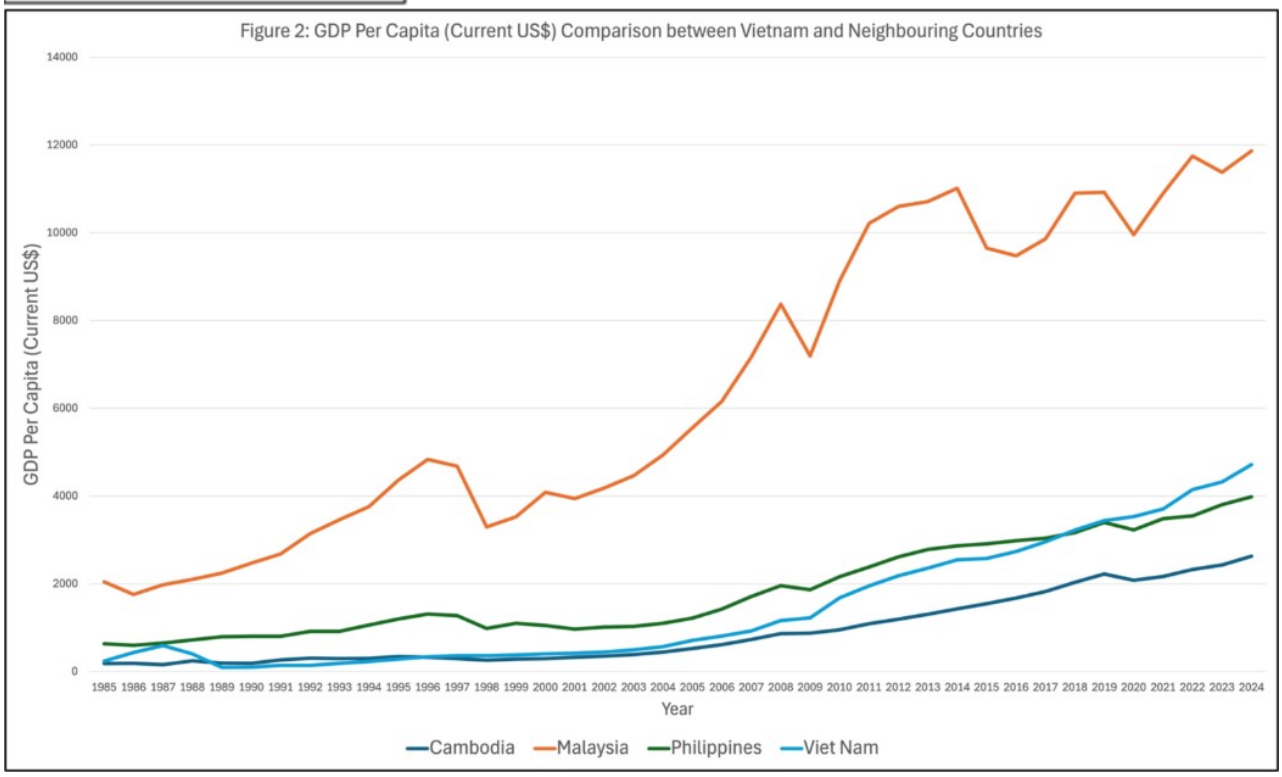
Whilst growth has not been perfectly smooth, Vietnam has largely avoided any deep recessions that drastically altered progress. We can see that despite the 2008 financial crash, the COVID 19 pandemic and heavy fluctuations in neighbouring countries, there has been a maintaining of positive and robust GDP growth. In addition, economic growth has outpaced most comparative emerging and developing countries in Asia (IMF, 2024), and inflation has been holding low and steady at around 2.8% for the last decade (World Bank, 2024c).

Source: World Bank, 2024b



Looking at GDP per capita in figure 2, sitting at $4717.30 as of 2024 (World Bank, 2024d). In fact, Vietnam has seen a steady growth of between 4-6% year-on-year in GDP per capita from the late 1980s onwards, with a minor drop to around 2% growth in 2020 and 2021 during the COVID pandemic (World Bank, 2024e).

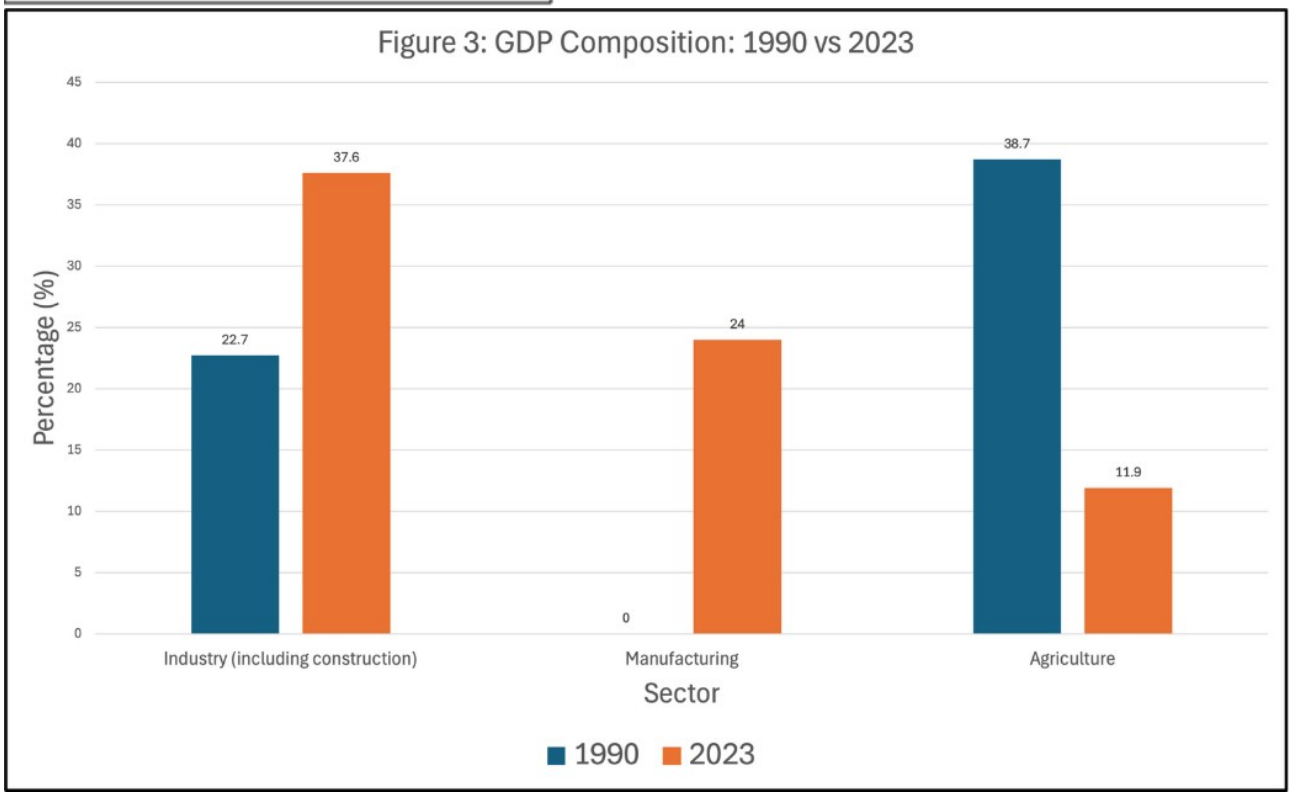
Source: World Bank, 2024d



Structural Transformation:

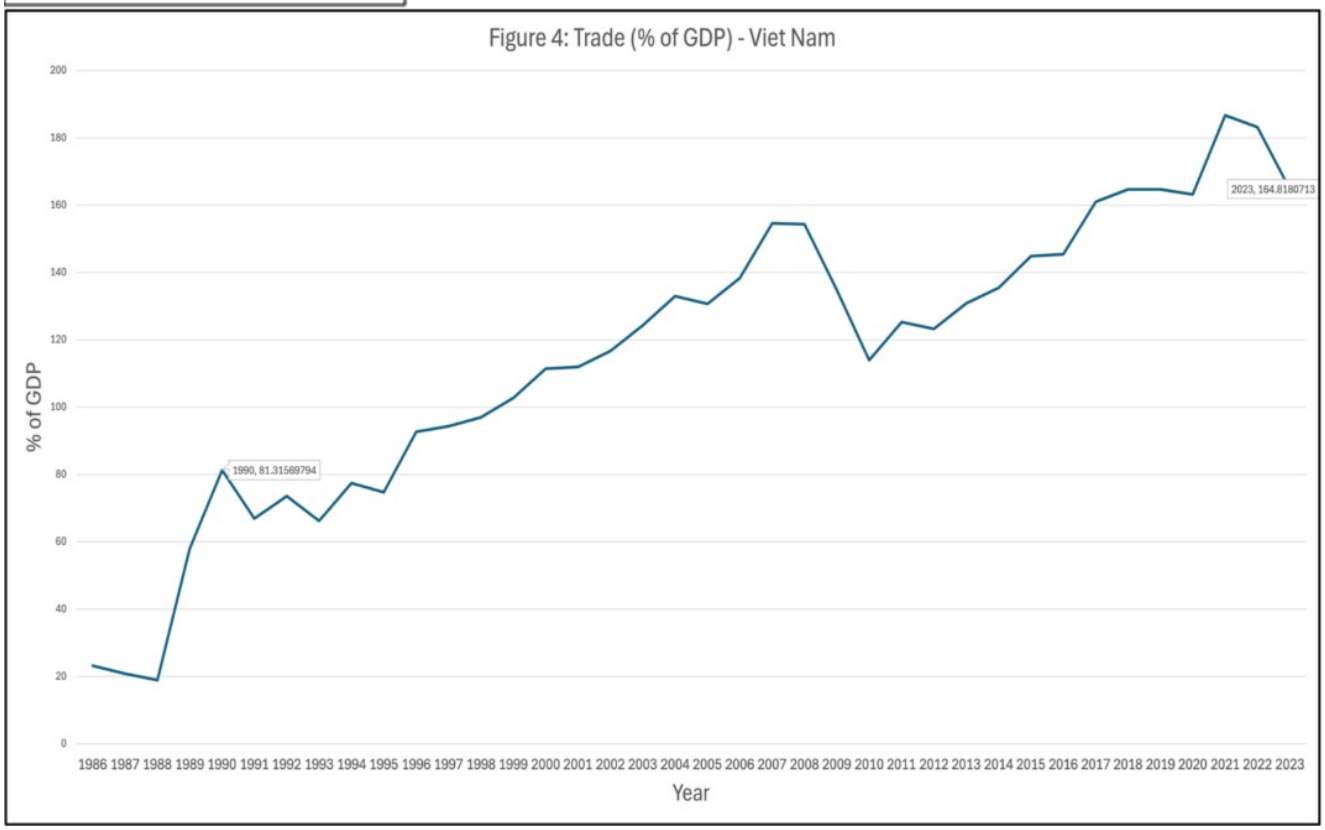
A major factor in Vietnam's development has been the shift from agricultural focus towards an economy with thriving industry and services to trade. From the late 1980s onwards, the proportion of GDP reliant on agriculture, forestry and fishing has been steadily decreasing from the mid 30 percentage points down to just 11.9% as of 2023 (World Bank, 2023c). In contrast, the contribution of manufacturing has drastically increased in the last two decades. Mainly fuelled by FDI and an export-based approach, services expanded and urbanisation occurred, allowing incomes to rise (Nguyen, 2018). This pattern aligns with classical development thinking, where labour moves from low-productivity agriculture to high-productivity services, raising economy wide efficiency and productivity (McMillan & Rodrik, 2014). Looking at figure 3, we can see this jump in industry and manufacturing, and simultaneous drop in agriculture proportions from the Doi Moi reforms early stages through to 2023.

Source: World Bank, 2023a,b,c



Trade openness has been a major indicator in Vietnam's development, with this shift in agricultural exports moving towards tech, electronic components, textiles and machinery (Anwar & Nguyen, 2010). In particular, Vietnam's trade as a percentage of GDP sits at 165% as of 2023 (World Bank, 2023d). This is a huge jump from previous proportions as shown in figure 4 below, reflecting the transition to liberal trade policy and integration of Vietnam into global supply chains. A ratio of trade to GDP this high reflects a high openness to global demand and removes reliance on domestic consumption, allowing them to specialise in advantageous sectors. In addition, the productivity gains from integration into global networks means improved quality, efficiency, as well as direct links to improvements on poverty and real incomes (Do et al, 2021). This increase trade also highlights the country's shift towards external demand, notably after Vietnam joined the World Trade Organisation in 2007 and further reduced barriers through trade agreements, FDI increased at around 13.1% per year, highlighting the role of global integration in development (OECD, 2025).

Source: World Bank. 2023d



Whilst this trade does have clear benefits, it also exposes the country to external shocks from vital markets such as the US and China whose involvement in tech is significant. Because of Vietnam's proportion of export production, it also becomes difficult to escape the "middle-income trap", where a country reaches a certain level of income and loses its cost competitiveness to lower-income countries whilst simultaneously not being innovative or productive enough to compete with those in higher-income brackets (World Bank, 2024f).

To better understand FDI and its support of economic expansion, we can run a simple regression model using the World Bank's annual data. We can examine the relationship between FDI and GDP growth by using an ordinary least squares (OLS) regression. We will use GDP growth as the dependent variable and FDI as a percentage of GDP as the explanatory variable, covering from 1986 to 2023 such that we can see the start of policy influence up till the latest data available. Our regression model is therefore:

$$GDP\ Growt\ h_t = \alpha + \beta_1 \left(FDI\_GDP_t \right) + \epsilon_t$$

Upon using excels regression analysis tool, I was able to obtain the following results:

Regression Statistics	
Multiple R	0.505759091
R Square	0.255792258
Adjusted R Square	0.23511982

Standard Error	1.488445912
Observations	38

From the 38 observations we were able to collect the below coefficients:

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	4.85171435	0.5092183	9.52776895	2.2259E-11
FDI %	0.325237116	0.09245965	3.51761137	0.00119853

Our estimated model is therefore:

$$GDP\ Growt\ h_t = 4.8517 + 0.3252\left(FDI\_GDP_t\right) + \epsilon_t$$

Where:

- $GDP\ Growth_t : annual\ GDP\ growth\ (\%)$
- $FDI\_GDP_t : FDI\ net\ inflows\ (\%\ of\ GDP)$
- $4.8517 : baseline\ growth\ prediction$
- $0.3252 : marginal\ effect\ of\ FDI\ inflow$
- $\epsilon_t : error\ term\ capturing\ ot\ h\ er\ influences\ on\ growth$

Our FDI coefficient means that a one percentage point increase in FDI inflow is associated with a 0.325 percentage point increase in GDP growth, which is statistically significant. Our p-value being 0.0012 means that the relationship is highly significant and we are able to reject the hypothesis that FDI has no effect. In addition, our R-squared value sitting at 0.2558 means that FDI alone explains approximately 26% of the year-to-year change in GDP growth, for a single-variable regression this is a very strong result showing FDI is a key factor in growth. This provides clear empirical support that Vietnam's export-led development has been heavily dependent on sustained inflows of foreign capital.

Exports and Imports:

Breaking down this shift in trade further, exports expanded at a rapid pace as the movement to manufactured products occurred. In the early 90s, rice and coffee were dominant exports, but by contrast the largest exports now include electronics, machinery and high-value textiles. This shift was largely a result of firms relocating production, drawn by the improved logistics, competitive labour costs and favourable policies (Nguyen et al, 2025). Imports have also seen a dramatic increase, largely caused by demand for intermediary goods for manufacturing, machinery and equipment to support this, and domestic industrialisation (Can, 2022). In particular, Vietnam has a specialisation in downstream levels of assembly, where intermediate parts are exported to foreign markets for assembly, known as a forward global value chain (Korwatanasakul & Hue, 2022). This

has shown direct benefits towards the labour market by producing more jobs and improving specialised skills and labour productivity.

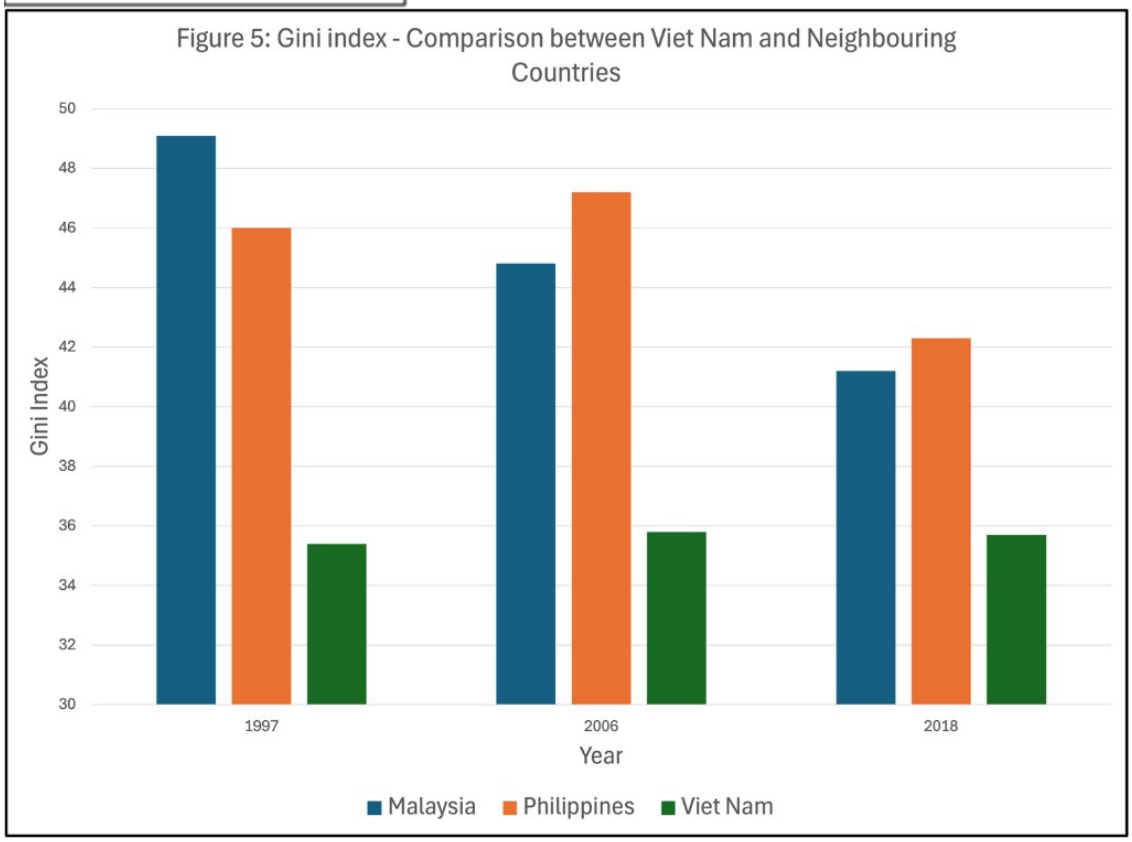
Source: World Bank, 2023d

Poverty Reduction and Inequality:

Vietnam has one of the most successful reductions in poverty of today. Falling from 57.5% in 1992 down to a steady 1-3% over the last decade, extreme levels of poverty where incomes are below $3 a day are nearing complete removal from society (World Bank, 2022a). Much of this has come from the structural change, as wages rise via employment into manufacturing and services and the decollectivisation of agricultural land allowing for more profitable farming.

Looking at inequality, the Gini coefficient for Vietnam sits at 36.1 as of 2022 (World Bank, 2022b). In comparison to its neighbouring countries this has held strong, whilst other countries have been battling to reduce their income disparities. Looking at figure 5 below, I analysed years where all 3 countries had data available. A value of 36.1 for 2022 places Vietnam at a level of moderate-income inequality, being higher than some more advanced countries but comparatively low for emerging economies. The fact it has remained at a stable level since the Doi Moi reform is impressive, given the inequality increases typically seen as a result of industrialising and structural transformations. This stability suggests that Vietnam's growth model has been broadly inclusive, with the economic gains from expansion, human capital investment and widespread reform enabling the population to benefit from rising incomes (Baum, 2020). However, the country wide Gini coefficient masks more persistent localised issues. The shift in poverty rates and economic strength from urban to rural areas is quite dramatic. The human and financial capital restrictions as a result of distance leaves households at a disadvantage, with the lowest poverty rates being in regions containing the three largest cities (World Bank, 2022c).

Source: World Bank. 2022b

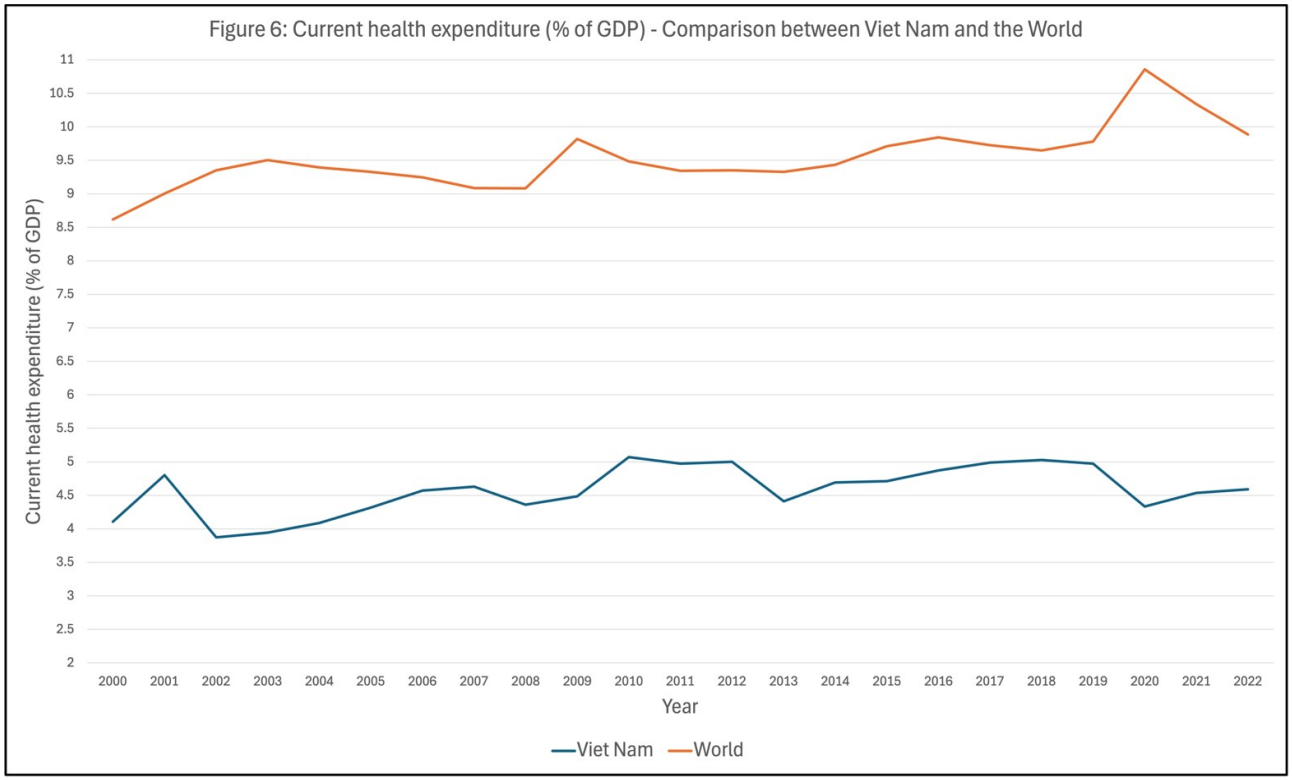


Human Development:

Vietnam's human development outcomes have improved substantially since the early 90s, reflecting the strong commitments towards expanding social services along with economic reform. The Human Development Index (HDI) increased from 0.499 in 1990 up to 0.766 as of 2023 (UNDP, 2025). Life expectancy now sits at 76 and there have been rises in rates of school enrolment. However, these national averages have regional and ethnic disconnect when looking at the local level. Ethnic minority groups and households in remote areas continue to experience lower educational rates, worse health support, and higher poverty than the majority of the population, indicating the social progress is not equally distributed (World Bank, 2022c).

The education system quality also remains uneven. Just 58% of students end up progressing and completing secondary education, with institutions struggling to deliver specialisation to help the country progress towards a more technology-inclusive and innovative economy (OECD, 2025). Within the health sector, shortages of specialisation and capacity in the poorer regions have led to urban residents benefitting more from the investments. That being said, the country has seen great success in expanding its health insurance coverage, with 2024 seeing a 94.2% rate of the population (VSS, 2025). In

terms of actual expenditure, Vietnam sits at 4.59 as of 2022 and has stayed between 3 and 5 percent for the last few decades (World Bank, 2022d). In comparison the global average has sat around 9-10% during that same time (World Bank, 2022e), as shown on figure 6 below. At face value this may indicate a smaller share of national output being utilised, but Vietnam has still achieved strong health outcomes as mentioned above, indicating the high efficiency of their primary care system and effective use of expenditure on preventive care and insurance coverage. It does also however explain the urban-rural disparities and that the potential underinvestment could be damaging infrastructure and training.



Policy Recommendations

The analysis conducted points out that whilst Vietnam has delivered strong results from development, there are several weaknesses that could constrain the future progress. As such, the policy recommendations focus on deepening certain aspects as opposed to reversing existing strategy.

FDI has been a key driver of Vietnam's growth as shown by relevant literature as well as the simple regression model run. However, this heavy reliance can leave the economy vulnerable to shocks. Policy should priorities strengthening the bond between foreign and domestic firms by improving access for smaller firms to finance, encouraging technology transfers and expanding development programs for suppliers. These measures would reduce vulnerability and support a more productivity driven growth.
Despite strong learning outcomes, Vietnam faces growing skill mismatching as the economy tries to transform into higher-value production. We see weaknesses in tertiary education, alongside uneven education access across the country, which risk constraining

productivity. Policies should look to improve the training quality, aligning information with the labour-market demand, and look to strengthen the cooperation between schools and firms. There could also be reduced inequalities via targeted investments into the education system in disadvantaged regions. Economic indicators mask the significant disparities between urban and rural areas, particularly within ethnic minority groups. These inequalities remain evident in education, health and income. Targeted intervention within infrastructure, access to basic services and support for rural livelihood are essential to maintain gains in human development and capital are shared across the country.

Conclusion

Vietnam's development trajectory since the late 1980s represents remarkable transformation. Holding to market-oriented reform under Doi Moi laid foundations for both significant and sustained economic growth, dramatic improvements to human development indicators, and deepened connection to trade. Structural shifts have tailored towards manufacturing and services, with support from FDI leading to success. However, there are important challenges that must be overcome. This growth is heavily dependent on foreign capital with a need for stronger integration into global value chains, human capital is being constrained, and regional inequalities persist. Addressing these will be critical to escape this middle-income trap.

Looking forward, Vietnam needs to upgrade their export and investment focused model. By strengthening domestic vision and improving the skills development and utilisation, there is potentially for improved institutions, more inclusive development, and sustaining growth towards higher income status.

References

Anwar, S. and Nguyen, L. (2010). Foreign direct investment and economic growth in Vietnam. Asia Pacific Business Review. 16. Pp183-202. Available at: https://www.researchgate.net/publication/238088356_Foreign_direct_investment_and_economic_growth_in_Vietnam

Baum, A. (2020). IMF Working Paper: Vietnam's Development Success Story and the Unfinished SDG Agenda. Available at: https://www.imf.org/-/media/files/publications/wp/2020/english/wpiea2020031-print-pdf.pdf?

Can, L. (2022). Upgrading Vietnam's Participation in the Global Value Chains. Southeast Asian Affairs, 392-410. Available at: https://www.jstor.org/stable/27206758?seq=1

Do, Q. A., Le, Q. H., Nguyen, T., D., Vu, V. A., Tran, L. H. and Nguyen, C. T. T. (2021). Spatial Impact of Foreign Direct Investment on Poverty Reduction in Vietnam. J. Risk Financial Manag. 2021, 14(7), 292. Available at: https://www.mdpi.com/1911-8074/14/7/292

IMF (2018). Vietnam: Raising Millions Out of Poverty. Available at: https://www.imf.org/en/countries/vnm/vietnam-raising-millions-out-of-poverty

IMF Asia and Pacific Dept (2024). Vietnam: 20204 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Vietnam. Available at: https://www.elibrary.imf.org/view/journals/002/2024/306/article-A001-en.xml?

Khalidi, R. (2025). Vietnam's Doi Moi: An inspiring story of renewal and partnership. Available at: https://www.undp.org/Vietnam/blog/Vietnams-doi-moi-inspiring-story-renewal-and-partnership

Korwatanasakul, U. and Hue, T. T. (2022). Global Value Chain Participation and Labour Productivity in Manufacturing Firms in Vietnam: Firm-Level Panel Analysis. Available at:

https://www.eria.org/uploads/media/discussion-papers/FY22/Global-Value-Chain-Participation-and-Labour-Productivity-in-Manufacturing-Firms-in-Viet-Nam-Firm-Level-Panel-Analysis.pdf
McMillan, M., Rodrik, D. and Verduzco-Gallo, I. (2011). Globalization, structural change and productivity growth. World Development, Volume 63, November 2014, pp11-32. Available at: https://www.sciencedirect.com/science/article/pii/S0305750X13002246
Miltimore, J. (2024). How Vietnam went from the poorest economy in the world to a prosperous exporter. Foundation for Economic Education. Available at: https://fee.org/articles/how-vietnam-went-from-the-poorest-economy-in-the-world-to-a-prosperous-exporter/
Nguyen, H. (2018). Empirical Evidence of Structural Change: The Case of Vietnam's Economic Growth. Journal of Southeast Asian Economies. 35. pp237-256. Available at: https://www.researchgate.net/publication/327800959_Empirical_Evidence_of_Structural_Change_The_Case_of_Vietnam's_Economic_Growth
Nguyen, N. T. B., Masaru, I. and Hong, B. X. (2025). Analyzing Vietnam's Economic Transformation from 2007 to 2023: Insights from Structural Decomposition of Input-Output Tables. Economies 2025, 13, 182. Available at: https://www.mdpi.com/2227-7099/13/7/182
OECD (2025). OECD Economic Surveys: Vietnam 2025, OECD Publishing, Paris. Available at: https://www.oecd.org/en/publications/oecd-economic-surveys-viet-nam-2025_fb37254b-en/full-report/harnessing-trade-and-investment-flows-to-boost-productivity_98d56c90.html
Srinivasan, K., Spitaller, E., Braulke, M., Mulder, C. B., Shishido, H., Miranda, K. M., Dodsworth, J. R., and Lee, K. (1996). VI Stabilization and Adjustment in the Presence of Currency Substitution. In Vitenam, USA: International Monetary Fund. Available at: https://www.elibrary.imf.org/display/book/9781557755384/ch006.xml
UNDP (2025). Vietnam maintains high Human Development Index Score: UNDP report. Available at: https://www.undp.org/vietnam/press-releases/viet-nam-maintains-high-human-development-index-score-undp-report
VSS (2025). Vietnam Social Security: Universal Health Insurance – A Chance for Equal Access to Healthcare Services. Available at: https://vss.gov.vn/english/news/Pages/vietnam-social-security.aspx?CateID=198&ItemID=12528
World Bank (2022a). Poverty headcount ratio at $3.00 a day (2021 PPP) (% of population) – Vietnam. Available at: https://data.worldbank.org/indicator/SI.POV.DDAY?locations=VN
World Bank (2022b). Gini index – Vietnam, Malaysia, Philippines. Available at: https://data.worldbank.org/indicator/SI.POV.GINI?end=2023&locations=VN-MY-PH&start=1992
World Bank (2022c). From the last mile to the next mile – 2022 Vietnam Poverty and Equity Assessment. Pp87-90. Available at: https://documents1.worldbank.org/curated/en/099115004242216918/pdf/P176261155e1805e1bd6e14287197d61965ce02eb562.pdf
World Bank (2022d). Current health expenditure (% of GDP) – Vietnam. Available at: https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS?locations=VN
World Bank (2022e). Current health expenditure (% of GDP). Available at: https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS
World Bank (2023a). Industry (including construction), value added (% of GDP) – Vietnam. Available at: https://data.worldbank.org/indicator/NV.IND.TOTL.ZS?locations=VN&most_recent_year_desc=true
World Bank (2023b). Manufacturing, value added (% of GDP) – Vietnam. Available at: https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=VN&most_recent_year_desc=true
World Bank (2023c). Agriculture, forestry, and fishing, value added (% of GDP) – Vietnam. Available at: https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=VN
World Bank (2023d). Trade (% of GDP) – Vietnam. Available at: https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?locations=VN&most_recent_year_desc=true
World Bank (2024a). Population, total – Vietnam. Available at: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=VN
World Bank (2024b). GDP (current US$) – Vietnam, Malaysia, Philippines, Cambodia. Available at: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2024&locations=VN-MY-PH-KH&name_desc=false&start=1960&view=chart

World Bank (2024c). Inflation, consumer prices (annual %) – Vietnam. Available at: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=VN
World Bank (2024d). GDP per capita (Current US$) – Vietnam, Malaysia, Philippines, Cambodia. Available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=VN-MY-KH-PH&start=1985
World Bank (2024e). GDP per capita growth (Annual %) – Vietnam. Available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?locations=VN&start=1985
World Bank (2024f). World Development Report 2024: The Middle-Income Trap. Available at: https://www.worldbank.org/en/publication/wdr2024

The Sources of Large Growth and Economic Interpretation

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1. Introduction

Building on neoclassical growth models (Solow, 1956), convergence theory indicates that a country's per capita growth rate tends to be inversely related to initial level of income (productivity) per person. While this neoclassical view holds that sectoral composition is a relatively insignificant exogenous factor of economic growth, subsequent research (e.g., Echevarria, 1997) integrates both the former approach with empirical foundations that posit that growth *is* brought about by sectoral structures (Kuznets, 1971; Baumol et al., 1986), as opposed to regarding sectoral composition as a by-product of aggregate growth.

Therefore, this analysis aims to determine whether instances of rapid productivity growth, or stagnation, are underpinned by economy-wide convergences, or result from idiosyncratic sectoral shifts that do not permeate across the broader economy. Specifically, the report addresses: “To what extent are extreme productivity growth anomalies (identified in *Task One*) driven by structural transformation, rather than sector-specific volatility?”. This report begins by examining the aggregate differences between mature and emerging economies, before focusing on three case studies: China (1960-2017), Argentina (1990-2017), and Georgia (2003-2017).

2. Methodology

The empirical data used are obtained from two primary sources: Penn World Table v11.0 (1950-2023; see Appendix) (Feenstra et al., 2015) supports case study selection, while the World Bank Data360 Labor productivity indicator (2011 international PPP exchange rate, 000’s) (1950-2017) derives results in section 3. Additionally, regional definitions are dynamically retrieved via the World Bank API v2.

To validate the neoclassical “catch-up effect’, an Ordinary Least Squares (OLS) regression estimates for the unconditional beta-convergence (i.e., negative beta), across a global 92-economy balanced sample (World Bank Data360, 2025; see Table A6 for full regression output). To avoid temporal bias, the cross-sectional model was restricted to 1995-2017, regressing the cumulative growth rate (see Appendix notes for calculation) against initial productivity level, yielding a beta coefficient to proxy the general catch-up hypothesis.

The sample restriction is relaxed for the cluster-based comparative analysis, to capture the full time-series of G7 and BRICS aggregate sectoral productivity, conforming with structural transformation frameworks (e.g., Kuznets, 1971; See Table A1 for a summary of extreme growth rates within these clusters). Within the BRICS cluster, China was chosen as an asymmetric distributional outlier; as opposed to other members, China only appeared in the top tail of extreme productivity growth (Table A2).

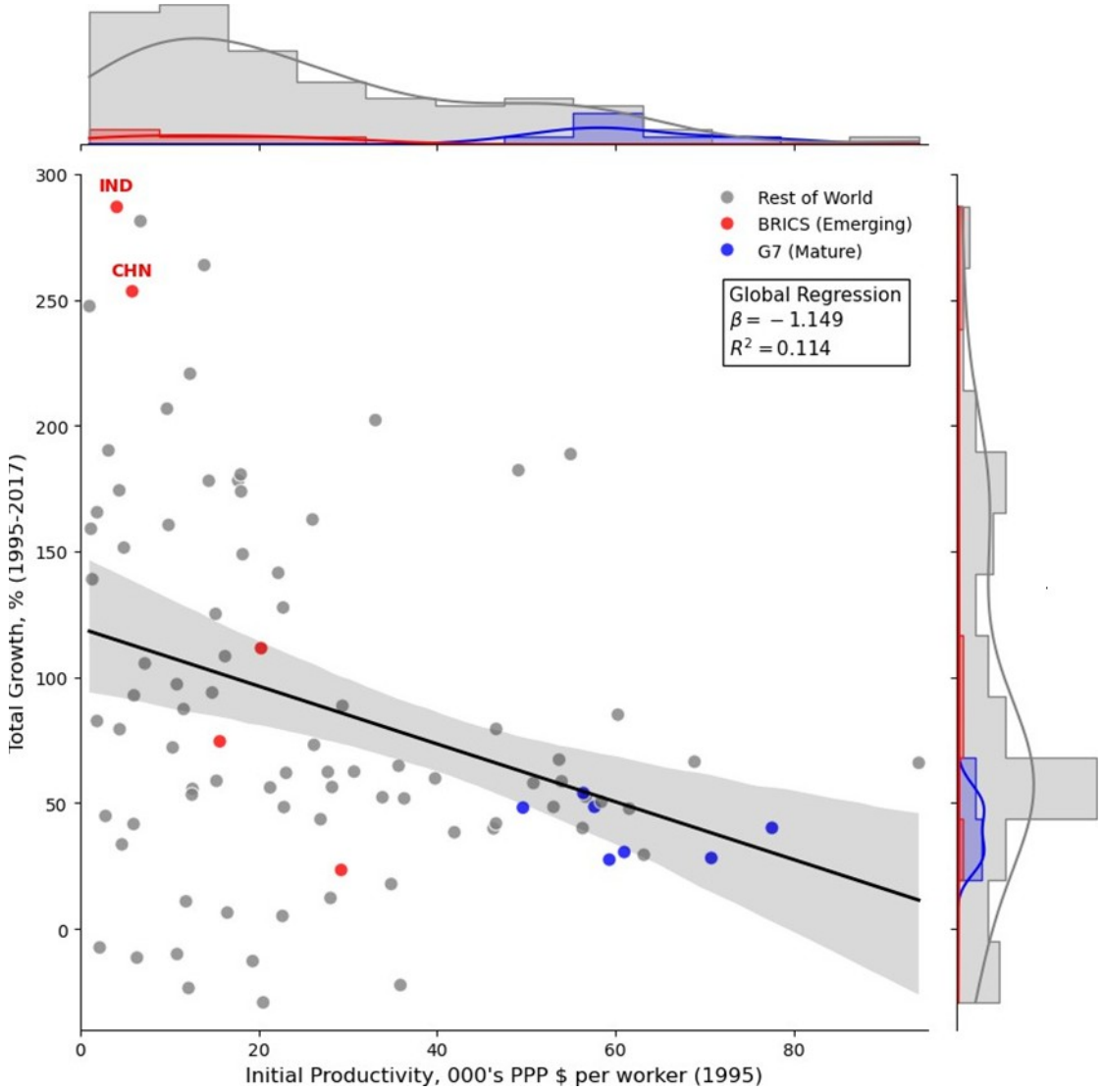
Furthermore, case study countries were selected using Z-score methodology to mitigate impermanent stochastic noise, notably highly volatile Middle Eastern and Gulf State economies (Table A3), in smaller economies. Argentina and Georgia represent example cases where productivity shocks were extreme relative to their own respective historical distributions (Table A4), ensuring the subsequent analysis focuses on statistical rarities rather than frequent productivity swings.

3. Results

3.1 Aggregate Convergence and Global Distribution

Figure 1 plots the relationship between cumulative growth rate (%) and initial labour productivity (000's PPP dollars per worker) (1995-2017). The OLS regression yields a strongly statistically significant negative coefficient (β=-1.149, p-value=0.001), providing evidence of unconditional beta convergence across the 92-economy sample. Neoclassical theory assumes that productivity eventually forms a normally distributed cluster about a global steady state.

Figure 1 – Global Productivity Convergence (1994-2017)



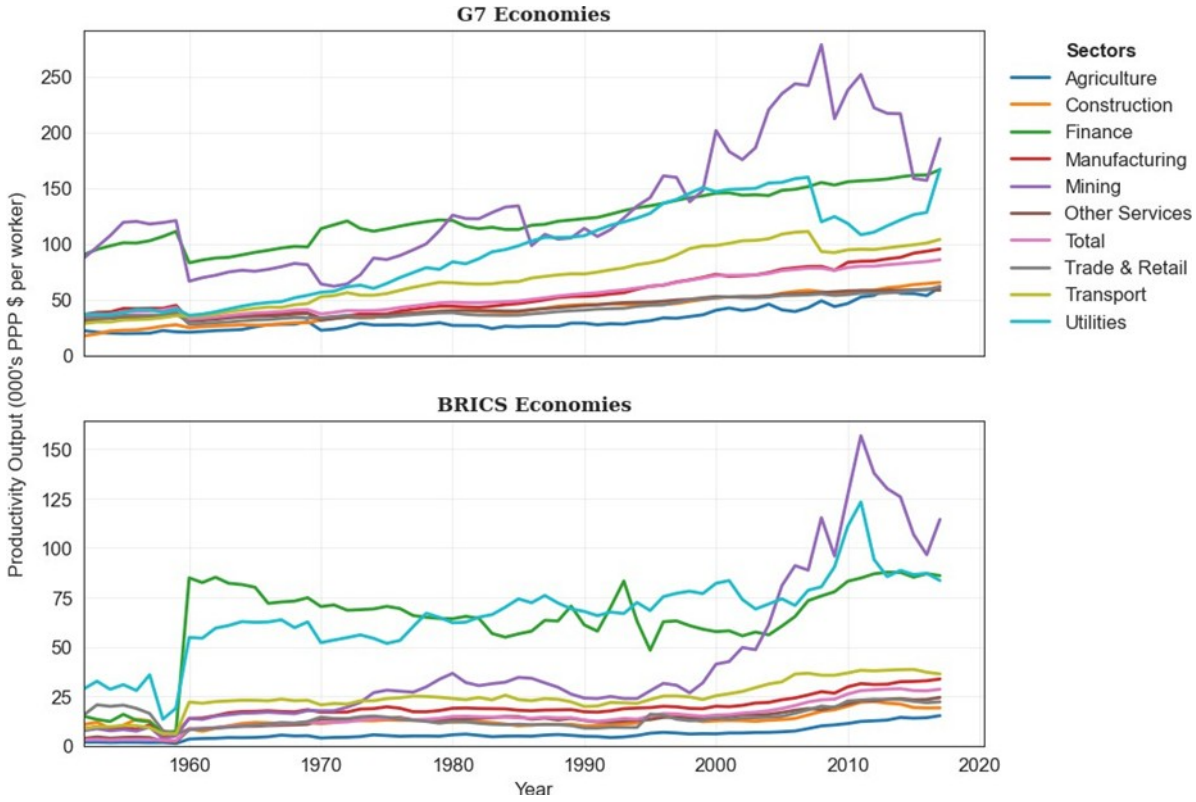
However, the marginal distributions in Figure 1 signal structural distribution heterogeneity between clusters, exhibiting high kurtosis and non-normality. This supports Quah's (1993) criticism that standard global regressions capture Galton's fallacy, suggesting universal mean reversion in the absence of a true catch-up effect. Additionally, the distribution visually confirms the divergence into 'twin peaks' (Quah, 1997), where the data bisects into two convergence clubs, rather than one steady state.

Henceforth, performing a Mann-Whitney U test corroborates that G7 and non-G7 clusters median growth rates are sampled from statistically heterogeneous distributions (U-stat=459.0, p-value<0.01; see Table A5 for summary statistics). This dispersion of clusters verifies Baumol (1986) findings that convergence is unequivocally shared among industrialised economies (e.g., G7) but not necessarily developing economies, compelling a disaggregated sectoral analysis of the BRICS versus G7 economies clusters.

3.2 Comparison of Aggregate Sector Productivity

Figure 1 substantiates that our dataset forms convergence clubs, so Figure 2 separates the mature and emerging clusters to investigate their average sectoral productivity drivers. The G7 economies average provides evidence of sustainable wider-economy productivity growth, led by continuous steady growth in high-value sectors, such as Finance, exceeding 150,000 PPP$ per worker by 2017.

Figure 2 – Time-Series Average Sectoral Productivity of the G7 vs. the BRICS Economies (1950-2017)



Nevertheless, the BRICS cluster average is driven largely by mining post-1990, which peaked at >150,000 PPP$ in 2011. This volatility coincides with McMillan et al.'s (2014) evidence of growth-reducing structural change, wherein emerging markets fail to converge across the whole economy as labour remains static in low-productivity sectors. This is particularly the case where a country has a relatively large share of natural resources in exports, so rather than experiencing true structural transformation, these enclave sectors cannot absorb unemployment from sectors, such as agriculture, into high-productivity sectors.

Unlike the G7 steady manufacturing productivity growth, the BRICS manufacturing line remains stagnant relative to the growth in mining and the higher general output in finance and utilities. Manufacturing is the sector that *can* unconditionally converge with rich economies without requiring economy-wide convergence (Rodrik, 2013). However, figure 2 indicates that the BRICS economies, on average, failed to appropriately sustain labour transition in this sector, consequently suffering from 'premature de-industrialisation' (Rodrik, 2016), i.e., ceasing opportunities to converge with other early industrialisers.

Figure 3 – Sectoral Comparison of China vs. the BRICS Average (1960-2017)

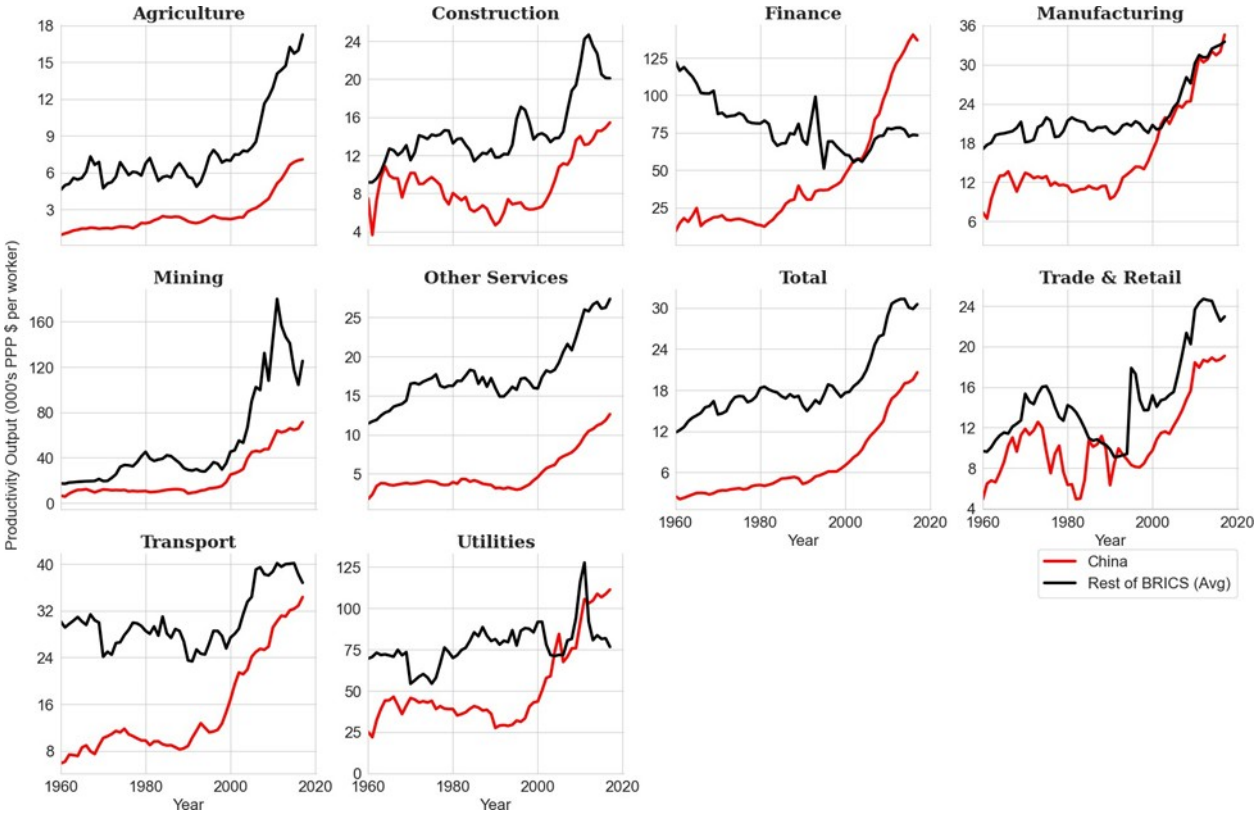


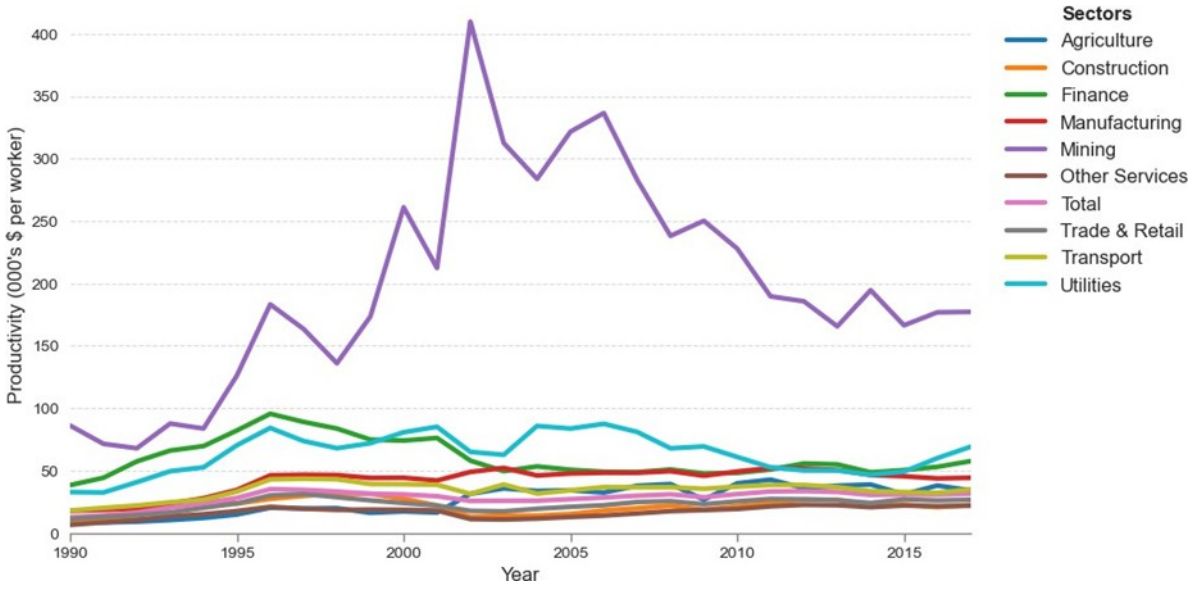
Figure 3 indicates an intra-group distinction: while the 'rest of BRICS' perpetuated a higher historical baseline manufacturing through the 1900's (driven by early industrialization of the USSR and Brazil), the productivity gap gradually shrunk until the early 2000's. China exhibited rapid convergence with the rest of BRICS in manufacturing, and a general growth across its economy, particularly in high-value utilities and finance sectors.

This nuances the 'Asian Miracle' outlined by McMillan et al. (2014); China systematically experienced productivity-inducing structural change, featuring a flow of labour from rural agriculture sectors (71% to 45% of total employment between 1978-2005) to urban industry sectors (Cai et al., 2008), such as manufacturing and finance. This empirical evidence supports that the unconditional convergence effect *does* require internal structure shifts. The following section will investigate how these sectors operate during periods of productivity growth shocks, specifically for the statistical outliers of Argentina and Georgia (Table A4).

3.3 Case Study Analysis

Argentina's data (Figure 4) details a boom-bust rather than true productivity convergence. When Argentina achieved a 5-year growth rate of 122.87% (Table A3) (3.42 standard deviations greater than their average growth rate), Figure 4 elucidates this aggregate growth is almost entirely driven by the Mining sector, which rocketed to >400,000 PPP$ by 2001, before a sustained collapse back to its 1996 level by 2013. Despite an upward trend in most sectors from 1990 to 1996, foundational sectors such as manufacturing and finance stagnated post-boom, thus supporting a case of growth-reducing structural change theory of McMillan et al. (2014).

Figure 4 – Argentina: Mining Sector Dependence (1990-2017)



Following bouts of hyperinflation in the early 1990's, Argentina's underwent structural reform (Convertibility Plan of 1991), adopting a market approach of "hyper-openness" (Pou, 2000). This consequently compressed manufacturing - Argentina's historically largest above-average productivity sector - productivity prematurely, and thus suffering significant unemployment increases.

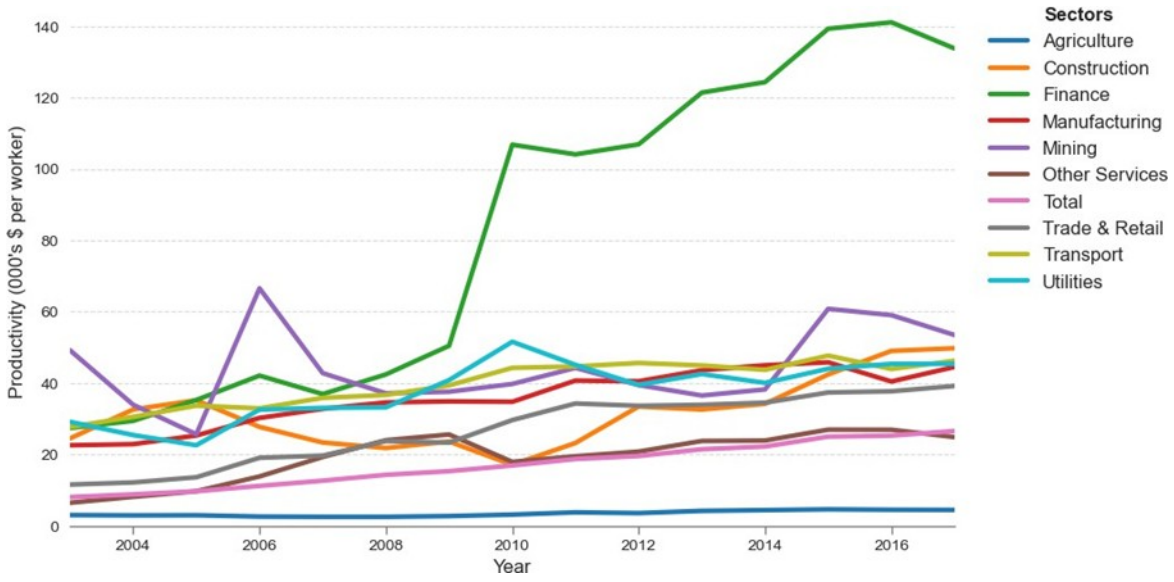
Therefore, as labour is shifted out of the sector, the potential for broader convergence departed. Ultimately, these structural reforms culminated in fiscal fragility, contributing to a 28% economy contraction during the 2001 financial crisis (Saxton, 2003). When the mining boom collapsed (2001), the absence of a diversified economy caused aggregate productivity to revert, and therefore establishing aggregate growth rate (of 122.87%) in 1996, was merely a stochastic commodity shock.

Conversely, Georgia's data (Figure 5) reveals a successful post-shock recovery, exhibiting 61.10% growth in 2010 (Table A4), which is 2.82 standard deviations greater than their historical average growth rate. After rapid and deep market liberalizations, including deregulation and privatization, following the 2003 Rose Revolution (Lawson et al., 2018), Georgia's economy displays broad, multi-sector productivity growth.

As opposed to Argentina's overreliance on a stochastic mining sector shock for productivity growth in Figure 4, Georgia stimulated growth-enhancing structural change (McMillan et al., 2014), pivotal to countries exhibiting long-term growth, such as highly industrialised mature economies. Reducing market barriers to entry enabled a reallocation of labour from agriculture (for which productivity remains stagnant in Figure 5) into higher-value sectors.

Therefore, Georgia's catch-up is predominantly finance-led, providing high-productivity growth to >140,000 PPP$ in 2016. Growth across all sectors except agriculture and mining demonstrates that structural reform can be a vehicle for unconditional convergence, as Georgia continues to modernise its economy.

Figure 5 – Georgia: Structural Recovery Across Key Sectors (2003-2017)



4. Conclusion

This report aimed to investigate the sector(s) responsible for large productivity growth rates. We have adopted defined clusters and three case study countries to determine whether productivity growth is associated with economy-wide shifts, or led largely by specific sectors. The report draws upon three key findings. First, global productivity growth relatively bifurcates in accordance to Quah (1993) results, wherein mature economies converge at higher productivity levels and lower growth rates relative to emerging economies. Second, true economy convergence is determined by structural transformation into high-productivity sectors such as finance (Georgia) and manufacturing (China). Third, growth attributed wholly to a specific sector, such as mining (Argentina), can conceal premature de-industrialisation underneath emphatic growth rates.

5. Bibliography

Baumol, W.J., 1986. Productivity growth, convergence, and welfare: what the long-run data show. *The American economic review*, pp.1072-1085.

Cai, F., Park, A. and Zhao, Y., 2008. The Chinese labor market in the reform era.

Echevarria, C., 1997. Changes in sectoral composition associated with economic growth. *International economic review*, pp.431-452.

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table". *The American Economic Review, 105*(10), 3150-3182.
Kuznets, S., 1971. *Economic growth of nations: Total output and production structure*. Harvard University Press.
Lawson, R., Grier, K. and Absher, S. (2018). You say you want a (Rose) Revolution? The effects of Georgia's 2004 market reforms. *Economics of Transition and Institutional Change*, 27(1), pp.301–323.
McMillan, M., Rodrik, D. and Verduzco-Gallo, Í., 2014. Globalization, structural change, and productivity growth, with an update on Africa. *World development*, *63*, pp.11-32.
Pou, P. (2000). *Finance and Development*. [online] Finance and Development | F&D. Available at: https://www.imf.org/external/pubs/ft/fandd/2000/03/pou.htm.
Quah, D., 1993. Galton's fallacy and tests of the convergence hypothesis. *The Scandinavian Journal of Economics*, pp.427-443.
Quah, D.T., 1997. Empirics for growth and distribution: stratification, polarization, and convergence clubs. *Journal of economic growth*, *2*(1), pp.27-59.
Rodrik, D., 2013. Unconditional convergence in manufacturing. *The quarterly journal of economics*, *128*(1), pp.165-204.
Rodrik, D., 2016. Premature deindustrialization. *Journal of economic growth*, *21*(1), pp.1-33.
Saxton, J. (2003). *ARGENTINA'S ECONOMIC CRISIS: CAUSES AND CURES*. [online] Available at: https://www.jec.senate.gov/public/_cache/files/5fbf2f91-6cdf-4e70-8ff2-620ba901fc4c/argentina-s-economic-crisis---06-13-03.pdf.
Solow, R.M., 1956. A contribution to the theory of economic growth. *The quarterly journal of economics*, *70*(1), pp.65-94.
World Bank Data360. (2025). Available at: https://data360.worldbank.org/en/indicator/WB_ASPD_LABOR_PRODUCTIVITY_PPP
Worldbank.org. (2026). Available at: https://api.worldbank.org/v2/country

6. Appendix

Notes:

- Productivity Lag is given by productivity 5 years before.
- Growth Rate (%) is calculated as (Productivity – Productivity Lag) / Productivity Lag * 100, as provided in Tables A1-A4.
- Cumulative Growth Rate (%) is calculated as ((Productivity – Initial Productivity) – 1) * 100, as referenced in Section 2.
- Tables A1-A4 provided by Penn World Table v11.0 Dataset.
- Tables A5-A6 provided by World Bank Data360 API.

Table A1 – Major (G7 and BRICS) Economies (Two) Largest and Smallest Growth Rates

Year	Entity	Productivity	Productivity Lag	Growth Rate (%)
Largest				
2008	Russia	24.79	12.56	97.29
2007	Russia	21.65	11.60	86.65
1996	Brazil	15.01	8.50	76.68
1996	China	2.73	1.65	65.81
1997	Brazil	14.36	8.71	64.92

1995	China	2.50	1.53	64.23
2007	India	4.20	2.63	59.67
2010	India	5.31	3.36	58.12
1970	Japan	12.50	8.01	56.06
1972	Japan	14.33	9.19	55.92
1955	Germany	8.16	5.40	51.09
1956	Germany	8.71	5.93	46.96
1963	Italy	12.07	8.27	45.85
1974	Italy	25.11	17.22	45.82
1973	France	28.30	20.18	40.25
1972	France	26.48	19.08	38.79
1997	UK	55.19	42.58	29.60
2006	South Africa	20.62	15.98	29.06
1996	UK	52.78	40.97	28.83
1956	Canada	18.96	14.73	28.73
1959	Canada	21.11	16.78	25.82
2007	South Africa	21.51	17.39	23.70
1965	US	32.72	27.87	17.41
1966	US	33.61	28.77	16.79
		Smallest		
1997	Russia	11.55	15.26	-24.30

1982	India	1.46	1.86	-21.40
1998	Russia	10.78	13.67	-21.15
1980	India	1.59	2.01	-20.65
2001	Brazil	12.36	15.01	-17.70
2002	Brazil	12.23	14.36	-14.83
2019	South Africa	20.57	22.90	-10.20
2018	South Africa	20.91	23.28	-10.18
2010	UK	62.20	66.20	-6.06
2020	Japan	48.22	51.10	-5.64
2011	UK	62.84	66.27	-5.17
2018	Japan	48.39	50.89	-4.91
2019	Canada	60.96	63.83	-4.49
1961	China	0.53	0.55	-4.34
1985	Italy	34.22	35.59	-3.85
2006	Italy	54.02	55.52	-2.70
1959	China	0.52	0.53	-2.50

2016	Canada	60.48	61.11	-1.03
1985	Germany	28.88	28.48	1.41
1984	Germany	28.65	28.11	1.92
1985	France	38.72	37.68	2.77
2015	US	74.99	72.94	2.80
2016	US	75.29	72.99	3.15
2016	France	72.82	70.50	3.30

Table A2 – Major (G7 and BRICS) Economies Top and Bottom Tails of Distribution

Year	Entity	Productivity	Productivity Lag	Growth Rate (%)
Top Tail (Most Volatile Booms)				
2008	Russia	24.79	12.56	97.29
2007	Russia	21.65	11.60	86.65
1996	Brazil	15.01	8.50	76.68
1996	China	2.73	1.65	65.81
1997	Brazil	14.36	8.71	64.92
1995	China	2.50	1.53	64.23
2006	Russia	18.64	11.39	63.66
2008	China	7.10	4.39	61.61
2009	Russia	22.72	14.07	61.46
2007	China	6.49	4.04	60.61
2007	India	4.20	2.63	59.67
2010	Russia	25.58	16.02	59.66
2010	India	5.31	3.36	58.12
2008	India	4.39	2.79	57.57
2009	China	7.62	4.85	56.98
Bottom Tail (Most Volatile Crashes)				
1997	Russia	11.55	15.26	-24.30
1982	India	1.46	1.86	-21.40
1998	Russia	10.78	13.67	-21.15
1980	India	1.59	2.01	-20.65
1981	India	1.53	1.92	-20.31
1999	Russia	10.06	12.50	-19.54
2001	Brazil	12.36	15.01	-17.70
1983	India	1.46	1.77	-17.43
1979	India	1.60	1.88	-14.99
2002	Brazil	12.23	14.36	-14.83
2003	Brazil	11.99	13.84	-13.37
1985	India	1.41	1.59	-11.67

1984	India	1.42	1.60	-11.17
2016	Brazil	17.97	20.07	-10.48
2019	South Africa	20.57	22.90	-10.20

Table A3 – Largest and Smallest Global Growth Rates

Year	Entity	Productivity	Productivity Lag	Growth Rate (%)
Largest				
2010	Zimbabwe	3.26	0.77	325.09
2010	Azerbaijan	17.73	6.82	159.97
2011	Azerbaijan	22.65	9.65	134.68
2013	Zimbabwe	4.36	1.93	125.60
1996	Argentina	26.70	11.98	122.87
2011	Iraq	37.47	17.19	117.99
2008	Venezuela	25.99	11.97	117.14
2012	Iraq	41.84	19.93	109.96
2010	Iraq	31.66	15.28	107.20
2011	Myanmar	4.11	1.99	105.95
2007	Trinidad & T.	50.67	24.67	105.35
2021	Myanmar	10.00	4.88	104.81
1995	Argentina	21.26	10.43	103.83
2021	Syria	22.66	11.17	102.94
2012	Congo	9.34	4.61	102.33
Smallest				
2023	Sudan	4.65	23.09	-79.85
2022	Sudan	5.22	18.32	-71.50
2015	Oman	30.18	75.81	-60.19
2016	Oman	26.72	65.67	-59.32
2021	Sudan	5.51	12.75	-56.79
2014	Oman	38.27	80.67	-52.55
2013	Oman	43.67	90.05	-51.51
2020	Yemen	3.53	7.18	-50.85
2019	Yemen	3.89	7.89	-50.66
2017	Oman	25.00	50.06	-50.05
2017	Yemen	4.18	8.15	-48.65
2016	Qatar	59.66	116.07	-48.60
2017	Kuwait	43.14	82.62	-47.78
2016	Kuwait	41.38	78.19	-47.08
2017	Qatar	64.44	121.55	-46.99
2023	Sudan	4.65	23.09	-79.85

2022	Sudan	5.22	18.32	-71.50
2015	Oman	30.18	75.81	-60.19
2016	Oman	26.72	65.67	-59.32

Table A4 – Largest vs. Smallest Global Z-Scores

Year	Country	Growth Rate (%)	Avg. Growth Rate (%)	Std. Dev Growth Rate (%)	Z-Score
Largest					
2008	Venezuela	117.14	10.17	27.01	3.96
1996	Argentina	122.87	22.11	29.46	3.42
2002	Bulgaria	51.18	16.97	10.33	3.31
1996	Brazil	76.68	16.78	18.64	3.21
2010	Zimbabwe	325.09	47.20	89.44	3.11
1964	Spain	61.62	19.92	13.44	3.10
1974	Netherlands	51.31	14.84	11.93	3.06
2010	Georgia	61.10	32.31	10.19	2.82
1995	Argentina	103.83	22.11	29.46	2.77
2011	Switzerland	33.58	12.82	7.56	2.75
Smallest					
1985	Belgium	-11.70	15.50	10.02	-2.72
2016	Hungary	-11.08	16.17	10.63	-2.57
2023	Moldova	-11.61	42.18	21.39	-2.51
2016	Norway	-23.97	19.52	17.31	-2.51
2017	Norway	-23.87	19.52	17.31	-2.51
2015	Australia	-2.24	10.85	5.28	-2.48
2013	Botswana	-28.86	-4.05	10.03	-2.47
1978	New Zealand	-12.42	7.53	8.19	-2.44
2016	Denmark	-0.93	15.21	6.67	-2.42
1979	New Zealand	-12.20	7.53	8.19	-2.41

Table A5 – Descriptive Statistics (1995-2017)

Cluster	Count	Mean	Std. Dev	Min	Max
BRICS	5	149.95	114.69	23.42	286.87
G7	7	39.58	10.94	27.52	53.98
Rest of World	80	88.05	70.92	-29.22	281.24

Table A6 – OLS Regression

Measure	Value
Slope (β)	-1.149
Standard Error	119.460
Intercept	0.114
p-value	0.001
R-squared	0.338

Competing in the Shadow of a Legend: The Superstar Effect in Gymnastics

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Business and Economics of Sport 2025-2026

Executive Summary

Female artistic gymnastics all-around competitions comprise of four apparatus: vault, uneven bars, beam, and floor. Since 2013, Simone Biles has dominated the discipline, securing six World Championship all-around titles and two Olympic all-around titles. Rosen's (1981) Superstar Model states that the presence of an exceptionally high-performing individual generates disproportionately large rewards for that athlete and alters the behaviour of competitors, either by motivating them to elevate their performance or by inducing intimidation effects.

Using data from USA Gymnastics (2025) covering all all-around finals in the Olympics and World Championships between 2008 and 2025, this study evaluates the extent to which Biles, as the superstar, influences the performance of other gymnasts. OLS estimates reveal a significant positive superstar effect, indicating that competing against a dominant athlete acts more as an incentive than an intimidation. Comparative analysis between the Olympic Games and World Championships shows that this effect is stronger at the Olympics, consistent with the idea that superstar influence intensifies in larger, more visible competitive environments.

Introduction

The superstar effect refers to the phenomenon where the presence of an exceptionally high-performing individual in a competitive environment generates disproportionately large rewards for that individual and alters the behaviour of other competitors. Such effects may manifest through increased motivation or, conversely, through intimidation, ultimately influencing performance outcomes and widening score differentials.

In women's artistic gymnastics, we look at this phenomenon in relation to Simone Biles. Representing team USA, Biles is widely recognised for her consistent and complex performances. At her Olympic debut in 2016, she achieved a record-breaking all-around winning margin of 2.100 points. She subsequently became the first U.S. gymnast to secure four gold medals at a single Olympic Games (OGs) and the first gymnast to win six World All-Around titles (2013–2015, 2018–2019, 2023). Across her career, she has accumulated 30 World Championship (WC) medals, 23 of which are gold (Peszek, 2019).

Biles' influence extends beyond athletic performance. Her OG and WC successes have substantially increased her public visibility, contributing to rapid growth in her social media following and attracting major sponsorships from brands such as Nike, Athleta, and UberEATS. She utilises her platform to advocate for social causes, including foster care, mental health, and access to education.

Empirical evidence suggests that the behavioural responses of competitors vary depending on the degree of dominance exhibited by the superstar. Lackner (2023) found that when a single, clearly dominant athlete is present (such as Biles in women's all-around competition) other competitors exhibit significantly reduced effort. In contrast, the presence of a less dominant superstar appears to increase risk-taking among competitors.

This pattern aligns with findings from Meissner et al. (2021), who found that gymnasts attempt more difficult routines in events where the superstar is relatively weaker. Given that the all-around final comprises four apparatus, it's plausible that competitors strategically target the apparatus in which the superstar is weakest in to narrow the performance gap.

The aim of this study is to assess the impact that Biles (as the superstar) has on the performances of other competitors. This will be tested using the hypotheses below.

$$H_0: The\ presence\ of\ a\ superstar\ has\ no\ affect\ on\ performances\ given\ in\ female\ all - around\ finals$$

$$H_1: The\ presence\ of\ a\ superstar\ has\ an\ affect\ on\ performances\ given\ in\ female\ all - around\ finals$$

Figure 1 – Null and alternative hypotheses for the study.

Hill et al. (2014) examined the superstar effect in the context of 100-metre sprinting, focusing on races in which Usain Bolt was present. Their analysis indicates that the participation of a dominant athlete is associated with improved performances among average competitors (who recorded faster times and had a higher probability of achieving personal bests). These findings contrast with Lackner (2023), who reported discouragement effects in the presence of a clearly dominant superstar. Hill et al. also found that the positive performance spillover is diminished for relatively fast runners and decreases as the competition progresses. Applied to artistic gymnastics, this pattern would imply that any positive superstar effect would be more pronounced during qualification rounds of the all-around competition.

Contrary to Hill et al, Babington et al. (2020), in a replication of Brown's earlier work using data from professional golf and alpine skiing, found no statistically significant effects of a superstar's presence on the performance of highly ranked competitors.

Theoretical Model

Rosen's Superstar Model (1981) provides a useful theoretical framework for interpreting the findings of this study. Rosen argued that in certain markets, marginal variations in talent can translate into disproportionately large differences in rewards. This dynamic emerges as technology enables the most skilled athletes to reach vast audiences at low marginal costs.

Rosen's key takeaway (that small talent differentials generate substantial reward disparities) is particularly relevant in markets/sports where performances can be broadcast, scaled, and consumed globally. Artistic gymnastics fits this structure closely. Biles is a consistent finalist at major international competitions, and these events are widely televised. As her dominance persisted, media coverage intensified, which expanded her visibility and helped her attain major brand deals. Her growing online presence further magnified her reach, allowing millions to engage with her on a regular basis.

Rosen's framework also highlights potential consequences for non-superstar competitors. The presence of a dominant athlete can generate two opposing incentive effects: it may inspire greater effort among some competitors or discourage others who perceive the superstar's achievements as unattainable. Dickson's (2011) analysis of the "Tiger Woods effect" in golf provides empirical evidence of this duality. He finds that, on average, golfers performed 0.6 strokes worse per round when Woods competed, whereas top-ranked golfers improved by approximately 4.2 strokes. These results suggest that superstar effects can simultaneously intimidate and motivate dependant on the competitor's relative skill level.

A further implication of Rosen's model is the potential for strategic differentiation. Competitors may seek to avoid direct comparison with the superstar by specialising in areas where the superstar is relatively weaker. This strategy links with Meissner et al. (2021), as they found that gymnasts attempt more difficult routines in events where the superstar is relatively weaker. Applied to this study, we would expect that athletes may increase difficulty on the uneven bars and balance beam (apparatus where Biles has historically shown less relative dominance) to narrow the competitive gap.

The existing literature on superstar effects within gymnastics is notably limited. One likely explanation is the sport's reliance on subjective scoring systems. Execution scores depend on judges' assessments, introducing potential sources of bias that complicate defining causal relationships. These challenges contrast with sports such as swimming or track events, where performance is measured objectively. The difficulty of isolating the influence of a superstar from judging may therefore contribute to the relative scarcity of empirical research in this domain.

This study examines the extent to which Biles, as a dominant superstar, influences the performance of other competitors. The analysis draws primarily on Meissner et al. (2021) and Lackner (2023), whose investigations of the superstar effect provide the most relevant points of comparison. A key distinction of this study is its explicit integration of Rosen's Superstar Model into the empirical interpretation, allowing for a more comprehensive theoretical framing of how talent differentials translate into performance and behavioural responses.

Data and Methodology

This study examines how the presence of a "superstar" influences the performance of other competitors in female all-around finals.

The dataset contains final scores, sourced from USA Gymnastics (2025). Each final includes 24 gymnasts; three finals contained athletes classified as "DNF", which were excluded to ensure comparability across performances. The analysis covers all OG and WC all-around finals from 2008 to 2025.

Models

$$Performance_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 1 – Main performance regression

Eq. (1) forms the basis of the empirical analysis, with ten additional model variations estimated (appendix, eq 2-11). To assess Rosen's Superstar Model, eight models use disaggregated scores (difficulty and execution scores), allowing a more detailed examination of how superstars influence strategic behaviour, enabling direct comparison with Meissner et al. (2021) and Lackner (2023).

Comparative analysis is conducted to evaluate whether the magnitude or direction of the superstar effect differs across tournament types.

	Performance - Olympics	Performance - Worlds
Mean	56.10	54.07
P-Value (Two-tail)	0.000	

Table 1 - T-Test for performance means in the Olympics Versus World Championships. Full testing results reported in appendix, table a.

Table 1 shows statistically significant mean performance differences between the OGs and WCs (1% level). The comparative regression analysis (appendix models 10-11) will help identify the factors driving these differences.

Robust standard errors are used to address heteroskedasticity and ensure more reliable p-values.

Preliminary Data Analysis

	Mean	Standard Deviation	Range	Minimum	Maximum	Count
Performance	54.633	2.977	21.326	41.999	63.325	429
Superstar Present	0.443	0.497	1	0	1	429
Starting Apparatus	2.494	1.120	3	1	4	429
Superstar	0.019	0.135	1	0	1	429
Olympics	0.277	0.448	1	0	1	429
Home Advantage	0.049	0.216	1	0	1	429
Covid Affected	0.112	0.316	1	0	1	429
Age	19.747	3.267	17.455	15.726	33.181	429
Age^2	400.586	142.555	853.659	247.308	1,100.967	429
In superstars' group	0.112	0.3156	1	0	1	429
Year of Competition	2016	5.238	17	2008	2025	429

Table 2 - Descriptive statistics of control variables in the regression model shown by equation 1. Please see appendix table c for full variable descriptions and descriptive statistics.

The dependent variable in this study is performance, which is calculated as the sum of the difficulty and execution scores minus any penalties. Table 2 shows that the mean performance/score is 54.633, a value near the upper end of the scoring range. This suggests that gymnasts in all-around finals have maintained consistently high-performance levels over the past seventeen years.

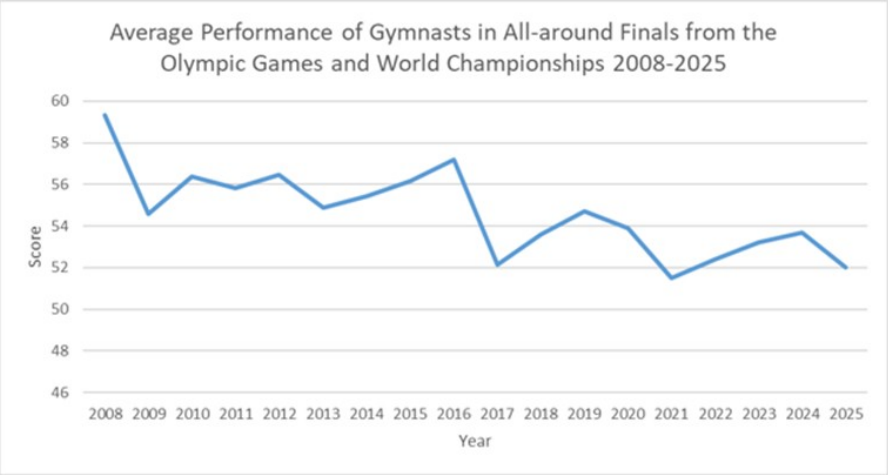

Figure 2 - Graph of average performance (by overall score) from gymnasts in female all-around Olympic Games and World Championships 2008-2025.

Figure 2 illustrates a steady decline in average performance, contrasting with trends in other sports where performance has improved. Weiss et al. (2016) reported substantial reductions in running times across all distances over the past century, while Cengiz et al. (2023) noted that swimming performance improved in recent years but plateaued during the 1980–90s, suggesting potential limits. The downward trend in gymnastics scores may similarly indicate that athletes are approaching the upper bounds of what is achievable under current scoring standards.

Age was identified for each gymnast at the time of competition. König et al. (2014) found that older finalists performed better in swimming at the OGs and WCs.

Table 2 shows that the mean age in this study is 19.747. Knechtle et al. (2016) reported comparable age patterns among elite female swimmers (mean of 21 ± 3.45 and a range of 20), suggesting that the age profile of top gymnasts is broadly consistent with other Olympic and WC sports. An age-squared term is included to capture potential non-linear effects.

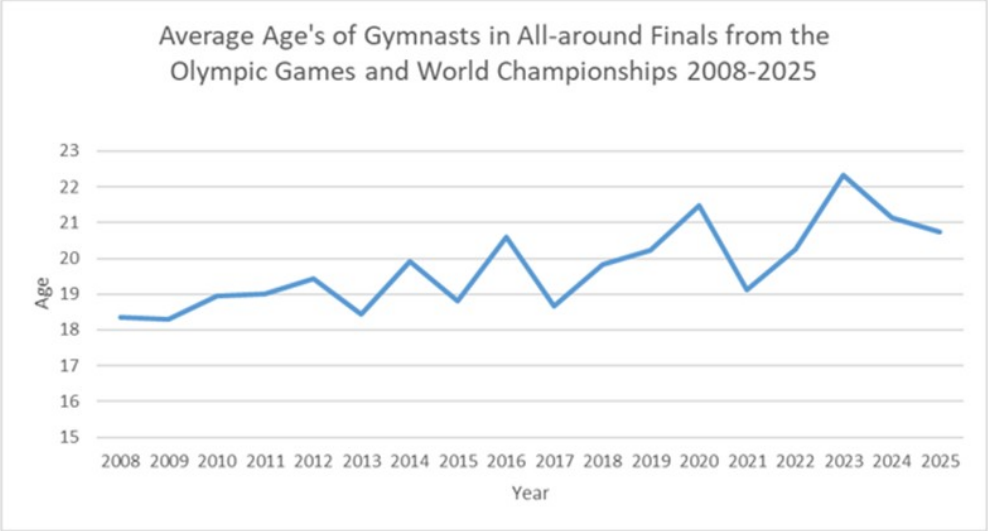

Figure 3 - Graph of average age of gymnasts in female all-around Olympic Games and World Championships 2008-2025.

Figure 3 indicates a gradual increase in the average age of competitors, consistent with König et al. (2014), who also report rising ages among elite swimmers.

All remaining variables are binary. The focal point "superstar present", identifies whether Biles competed. Two additional controls, "superstar" and "in superstar's group" (inspired by Babington et al., 2020) capture whether the gymnast is the superstar and whether she competed in the same rotation group, helping to isolate direct and indirect effects.

A "COVID-affected" variable accounts for pandemic disruptions in 2020–2021, including reduced crowds, social-distancing measures, and the postponement of the 2020 OGs.

As the OGs and WCs are hosted in different countries, a “home advantage” variable is included. Balmer et al. (2003) documents strong home-nation effects in subjectively judged sports, suggesting that crowd influence and judging discretion may also matter in gymnastics.

The “Olympics” variable distinguishes OGs from WC finals. Milinović et al. (2013) found no significant performance differences between these competitions in female throwing events.

	Mean	Standard Deviation	Range	Minimum	Maximum	Count
Vault - Difficultly	5.123	0.576	3.1	3.300	6.4	309
Bars - Difficultly	5.725	0.534	3.4	3.800	7.2	309
Beam - Difficultly	5.497	0.446	2.7	4.000	6.7	309
Floor - Difficultly	5.401	0.476	2.8	4.100	6.9	309
Vault - Execution	8.950	0.281	2.033	7.533	9.566	309
Bars - Execution	7.844	0.662	4.300	4.766	9.066	309
Beam - Execution	7.521	0.767	6.333	2.6	8.933	309
Floor - Execution	7.902	0.498	3.467	5.666	9.133	309
Superstar Present	0.615	0.487	1	0	1.000	309
Superstar	0.026	0.159	1	0	1.000	309
Starting Apparatus	2.492	1.121	3	1	4	309
Olympics	0.230	0.421	1	0	1.000	309
Home Advantage	0.039	0.194	1	0	1.000	309
Covid Affected	0.155	0.363	1	0	1.000	309
Age	20.111	3.313	16.734	15.808	32.542	309
Age^2	415.405	145.324	809.112	249.900	1,059.012	309
In superstars’ group	0.155	0.363	1	0	1.000	309
Year of Competition	2019	3.777	12	2013	2025	309

Table 3 - Descriptive statistics of control variables in the adapted regression models. (full descriptive statistics table d).

Table 3 reports descriptive statistics for the adapted regression models examining the effects of superstar presence on difficulty and execution scores. USA Gymnastics (2025) changed its data-collection format, meaning disaggregated scores are only available from 2013, resulting in smaller sample sizes for these models.

Results

Overall Performance

	Performance
Superstar Present	1.030***
	(0.227)
R2	0.652
N	429

Table 4 - Overall Performance based on final score, regression result for variable "superstar present". Please see full regression results in appendix table e
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 4 indicates that when a superstar is present, performance increases by 1.030 points (hvc), significant at the 1% level. This result contrasts Babington et al's. (2020), who found no significant evidence that superstars influence the performance of highly ranked competitors. The positive effect observed here aligns with Rosen's Superstar Model, suggesting that the presence of a dominant athlete can inspire competitors to elevate their performance – also agreeing with findings from Dickson (2011).

Being assigned to the superstar's rotation group reduced performance by 0.750-points (hvc), significant at the 5% level. This finding builds on Rosen's implications for competitors, as it suggests that proximity to a superstar may generate intimidation effects (thus reducing performance).

All starting-apparatus dummy variables are significant at the 1% level, indicating that beginning on any apparatus other than vault is associated with a 2.073–4.030-point reduction. This is plausible in terms of consistency, as the starting groups are set through scores at qualifications.

The regression results also show that competing at the OGs increases performance by 2.050 points (hvc), significant at the 1% level. This contradicts Milinović et al. (2013), as they found no significant performance differences between Olympic and WC finals in female throwing events.

Neither home advantage nor age variables exhibits statistically significant effects on performance.

COVID-affected competitions reduce performances by 0.723-points (hvc, 5% level), likely reflecting reduced crowds, altered training, and the postponement of the 2020 OGs.

Year-of-competition variable indicates a decline of 0.298 points per year (hvc), significant at the 1% level. This result corroborates the preliminary trend analysis presented earlier (Figure 2).

Execution Regressions

	Vault execution	Bars execution	Beam execution	Floor execution
Superstar Present	0.013	0.0385	0.776***	0.030
	(0.054)	(0.119)	(0.134)	(0.085)
R2	0.171	0.149	0.316	0.270
N	309	309	309	309

Table 5 - Execution score regression, regression result for variable "superstar present". Please see full regression results in appendix table f.
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 5 shows that when a superstar is present, execution scores increase across all apparatus by 0.013–0.776 points (hvc), though only the beam effect is significant (1 % level). This contradicts Lackner (2023), who argues that superstar effects depend on event-specific dominance. Given Biles' strength on floor and vault and relative weakness on bars and beam, stronger effects would be expected on vault and floor, yet the results do not reflect his finding as they're insignificant.

Home-advantage effects remain insignificant, but the coefficients differ in sign across apparatus. Performing with a home-advantage decreases execution by 0.141 on bars and by 0.075 on floor (hvc), counter to Balmer et al. (2003), who found strong home-advantages in subjectively judged sports. The negative floor coefficient is especially notable given the event's high subjectivity, where crowd influence would be expected to impact scores

Being in the superstar's rotation group reduces execution scores on all apparatus, though without statistical significance. The uniformly negative coefficients are consistent with Rosen's consequence of intimidation effects.

Difficulty Regressions

	Vault difficulty	Bars difficulty	Beam difficulty	Floor difficulty
Superstar Present	0.107	0.132*	0.231***	0.054
	(0.071)	(0.078)	(0.064)	(0.066)
R2	0.514	0.274	0.338	0.430
N	309	309	309	309

Table 6 - Difficulty score regression, regression result for variable "superstar present". Please see full regression results in appendix table g.
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 6 shows that the "superstar present" variable is statistically significant only on bars and beam (10% and 1% levels). When a superstar competes, other gymnasts increase their difficulty by 0.054–0.231 points. This aligns with Meissner et al. (2021), who found that gymnasts raise difficulty in events where the superstar is relatively weaker. Since bars and

beam are Biles' weaker apparatus, the observed increase supports both their findings and Rosen's strategic-differentiation mechanism.

Similar to Equation (1) (appendix table e), difficulty scores decline over time (hvc), with vault and floor showing 1% significance. This supports Lackner's (2023) argument that competitors reduce risk-taking in events where the superstar is strongest. Given that the sample spans Biles' entire career, the downward trend is consistent with her increasing superstar dominance, discouraging risk-taking difficulty upgrades.

Age remains insignificant, though coefficient signs suggest a concave relationship, with difficulty peaking mid-career.

The Olympics variable is significant at the 1% level across all apparatus, indicating that difficulty scores are 0.155–0.361 points higher at the OGs than at the WCs.

Comparative Analysis: Olympic Games Versus World Championships

	Olympics	Worlds
Superstar Present	2.743***	1.097***
	(0.809)	(0.231)
R2	0.717	0.607
N	119	310

Table 7 - Overall Performance based on final score, regression result for variable "superstar present", by competition type for comparative analysis. Please see full regression results in appendix table h.
*Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01*

Table 7 shows that a superstar being present in both competitions is significant at the 1% level. However, the magnitude of the effect is notably larger in the OGs. This pattern aligns with Rosen's Superstar Model, which states that superstar influence intensifies when performances can be scaled. Viewership figures support this interpretation: Adgate (2024) reports that women's gymnastics at the Paris Olympics averaged 12.7 million viewers on NBC, whereas US TVDB (2022) stated that 682 thousand watched the 2022 gymnastics WCs (on NBC). The substantially larger Olympic audience provides a plausible mechanism for the amplified superstar effect observed in the OGs.

Being in the superstar's rotation group reduces performance by 1.749 points in the OGs (HVC, 5% level), with no significant effect in the WCs. This supports the view that superstar influence is stronger in larger events, consistent with Rosen's argument of the consequences of competing alongside a superstar.

For both OGs and WCs, the starting-apparatus dummy variables indicate that beginning on any apparatus other than vault decreases scores (hvc, 1% level). Larger magnitudes in the OGs suggest greater disparities between starting groups, likely reflecting stronger sorting-like effects from qualification rankings.

Home-advantage coefficients, though insignificant, differ in sign across competitions: performance decreases by 2.164 points in the OGs but increases by 0.165 points in the WCs (hvc). This contradicts Balmer et al. (2003), who found strong home advantages in subjectively judged sports.

COVID-19 effects also vary by competition type. COVID-affected years increase performances by 1.399 points at the OGs (hvc) but decrease performances by 1.027 points at the WCs (hvc, 5 percent level). The WC result aligns with Rovetta et al. (2021), who attributed reduced scoring in crowd-free football matches to the absence of spectator influence. The contrasting Olympic effect may reflect unique circumstances surrounding the postponed 2020 Games, including extended preparation time, altered training cycles, and psychological pressures that are not fully captured in the model.

Conclusion

This study examined how the presence of a superstar influences the performance of other competitors in women's artistic gymnastics all-around finals.

The findings provide clear evidence of a positive superstar effect: competitors perform better (and score higher) when a superstar is present. This effect is notably larger at the OGs than at the WCs, likely reflecting the greater scale and visibility of the Olympics. This pattern is consistent with Rosen's Superstar Model, which predicts that superstar influence intensifies in settings where performances can be more widely observed.

The analysis also revealed significant increases in both difficulty and execution scores on bars and beam when a superstar competed, suggesting that gymnasts strategically differentiate themselves from the dominant athlete. These results align with Rosen's theorised behavioural consequences from competitors and support the empirical findings of Meissner et al. (2021) and Lackner (2023).

A key limitation of the study is its reliance on basic regression techniques. Although OLS provides unbiased estimates under standard assumptions, violations of these assumptions may compromise reliability. Future research could employ more sophisticated causal inference methods, such as treatment-effect models, to better isolate the direct impact of competing against a superstar.

The analysis also focuses on a single superstar, which limits generalisability. Extending the time frame and incorporating previous superstars would allow for broader conclusions about superstar effects in gymnastics. Additionally, examining whether superstar effects differ by gender would offer further insight into potential psychological or behavioural differences in how athletes respond to elite competitors.

Bibliography

Adgate, B. (2024). The Paris Olympics Averaged 30.6 Million Viewers across NBCU Platforms. *Forbes*. [online] 14 Aug. Available at: https://www.forbes.com/sites/bradadgate/2024/08/13/the-paris-olympics-averaged-306-million-viewers-across-nbcu-platforms/.

Babington, M., Goerg, S.J. and Kitchens, C., 2020. Do tournaments with superstars encourage or discourage competition?. *Journal of Sports Economics*, *21*(1), pp.44-63.

Balmer, N.J., Nevill, A.M. and Williams, A.M., 2003. Modelling home advantage in the Summer Olympic Games. *Journal of sports sciences*, *21*(6), pp.469-478.

Cengiz, Ş.Ş. and Coşkun, E.Ş., 2023. Swimming in The Olympics. *International Journal of Sport Culture and Science*, *11*(1), pp.56-70.

Dickson, R.M., 2011. *The" Tiger Effect": Get it On, Get it Close, Get it in* (Doctoral dissertation, University of North Carolina at Charlotte).

Hill, B., 2014. The superstar effect in 100-meter tournaments. *International Journal of Sport Finance*, *9*(2), pp.111-129.

Knechtle, B., Bragazzi, N., König, S., Nikolaidis, P., Wild, S., Rosemann, T. and Rüst, C. (2016). The Age in Swimming of Champions in World Championships (1994–2013) and Olympic Games (1992–2012): a Cross-Sectional Data Analysis. *Sports*, 4(1), p.17. doi:https://doi.org/10.3390/sports4010017.

König, S., Valeri, F., Wild, S., Rosemann, T., Rüst, C.A. and Knechtle, B., 2014. Change of the age and performance of swimmers across World Championships and Olympic Games finals from 1992 to 2013–a cross-sectional data analysis. *SpringerPlus*, *3*(1), p.652.

Lackner, M., 2023. Effort and risk-taking in tournaments with superstars–evidence for teams. *Applied Economics*, *55*(57), pp.6776-6792.

Luan Peszek (2019). Simone Biles. In: *Encyclopædia Britannica*. [online] Available at: https://www.britannica.com/biography/Simone-Biles.

Meissner, L., Rai, A. and Rotthoff, K.W., 2021. The superstar effect in gymnastics. *Applied Economics*, *53*(24), pp.2791-2798.

Milinović, I., Milanović, D. and Harasin, D., 2013. Differences between best olympic results and best world athletics events' throws women accomplished in the olympic games' years. *Acta Kinesiologica*, *7*(2), pp.10-15.

Rovetta, A. and Abate, A., 2021. The impact of cheering on sports performance: comparison of serie a statistics before and during COVID-19. *Cureus*, *13*(8).

US TVDB (2022). *World Artistic Gymnastics Championships Ratings*. [online] Ustvdb.com. Available at: https://ustvdb.com/networks/nbc/shows/world-artistic-gymnastics-championships/ [Accessed 17 Jan. 2026].

USA Gymnastics (2025). *2025 Artistic Gymnastics World Championships • USA Gymnastics*. [online] USA Gymnastics. Available at: https://usagym.org/events/2025-artistic-gymnastics-world-championships/.

Weiss, M., Newman, A., Whitmore, C. and Weiss, S., 2016. One hundred and fifty years of sprint and distance running–Past trends and future prospects. *European Journal of Sport Science*, *16*(4), pp.393-401.

Appendix

Regression Models

$$VaultDifficulty_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 2 - Difficulty adapted regression model for the vault

$$BarsDifficulty_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 1 - Difficulty adapted regression model for the bars

$$BeamDifficulty_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 2 - Difficulty adapted regression model for the beam

$$FloorDifficulty_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 3 - Difficulty adapted regression model for the floor

$$VaultExecution_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 4 - Execution adapted regression model for the vault

$$BarsExecution_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 5 - Execution adapted regression model for the bars

$$BeamExecution_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 6 - Execution adapted regression model for the beam

$$FloorExecution_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 Olympics_i + \beta_4 HomeAdvantage_i + \beta_5 CovidAffected_i + \beta_6 Age_i + \beta_7 Age_i^2 + \beta_8 Superstar'sGroup_i + \beta_9 YearOfCompetition_i + \beta_{10} Superstar_i + u_i$$

Equation 7 - Execution adapted regression model for the floor

$$OlympicsPerformance_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 HomeAdvantage_i + \beta_4 CovidAffected_i + \beta_5 Age_i + \beta_6 Age_i^2 + \beta_7 Superstar'sGroup_i + \beta_8 YearOfCompetition_i + \beta_9 Superstar_i + u_i$$

Equation 8 - Olympics adapted regression model for comparative analysis

$$WorldsPerformance_i = a + \beta_1 SuperstarPresent_i + \beta_2 StartingApparatus_i + \beta_3 HomeAdvantage_i + \beta_4 CovidAffected_i + \beta_5 Age_i + \beta_6 Age_i^2 + \beta_7 Superstar'sGroup_i + \beta_8 YearOfCompetition_i + \beta_9 Superstar_i + u_i$$

Equation 9 - World Championship adapted regression model for comparative analysis

T-Test for Olympics Vs World Championship Performances

t-Test: Two-Sample Assuming Unequal Variances	- Performance	
	Performance - Olympics	*Performance - Worlds*
Mean	56.10	54.07
Variance	11.04	6.91
Observations	119	310
Hypothesized Mean Difference	0	
df	178	
t Stat	6.00	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.65	
P(T<=t) two-tail	0.00	
t Critical two-tail	1.97	

Table a – T-Test for mean differences in performance for Olympics and World Championships.

Variable Definitions

Variable Name	Variable Description
Performance	Overall score (difficulty score + execution score – penalties)
Vault - Difficultly	Difficulty score for vault completed
Bars - Difficultly	Difficulty score for uneven bar routine completed
Beam - Difficultly	Difficulty score for beam routine completed
Floor - Difficultly	Difficulty score for floor routine completed
Vault - Execution	Execution score for vault completed
Bars - Execution	Execution score for uneven bar routine completed
Beam - Execution	Execution score for beam routine completed
Floor - Execution	Execution score for floor routine completed
Superstar Present	Variable indicating whether the superstar is present 0= no superstar present. 1= superstar present
Starting Apparatus	Variable indicating what a gymnast's starting apparatus is 1= vault. 2= bars. 3= beam. 4= floor. [base group= vault]
Olympics	Variable indicating whether the all-around final is an Olympic or World Championship final. 0= World Championship. 1= Olympics
Home Advantage	Variable indicating whether the gymnast has a home advantage. 0= no home advantage. 1= home advantage
Covid Affected	Variable indicating whether the competition has been affected by Covid 0= not affected by Covid. 1= affected by Covid
Age	Age of gymnast
Age2	Age squared
In Superstars' Group	Variable indicating whether the gymnast is in the superstars group 0= not in the superstars group. 1= in the superstar's group
Year of Competition	Variable stating the year that the competition took place in
Superstar	Variable indicating if the gymnast is the superstar 0= not the superstar. 1= the superstar

Table b – Variable definitions for all variables used in the study

Descriptive Statistics

Performance		*Superstar Present*		*Superstar*		*Olympics*	
Mean	54.633	Mean	0.443	Mean	0.019	Mean	0.277
Standard Error	0.144	Standard Error	0.024	Standard Error	0.007	Standard Error	0.022
Median	54.699	Median	-	Median	-	Median	-
Mode	53.965	Mode	-	Mode	-	Mode	-
Standard Deviation	2.977	Standard Deviation	0.497	Standard Deviation	0.135	Standard Deviation	0.448
Sample Variance	8.861	Sample Variance	0.247	Sample Variance	0.018	Sample Variance	0.201
Kurtosis	0.526	Kurtosis	-1.956	Kurtosis	49.230	Kurtosis	-1.009
Skewness	0	Skewness	0.231	Skewness	7.141	Skewness	0.998
Range	21.326	Range	1	Range	1	Range	1
Minimum	41.999	Minimum	-	Minimum	-	Minimum	-
Maximum	63.325	Maximum	1	Maximum	1	Maximum	1
Sum	23,437.576	Sum	190	Sum	8	Sum	119
Count	429	Count	429	Count	429	Count	429

Home Advantage		*Covid Affected*		*Age*		*Age^2*	
Mean	0.049	Mean	0.112	Mean	19.747	Mean	400.586
Standard Error	0.010	Standard Error	0.015	Standard Error	0.158	Standard Error	6.883
Median	-	Median	-	Median	18.715	Median	350.254
Mode	-	Mode	-	Mode	17.512	Mode	306.682
Standard Deviation	0.216	Standard Deviation	0.316	Standard Deviation	3.267	Standard Deviation	142.555
Sample Variance	0.047	Sample Variance	0.100	Sample Variance	10.673	Sample Variance	20,322.051
Kurtosis	15.676	Kurtosis	4.125	Kurtosis	1.228	Kurtosis	3.084
Skewness	4.196	Skewness	2.471	Skewness	1.208	Skewness	1.632
Range	1	Range	1	Range	17.455	Range	853.659
Minimum	-	Minimum	-	Minimum	15.726	Minimum	247.308
Maximum	1	Maximum	1	Maximum	33.181	Maximum	1,100.967
Sum	21	Sum	48	Sum	8,471.395	Sum	171,851.227
Count	429	Count	429	Count	429	Count	429

In superstars group		*Year*		*Starting Appartus*	
Mean	0.112	Mean	2016.531469	Mean	2.494172494
Standard Error	0.015	Standard Error	0.252870857	Standard Error	0.054091845
Median	-	Median	2016	Median	2
Mode	-	Mode	2021	Mode	1
Standard Deviation	0.316	Standard Deviation	5.237540885	Standard Deviation	1.120367337
Sample Variance	0.100	Sample Variance	27.43183452	Sample Variance	1.25522297
Kurtosis	4.125	Kurtosis	-1.251449119	Kurtosis	-1.364151735
Skewness	2.471	Skewness	-0.009476758	Skewness	0.009626709
Range	1	Range	17	Range	3
Minimum	-	Minimum	2008	Minimum	1
Maximum	1	Maximum	2025	Maximum	4
Sum	48	Sum	865092	Sum	1070
Count	429	Count	429	Count	429

Table c - Descriptive Statistics (full results) based on regression model 1

Vault - Execution		Bars - Execution		Beam - Execution		Floor - Execution	
Mean	8.950	Mean	7.844	Mean	7.521	Mean	7.902
Standard Error	0.016	Standard Error	0.038	Standard Error	0.044	Standard Error	0.028
Median	8.966	Median	8.033	Median	7.600	Median	7.966
Mode	9.000	Mode	8.233	Mode	8.300	Mode	8.166
Standard Deviation	0.281	Standard Deviation	0.662	Standard Deviation	0.767	Standard Deviation	0.498
Sample Variance	0.079	Sample Variance	0.439	Sample Variance	0.589	Sample Variance	0.248
Kurtosis	7.023	Kurtosis	2.097	Kurtosis	5.478	Kurtosis	1.764
Skewness	-1.610	Skewness	-1.280	Skewness	-1.453	Skewness	-1.005
Range	2.033	Range	4.300	Range	6.333	Range	3.467
Minimum	7.533	Minimum	4.766	Minimum	2.600	Minimum	5.666
Maximum	9.566	Maximum	9.066	Maximum	8.933	Maximum	9.133
Sum	2,765.427	Sum	2,423.713	Sum	2,323.915	Sum	2,441.675
Count	309.000	Count	309.000	Count	309.000	Count	309.000

Vault - Difficulty		Bars - Difficulty		Beam - Difficulty		Floor - Difficulty	
Mean	5.123	Mean	5.725	Mean	5.497	Mean	5.401
Standard Error	0.033	Standard Error	0.030	Standard Error	0.025	Standard Error	0.027
Median	5.000	Median	5.700	Median	5.500	Median	5.400
Mode	5.000	Mode	5.600	Mode	5.400	Mode	5.000
Standard Deviation	0.576	Standard Deviation	0.534	Standard Deviation	0.446	Standard Deviation	0.476
Sample Variance	0.332	Sample Variance	0.285	Sample Variance	0.199	Sample Variance	0.226
Kurtosis	-0.543	Kurtosis	0.116	Kurtosis	-0.031	Kurtosis	0.435
Skewness	0.041	Skewness	-0.238	Skewness	0.020	Skewness	0.439
Range	3.100	Range	3.400	Range	2.700	Range	2.800
Minimum	3.300	Minimum	3.800	Minimum	4.000	Minimum	4.100
Maximum	6.400	Maximum	7.200	Maximum	6.700	Maximum	6.900
Sum	1,582.900	Sum	1,768.900	Sum	1,698.700	Sum	1,668.800
Count	309	Count	309	Count	309	Count	309

Superstar Present		Superstar		Olympics		Home Advantage	
Mean	0.615	Mean	0.026	Mean	0.230	Mean	0.039
Standard Error	0.028	Standard Error	0.009	Standard Error	0.024	Standard Error	0.011
Median	1.000	Median	-	Median	-	Median	-
Mode	1.000	Mode	-	Mode	-	Mode	-
Standard Deviation	0.487	Standard Deviation	0.159	Standard Deviation	0.421	Standard Deviation	0.194
Sample Variance	0.238	Sample Variance	0.025	Sample Variance	0.178	Sample Variance	0.037
Kurtosis	-1.786	Kurtosis	34.222	Kurtosis	-0.336	Kurtosis	21.150
Skewness	-0.474	Skewness	6.000	Skewness	1.291	Skewness	4.797
Range	1	Range	1	Range	1	Range	1
Minimum	-	Minimum	-	Minimum	-	Minimum	-
Maximum	1	Maximum	1	Maximum	1	Maximum	1
Sum	190	Sum	8	Sum	71	Sum	12
Count	309	Count	309	Count	309	Count	309

Covid Affected		Age		Age^2		In superstars group	
Mean	0.155	Mean	20.111	Mean	415.405	Mean	0.155
Standard Error	0.021	Standard Error	0.188	Standard Error	8.267	Standard Error	0.021
Median	-	Median	19.123	Median	365.700	Median	-
Mode	-	Mode	21.414	Mode	458.546	Mode	-
Standard Deviation	0.363	Standard Deviation	3.313	Standard Deviation	145.324	Standard Deviation	0.363
Sample Variance	0.132	Sample Variance	10.975	Sample Variance	21,119.075	Sample Variance	0.132
Kurtosis	1.668	Kurtosis	0.663	Kurtosis	2.003	Kurtosis	1.668
Skewness	1.912	Skewness	1.048	Skewness	1.419	Skewness	1.912
Range	1	Range	16.734	Range	809.112	Range	1
Minimum	-	Minimum	15.808	Minimum	249.900	Minimum	-
Maximum	1	Maximum	32.542	Maximum	1,059.012	Maximum	1
Sum	48	Sum	6,214.400	Sum	128,360.141	Sum	48
Count	309	Count	309	Count	309	Count	309

Year		Starting Appartus	
Mean	2019.067961	Mean	2.491909385
Standard Error	0.214859379	Standard Error	0.063786647
Median	2019	Median	2
Mode	2021	Mode	1
Standard Deviation	3.776883213	Standard Deviation	1.121266928
Sample Variance	14.2648468	Sample Variance	1.257239524
Kurtosis	-1.267281301	Kurtosis	-1.365709235
Skewness	-0.055613261	Skewness	0.013384895
Range	12	Range	3
Minimum	2013	Minimum	1
Maximum	2025	Maximum	4
Sum	623892	Sum	770
Count	309	Count	309

Table d - Descriptive Statistics (full results) based on regression model 2-9

Regression Results – Performance

	(1) performance
Superstar present	1.030***
	(0.227)
Starting: Bars	-2.073***
	(0.300)
Starting: Beam	-3.275***
	(0.347)
Starting: Floor	-4.030***
	(0.312)
Olympics	2.050***
	(0.222)
Home advantage	-0.375
	(0.758)
Covid affected	-0.723**
	(0.303)
Age	0.166
	(0.306)
Age2	-0.00328
	(0.00711)
In superstars' group	-0.750*
	(0.392)
Year of	-0.298***

competition	
	(0.0195)
superstar	3.096***
	(0.347)
_cons	655.8***
	(38.96)
R^2	0.652
N	429

Table e - Full regression results based on equation 1.
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Regression Results – Execution

	(1) Vault execution	(2) Bars execution	(3) Beam execution	(4) Floor execution
Superstar present	0.0127	0.0385	0.776***	0.0303
	(0.0539)	(0.119)	(0.134)	(0.0851)
Starting: Bars	-0.177***	-0.257*	-0.362***	-0.258***
	(0.0499)	(0.148)	(0.129)	(0.0896)
Starting: Beam	-0.242***	-0.296*	-0.597***	-0.402***
	(0.0593)	(0.156)	(0.145)	(0.0836)
Starting: Floor	-0.228***	-0.358**	-0.565***	-0.487***
	(0.0504)	(0.147)	(0.158)	(0.0894)
Olympics	0.0327	0.293***	0.135*	0.195**
	(0.0333)	(0.0797)	(0.0800)	(0.0759)
Home advantage	0.0547	-0.141	0.178	-0.075
	(0.0596)	(0.240)	(0.181)	(0.133)
Covid affected	0.0114	-0.226*	0.292**	0.00380
	(0.0507)	(0.120)	(0.138)	(0.0841)
Age	0.0456	0.111	0.175	0.121
	(0.0475)	(0.127)	(0.120)	(0.0785)
Age2	-0.000979	-0.00227	-0.00343	-0.00256
	(0.00110)	(0.00299)	(0.00270)	(0.00179)
In superstars' group	-0.0238	-0.0210	-0.102	-0.176
	(0.0616)	(0.170)	(0.156)	(0.126)
Year of	-0.0114**	-0.0374***	-0.0121	-0.0511***

competition				
	(0.00469)	(0.0129)	(0.0106)	(0.00768)
superstar	0.214	0.335**	0.108	0.415***
	(0.168)	(0.165)	(0.206)	(0.117)
_cons	31.50***	82.30***	29.73	110.0***
	(9.406)	(26.19)	(21.42)	(15.61)
R2	0.171	0.149	0.316	0.270
N	309	309	309	309

Table f - Full regression results based on equations 6-9.
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Regression Results – Difficulty

	(1) Vault difficulty	(2) Bars difficulty	(3) Beam difficulty	(4) Floor difficulty
Superstar present	0.107	0.132*	0.231***	0.0540
	(0.0710)	(0.0781)	(0.0643)	(0.0658)
Starting: Bars	-0.194**	-0.129	-0.182*	-0.220**
	(0.0924)	(0.116)	(0.0931)	(0.0896)
Starting: Beam	-0.242***	-0.294**	-0.375***	-0.312***
	(0.0897)	(0.119)	(0.0918)	(0.0892)
Starting: Floor	-0.531***	-0.526***	-0.429***	-0.471***
	(0.0893)	(0.118)	(0.0902)	(0.0889)
Olympics	0.260***	0.361***	0.155***	0.264***
	(0.0640)	(0.0701)	(0.0551)	(0.0567)
Home advantage	0.115	0.180	0.105	0.0797
	(0.0920)	(0.131)	(0.125)	(0.125)
Covid affected	0.104	-0.0812	-0.126*	-0.281***
	(0.0840)	(0.103)	(0.0702)	(0.0688)
Age	0.118	0.0883	0.0216	0.0977
	(0.0827)	(0.0940)	(0.0632)	(0.0779)
Age2	-0.00244	-0.00215	-0.000689	-0.00226
	(0.00192)	(0.00218)	(0.00140)	(0.00180)
In superstars' group	0.0273	0.0467	-0.0605	-0.0809
	(0.0999)	(0.133)	(0.104)	(0.107)
Year of competition	-0.0808***	-0.0113	-0.00993	-0.0302***

	(0.00774)	(0.00905)	(0.00673)	(0.00689)
superstar	0.686***	0.00496	0.486***	0.963***
	(0.0935)	(0.0978)	(0.0765)	(0.0941)
_cons	167.0***	27.66	25.49*	65.61***
	(15.62)	(18.34)	(13.45)	(13.81)
R^2	0.514	0.274	0.338	0.430
N	309	309	309	309

Table g - Full regression results based on equations 2-5.
Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

Regression Results – Comparative Analysis

	(1) Olympics	(2) Worlds
Superstar present	2.743***	1.097***
	(0.809)	(0.231)
Starting: Bars	-3.027***	-1.822***
	(0.523)	(0.376)
Starting: Beam	-4.210***	-2.926***
	(0.698)	(0.380)
Starting: Floor	-5.228***	-3.645***
	(0.567)	(0.377)
Home advantage	-2.164	0.165
	(2.427)	(0.372)
Covid affected	1.399	-1.027**
	(0.868)	(0.406)
Age	-0.456	0.781
	(0.477)	(0.554)
Age2	0.0110	-0.0183
	(0.0100)	(0.0133)
In superstars' group	-1.749**	-0.389
	(0.799)	(0.452)
Year of competition	-0.505***	-0.253***
	(0.0547)	(0.0224)
superstar	3.426***	2.957***
	(0.713)	(0.435)

_cons	1079.9***	558.3***
	(112.9)	(44.93)
R^2	0.717	0.607
N	119	310

Table h - Full regression results based on equations 10-11. Standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

An Analysis of the Mastercard-Vocalink Merger

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Industrial Organisation and Business Strategies 2025-2026

Introduction:

Modern payment systems rely on complex infrastructure that processes millions of transactions each day. In the UK, VocaLink is a major operator of this infrastructure, providing services for Bacs, Faster Payments and the LINK ATM network (Adeyemi, 2019). According to The Independent (2025), VocaLink processes over 90% of salaries, 98% of state benefits, and more than 70% of household bills, highlighting its importance within the UK payments industry. As most banks and payment service providers depend on these systems, VocaLink's position in the market is similar to an essential facility (Kapoor, 2016). This refers to a critical asset controlled by one firm that rivals must access in order to compete effectively (Cabral, 2017).

In July 2016, Mastercard announced plans to acquire a 92.4% stake in VocaLink Holdings for approximately $920 million, gaining majority control of the company (Peyton, 2017). The proposed acquisition raised concerns about its potential impact on the wider economy, particularly in relation to future competitiveness and innovation. While VocaLink operates upstream as an infrastructure provider, Mastercard occupies a downstream role, providing card-based services to banks, retailers and consumers (Coscelli, 2017; Kagan, 2025). The transaction therefore represented a form of vertical integration. Although vertical mergers are generally considered less problematic, problems arise when the acquiring firm gains control over a key input that rivals depend on. In this case, Mastercard's ownership of VocaLink could allow it to restrict or limit certain parts of the value chain for competing firms (Dijk, 2017). This practice is known as vertical foreclosure.

Background and Market Context:

In the years leading up to the acquisition, the UK payments industry was undergoing significant technological and regulatory changes (Dijk, 2017; PSR, 2018). The revised Payment Services Directive, for example, was designed to promote innovation and increase competition across the sector. Meanwhile, the Payment Systems Regulator expressed concerns that competition remained weak, arguing that VocaLink's ownership by a consortium of banks reduced incentives for entry and innovation (Long, 2016).

Concentration in the interbank payments market was also very high during this period. The European Commission (2016) estimated that VocaLink controlled around 80-90% of the market, while Mastercard's share was just 0-5%. This disparity suggests that VocaLink held a near-monopoly position and faced limited competitive pressure from existing rivals. Market concentration can also be assessed using the Herfindahl-Hirschman Index (HHI), which sums the squared market shares of all firms in an industry (Nocke and Whinston, 2022). Although no exact figure is reported, VocaLink's market share alone would imply an extremely high HHI, far exceeding levels typically associated with competitive markets. Consequently, VocaLink had greater scope to raise prices and degrade service quality, harming downstream firms that depend on its infrastructure.

One of Mastercard's primary motivations for the acquisition was to strengthen its position across the broader payments industry. At the time, Mastercard's business model was heavily centred on card-based payments, which placed it at a competitive disadvantage in areas such as direct debits and interbank transfers (Kagan, 2025; Boboev, 2025). As the industry rapidly shifted towards digital services, the acquisition of VocaLink provided Mastercard with a strategic opportunity to expand into this fast-growing segment (Rolfe, 2016). This was an area where Mastercard had historically struggled to compete in, partly due to Visa's well-established position (Long, 2016).

CMA Review:

The proposed acquisition of VocaLink by Mastercard was reviewed by the Competition and Markets Authority (CMA) to assess whether it would result in a substantial lessening of competition (SLC). The CMA initiated a Phase 1 investigation to identify potential competition concerns and to determine whether these could be addressed through undertakings in lieu (GOV.UK, 2017). The CMA's assessment focused primarily on the LINK ATM network, where VocaLink and Mastercard were two of only three firms capable of supplying LINK's required infrastructure (Megaw, 2017). Given that LINK operates more than 70,000 ATMs across the UK, the CMA considered the merger to pose significant risks to competition (Williams-Grut, 2017). However, the merger was ultimately cleared at Phase 1, with the CMA concluding that the relevant theories of harm were unlikely to result in an SLC (Dijk, 2017).

The CMA's main concern was the risk of vertical (input) foreclosure (Dijk, 2017). Through the acquisition of VocaLink, Mastercard would gain control over a critical upstream input used by downstream rivals such as Visa. This raised the possibility that Mastercard could weaken competition by imposing more restrictive access conditions, degrading service quality, or increasing fees (Coscelli, 2017). These risks were particularly relevant for LINK ATM, as its limited ability to switch infrastructure providers meant it could face higher costs.

The incentive to foreclose can be illustrated through the vertical arithmetic framework (Salop, 2018). Prior to the merger (Figure 1), VocaLink operated independently and earned an upstream margin on each unit sold. Following the acquisition (Figure 2), the integrated firm could raise input prices or impose restrictions on downstream rivals. This leads to an initial loss of upstream revenue from foregone sales (Region E). However, this loss could be offset by increased downstream profits if demand is diverted towards Mastercard, allowing it to earn a higher margin on both retained and newly captured sales (Regions F + G). Foreclosure is therefore profitable only when downstream gains exceed upstream losses. Given VocaLink's dominant position, any deterioration in access terms or service quality could significantly weaken rivals' ability to compete. As a result, the risk of foreclosure and its potential to result in an SLC were key concerns for the CMA.

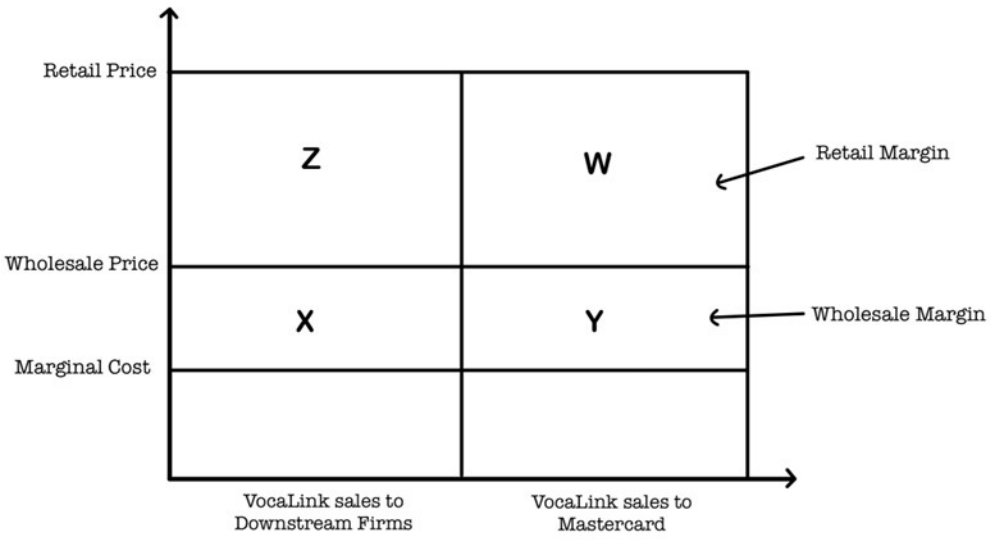

Figure 1: Vertical Arithmetic Pre-Merger, Adapted from OECD (2011)

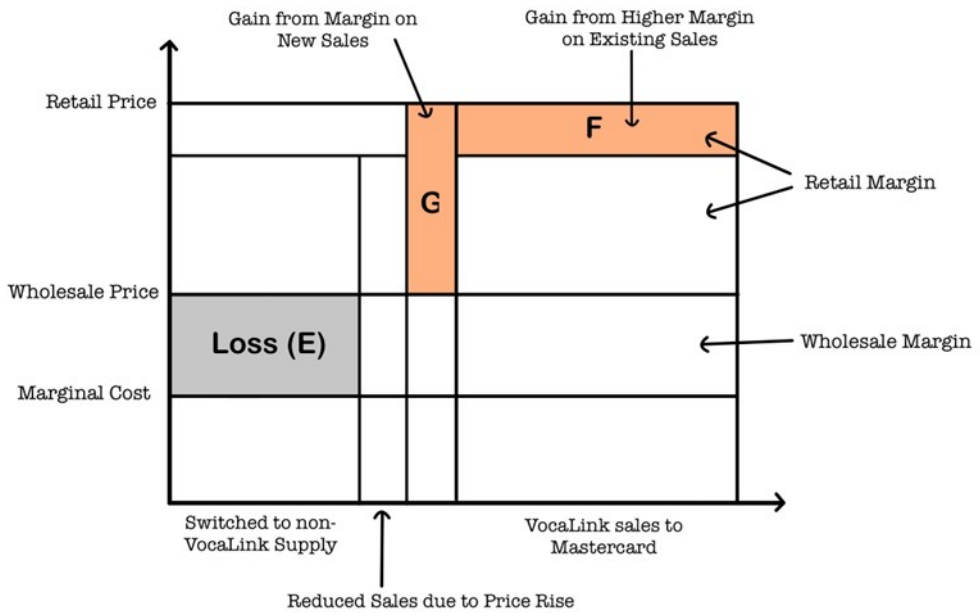

Figure 2: Vertical Arithmetic Post-Merger, Adapted from OECD (2011)

The CMA also considered a second potential harm relating to VocaLink's mobile app, Zapp, which offered an alternative to card-based payments by enabling account-to-account transfers (Dijk, 2017). Mastercard's expansion into digital services raised concerns that the merger could weaken competition through horizontal effects by eliminating Zapp as a potential competitor (Aigner et al., 2022). This would have strengthened Mastercard's market power, allowing it to raise fees or impose less favourable terms on consumers and retailers. However, the CMA found that Zapp had not yet gained sufficient market traction and therefore did not pose a significant threat to competition (Coscelli, 2017). In addition, large corporations such as Apple and Google were also expanding into this sector (Dijk, 2017). The CMA ultimately concluded that the issues concerning Zapp were unlikely to cause an SLC.

The CMA based its final decision on the risks associated with each theory of harm, with the greatest concerns relating to the LINK ATM network. Given LINK's crucial role in the UK payments system, the CMA believed that any disruption to its infrastructure would significantly affect the availability and reliability of cash withdrawals nationwide (Andreasyan, 2017; Decker, 2018). Moreover, the acquisition could leave Mastercard as the sole major supplier, enabling it to exploit economies of scale in ways that would place rivals and potential entrants at a substantial cost disadvantage. To address these concerns, the CMA accepted a series of remedies proposed by Mastercard. These included commitments to maintain open access to VocaLink's connectivity infrastructure, to transfer ownership of the LIS5 intellectual property rights to LINK, and to provide up to £5 million to cover switching costs for LINK members (Dijk, 2017). With these remedies in place, the merger was cleared at Phase 1 without the need for a more extensive Phase 2 referral.

Ex-Post Evaluation and Market Developments:

Following the CMA's approval of the merger in May 2017, several developments emerged within the UK payments sector. Although Mastercard complied with its commitments, regulators and commentators argued that the CMA had underestimated the strength of VocaLink's incumbency advantages (Coscelli, 2017). A key concern was that the payments infrastructure closely resembled a natural monopoly, with high fixed costs and significant barriers to entry discouraging the development of competing systems (PSR, 2016). As a result, market concentration remained high after the merger, despite the remedies imposed (Zephyre, 2025; European Commission, 2020). The CMA later acknowledged that market dynamics were more complex than initially assessed, and that the case might have reached a different conclusion if it had been reviewed under today's conditions (Aigner et al., 2022).

Nevertheless, the merger produced several benefits. Most notably, the key theories of harm identified by the CMA were not observed post-merger (Dijk, 2017). Mastercard did not engage in any discriminatory practices, and VocaLink continued to provide its services across the UK. The LINK ATM network also remained fully operational, with no restrictions or exclusions, suggesting that banks and consumers were not adversely affected by the acquisition. In addition, Mastercard increased investment in infrastructure and expanded VocaLink's operations, thereby supporting banks and payment service providers that depend on these systems (Strzalek, 2017; Gasper et al., 2016). A further development was the transformation of Zapp into Pay by Bank, enabling faster account-to-account transactions and providing a lower-cost alternative to card-based payments (Hassan, 2018). Mastercard has also expanded its services into international markets, such as South Africa, where digital payment systems have historically been less developed (Mwangi, 2024).

Conclusion:

Overall, the ex-post evidence presents a mixed picture. The merger was approved at Phase 1 and did not cause immediate observable harm. However, the market remained highly concentrated, suggesting that structural issues within the payments infrastructure persisted after the transaction. During its review, the CMA identified both vertical and horizontal concerns, but ultimately concluded that the proposed remedies were sufficient to mitigate these risks. By 2020, Mastercard had become one of the world's largest payments networks, generating $15.3 billion in net revenue (Gupta et al., 2022). The UK authorities have therefore continued to monitor the merged entity closely, and in 2025, the Bank of England fined VocaLink £11.9 million for failing to address risk management and governance weaknesses (Easton, 2025). While this fine was not a direct consequence of the merger, it nonetheless highlights the importance of ongoing regulatory oversight, as large-scale mergers can generate significant long-term risks to competition and consumer welfare.

Reference List

Adeyemi, A. (2019). "A New Phase of Payments in Europe: the Impact of PSD2 on the Payments Industry", *Computer and Telecommunications Law Review*, 25(2), pp. 46-53. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3375530 [Accessed 5 January 2026]

Aigner, R., Lopez, I.B., Dessens, B., Hegde, V., Heusel, N., Kozakova, A., Poncet, R., Rauber, M. and Santosuosso, G. (2022). "Ex-post Evaluation of Vertical Mergers: Report for the Competition and Markets Authority", *E.CA Economics Report*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1074008/E.CA_Report_on_Ex-post_Evaluation_of_Vertical_Mergers_-_public_version__stc_06.05.22_.pdf [Accessed 29 December 2025]

Andreasyan, T. (2017). "CMA voices concerns over VocaLink's takeover by Mastercard", *Fintech Futures*. Available at: https://www.fintechfutures.com/paytech/cma-voices-concerns-over-vocalink-s-takeover-by-mastercard [Accessed 22 December 2025]

Boboev, S. (2025). "Deep Dive: Mastercard's Shift - From Plastic to Platforms", *Fintech*. Available at: https://www.fintechwrapup.com/p/deep-dive-mastercards-shift-from [Accessed 5 January 2026]

Cabral, L.M.B. (2017). "Introduction to Industrial Organization, Second Edition", *MIT Press*.

Coscelli, A. (2017). "Anticipated acquisition by Mastercard UK Holdco Limited of VocaLink Holdings Limited: Decision on relevant merger situation and substantial lessening of competition", *Competition & Markets Authority*. Available at: https://assets.publishing.service.gov.uk/media/588f2c1fed915d4535000041/mastercard-vocalink-ftd.pdf [Accessed 10 December 2025]

Decker, C. (2018). "Exploratory analysis of the prospects for, and potential impacts of, ATM scheme competition", Payment Systems Regulator. Available at: https://www.psr.org.uk/media/3xupshqz/exploratory-analysis-of-the-prospects-for-and-potential-impacts-of-atm-scheme-competition.pdf [Accessed 27 December 2025]

Dijk, R.V. (2017). "Behavioural remedies: the CMA's approach to the Mastercard–VocaLink merger", *Oxera*. Available at: https://www.oxera.com/insights/agenda/articles/behavioural-remedies-the-cmas-approach-to-the-mastercard-vocalink-merger/ [Accessed 11 December 2025]

European Commission (2016). "Case M.8149 - MasterCard/ VocaLink", *Brussels*. Available at: https://ec.europa.eu/competition/mergers/cases1/202504/M_8149_5209411_54_5.pdf [Accessed 11 December 2025]

European Commission (2020). "Case M.9744 - MASTERCARD / NETS", *Brussels*. Available at:

https://ec.europa.eu/competition/mergers/cases1/202114/m9744_1442_3.pdf [Accessed 27 December 2025]
Easton, J. (2025). “Bank of England fines Mastercard's Vocalink £11.9m for compliance failures”, *FStech*. Available at: https://www.fstech.co.uk/fst/Bank_Of_England_Fines_Mastercards_Vocalink_11_9m_For_Compliance_Failures.php [Accessed 11 December 2025]
Gasper, B., Eisen, S. and Beaumont, R. (2016). “MasterCard Announces Acquisition of VocaLink”. Available at: https://investor.mastercard.com/investor-news/investor-news-details/2016/MasterCard-Announces-Acquisition-of-VocaLink/default.aspx [Accessed 4 December 2025]
GOV.UK (2017). “MasterCard / VocaLink merger inquiry”, *Competition and Markets Authority cases and projects*. Available at: https://www.gov.uk/cma-cases/mastercard-vocalink-merger-inquiry [Accessed 8 December 2025]
Gupta, S., Hill, L.A., Kelley, J. and Tedards, E. (2022). “Mastercard: Creating a World Beyond Cash”, *Harvard Business School*. Available at: https://bs-uploads.toptal.io/blackfish-uploads/portfolio_item_attachment/ccac72f8-4880-47d9-bec1-50298fd53e20/image/original/1_Mastercard_Creating_a_World_Beyond_Cash-6b12700ed08c7c1e13fcdf936f1e4816.pdf [Accessed 11 December 2025]
Hassan, U. (2018). “Worldpay and Mastercard Enter New Digital Payments Partnership”, *Tech Monitor*. Available at: https://www.techmonitor.ai/leadership/digital-transformation/worldpay-and-mastercard-partnership [Accessed 27 December 2025]
Kagan, J. (2025). “What Is Mastercard? Understanding Its Role in Global Payments”, *Investopedia*. Available at: https://www.investopedia.com/terms/m/mastercard-card.asp [Accessed 27 December 2025]
Kapoor, A. (2016). “Selling VocaLink to MasterCard will kill innovation in UK Payments”, *Linkedin*. Available at: https://www.linkedin.com/pulse/selling-vocalink-mastercard-kill-innovation-uk-payments-anish-kapoor [Accessed 6 January 2026]
Long, K. (2016). “Competition questions arise over MasterCard’s VocaLink buy-out”, *Euromoney, Corporate Banking*. Available at: https://www.euromoney.com/article/27bjsstsqxhkmh0zyz1i2/treasury/competition-questions-arise-over-mastercards-vocalink-buy-out/ [Accessed 10 December 2025]
Megaw, N. (2017). “Mastercard wins approval for £700m Vocalink deal”, *Financial Times*. Available at: https://www.ft.com/content/1f721c0a-10e9-37b0-89ec-0854a1773577 [Accessed 4 January 2026]
Mwangi, K. (2024). “Mastercard accelerates the path toward real-time card payments”. Available at: https://www.mastercard.com/news/eemea/en/newsroom/press-releases/en/2024/october/mastercard-accelerates-the-path-toward-real-time-card-payments/ [Accessed 24 December 2025]
Nocke, V. and Whinston N.D. (2022). “Concentration Thresholds for Horizontal Mergers”, *American Economic Review, 112(6), pp. 1915-1948*. DOI: 10.1257/aer.20201038
OECD (2011). “Economic Evidence in Merger Analysis”, *Competition Committee*. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2012/07/economic-evidence-in-merger-analysis_5cbedc15/e0bd0d3d-en.pdf [Accessed 10 January 2026]
Peyton, A. (2017). “Mastercard’s $920m acquisition of VocaLink officially closes”, *FinTech Futures*. Available at: https://www.fintechfutures.com/m-a/mastercard-s-920m-acquisition-of-vocalink-officially-closes [Accessed 10 December 2025]
PSR (2016). “Market review into the ownership and competitiveness of infrastructure provision” *Payment Systems Regulator*. Available at: https://www.psr.org.uk/media/tleazqdb/mr1523-infrastructure-market-review-final-report.pdf [Accessed 10 January 2026]
PSR (2018). “Discussion paper: Data in the payments industry”, *Payment Systems Regulator*. Available at: https://www.psr.org.uk/media/rscd3p2e/psr-discussion-paper-data-in-the-payments-industry-june-2018.pdf [Accessed 7 December 2025]
Rolfe, A. (2016). “What does the Mastercard acquisition of Vocalink mean for the UK payments industry”, *Payment Industry Intelligence*. Available at: https://paymentsindustryintelligence.com/what-does-the-mastercard-acquisition-of-vocalink-mean-for-the-uk-payments-industry/ [Accessed 15 December 2025]

Salop, S.C. (2018). “Invigorating Vertical Merger Enforcement”, *Yale Law Journal*. DOI: 10.2139/ssrn.3052332

Strzalek, A. (2017). “Mastercard completes VocaLink acquisition”, *FSTech*. Available at: https://www.fstech.co.uk/fst/Mastercard_Completes_VocaLink_Acquisition.php [Accessed 15 December 2025]

The Independent (2025). “Bank of England fines Mastercard’s Vocalink £11.9m over compliance failures”. Available at: https://www.the-independent.com/news/business/mastercard-bank-of-england-b2785693.html [Accessed 6 January 2026]

Williams-Grut, O. (2017). “MasterCard's £700 million takeover of VocaLink is in trouble with the competition watchdog”, *Business Insider*. Available at: https://www.businessinsider.com/cma-challenges-mastercards-takeover-of-vocalink-due-to-link-atms-2017-1 [Accessed 10 January 2026]

Zephyre. (2025). “Written Evidence Submitted by Zephyre”. Available at: https://committees.parliament.uk/writtenevidence/108341/pdf/ [Accessed 11 January 2026]

How Do Maternity Leave Policies Affect Female Labour Force Participation Across Countries?

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Motivation

Maternity leave policies are a central component of labour market design and play a crucial role in shaping female labour force participation (FLFP). As countries face ageing populations and skill shortages among other changes, strengthening women's position in the labour market has become a key policy objective. Maternity leave influences in the labour market through two main channels: income replacement, which lessens the immediate financial burden of childbirth, and job protection, which ensures a woman's right to return to her previous job (Low & Sanchez-Marcos, 2015). These features influence the opportunity cost of childbirth and therefore decisions about exiting and re-entering employment. However, the effects of such policies also depend on other factors, such as childcare availability and costs, the enforcement of job protection and cultural differences related to caregiving between countries. Understanding these variations provides important insight into why some maternity leave systems encourage strong re-entry while others do not, despite similar designs on paper.

Synthesised Evidence and Critical Reflection

Theoretical Background

Human capital theory suggests that time spent out of the labour market leads to skill depreciation and weaker future earnings (Mincer & Polachek, 1974). This makes maternity-leave design critical: shorter, job-protected leave limits time out of work, whereas very long leave increases human-capital losses and weakens career progression. Evidence supports this pattern—moderate-duration leave improves re-entry, while extended leave raises depreciation costs (Ruhm, 1998; Dobrotić et al., 2024). Yet these effects are not universal. As (Acemoglu et al. 2023) emphasises, human-capital outcomes depend on institutional structures. Nordic countries show that long leave does not reduce FLFP when supported by universal childcare, flexible working arrangements, and strong gender-equality norms, which mitigate skill loss and facilitate reintegration (Jaumotte, 2003).

Household bargaining theory adds further nuance. When maternity leave far exceeds paternity leave, caregiving tends to fall disproportionately to mothers, reinforcing gender-specialised labour roles. Non-transferable paternity quotas shift expectations by increasing fathers' participation, reducing employer bias, and narrowing the motherhood penalty (Avichezer, 2025). Together, these theories show that maternity-leave outcomes depend not only on leave duration but on complementary institutions, incentives, and social norms.

Contrary Evidence from Different Articles

Firstly, evidence from developing countries shows a generally positive and statistically significant relationship between the length of paid maternity leave and the share of women employed in the private sector. Amin and Islam (2019) find that a one-week increase of leave corresponds to a 2.6% rise in the proportion of female workers. Consistent with this, moving from the country with the shortest length of maternity leave to the longest is

associated with a 33.3% increase in the share of female workers. However, findings from OECD countries present a contrasting pattern. Lee and Jung (2024) show that maternity leave has an inverted U-shaped effect, where moderate leave supports women's return to work, but if the leave extends too long, the increase wage penalty like career interruption, outweighs the benefits and reduces female employment. This variation highlights that maternity leave alone does not determine labour-market outcomes. Instead, the effectiveness of leave depends critically on its interaction with other policies, including childcare capacity, labour regulation enforcement, and cultural expectations surrounding maternal employment. It also contradicts the positive relationship found by Amin and Islam (2019) in developing countries. The contrasting results suggest that the impact of extended leave is best understood though a combination of economic incentives, institutional design, and behavioural norms as policies that increase employment in developing countries may have the opposite effect in higher income OECD countries.

Cross-Country Comparison

Country	Leave Design	Childcare Availability	Cultural Norms	Labour-Market Outcomes
Sweden	Long, well-paid shared leave + paternity quota	Universal, affordable	Gender-equal norms	High re-entry; minimal wage penalty
South Korea	Long, well-paid leave	Limited for infants	Strong maternal expectations	Low re-entry despite generous leave
Mexico	Short, low-paid leave	Minimal state provision	Traditional gender roles	Very low participation post-childbirth

Table 1

These cases illustrate the degree to which institutional context shapes FLFP. Sweden demonstrates how integrating maternity leave with universal childcare, strong job protection, and paternity quotas produces consistently high maternal re-entry. South Korea's generous leave is undermined by insufficient childcare capacity and strong maternal-care norms, resulting in low re-entry despite seemingly favourable entitlements. Mexico shows that limited leave combined with traditional gender expectations and scarce childcare constrains women's ability to participate in paid work at all. The comparison shows that policy bundling—not individual interventions—explains the most variation in outcomes.

Trade-offs

Maternity leave policies involve a central trade-off between the opportunity cost of returning to work and the benefits of staying home to care for children. Paid leave lowers the financial and professional costs of childbirth, helping women maintain labour-market attachment and reducing the disruption to their career progression. However, the effectiveness of maternity leave depends heavily on complementary institutional supports. Policies that facilitate shared caregiving—such as accessible state-run childcare and meaningful paternity leave—enable mothers to return to work more quickly and retain their skills during leave (Schøne, 2004; Avichezer, 2025). Without these supports, longer leave may unintentionally reinforce traditional gender roles, widen the motherhood wage penalty, and encourage employers to discriminate if they anticipate prolonged maternal absences. Another key trade-off concerns the timing mismatch between leave expiry and childcare availability: where childcare for ages 0–2 is scarce or unaffordable, even well-designed maternity-leave systems fail to translate into sustained FLFP. Evidence indicates that the most effective arrangements combine moderate, well-paid leave with strong job-protection enforcement, reliable early-years childcare provision, and flexible work arrangements. Such integrated systems limit long-term skill depreciation, ease transitions back into employment, and promote more equitable labour-market outcomes.

Contributing Insight

A key insight from cross-country comparison is that maternity leave should be viewed as part of a broader family-policy ecosystem, not a stand-alone intervention. Systems that combine maternity leave with universal childcare and meaningful paternity quotas achieve higher re-entry rates, lower wage penalties, and a more equitable distribution of caregiving responsibilities. Non-transferable paternity leave in particular reshapes employer expectations by normalising fathers' participation in early childcare (Avichezer, 2025).

Sweden exemplifies how coordinated family policies reinforce each other to sustain high FLFP, whereas South Korea and Mexico demonstrate that generous leave without adequate institutional support yields limited improvements.

Limitations and Gaps

Cross-country analysis of maternity leave faces several limitations. Evidence often relies on statutory entitlements rather than actual uptake, which varies due to workplace culture, informality, eligibility rules, and social attitudes. Differences in childcare capacity, enforcement of job protection, and employer compliance further complicate comparisons. Endogeneity also remains a challenge, as countries with stronger gender-equality norms may adopt generous leave because such norms already support maternal employment. Data gaps are particularly acute in low- and middle-income contexts, especially concerning long-term wage outcomes, sectoral mobility, and employer responses to parental leave. Future research should use data that tracks individuals over time, linked to institutional indicators, to identify causal pathways more clearly. A further limitation for policymaking is that generalised recommendations may overlook capacity constraints, cultural resistance, and fiscal trade-offs. Although evidence highlights strong complementarities between

maternity leave, paternity quotas, and childcare provision (Avichezer, 2025; Lee & Jung, 2024), the optimal policy mix must ultimately be adapted to national context.

Policy Recommendations

1. Implement moderate-duration, well-paid maternity leave financed publicly

Moderate, well-paid leave supports maternal health and labour-market continuity while reducing skill depreciation associated with extended absences. Evidence shows that FLFP begins to fall when leave exceeds roughly 30 weeks (Del Rey et al. 2020). Public financing prevents employer discrimination and ensures equitable access across sectors (Amin & Islam, 2019). Strong job-protection enforcement—guaranteeing return to the same or an equivalent role—further strengthens re-entry prospects (Low & Sánchez-Marcos, 2015). In lower-income contexts, fiscal and enforcement constraints may require phased implementation or paired supporting policies.

2. Guarantee universal, affordable childcare aligned with maternity-leave expiry

Childcare availability is one of the strongest predictors of maternal return-to-work rates (Lee & Jung, 2024). When childcare is affordable and reliable, the opportunity cost of returning to work decreases, reducing short- and long-term wage penalties. Evidence from Norway shows that public childcare provision is more reliable and effective than subsidising private care (Schøne, 2004; Havnes & Mogstad, 2011). Governments should expand early-years childcare capacity and ensure access from the moment maternity leave ends.

3. Introduce non-transferable paternity quotas to normalise shared care-giving

Paternity quotas redistribute caregiving responsibilities and shift employer expectations surrounding parental leave. Evidence from Sweden demonstrates that when fathers take meaningful leave, maternal re-entry is faster, and wage penalties are reduced (Avichezer, 2025). Paternity quotas have relatively low technical implementation demands compared to childcare expansion and may therefore be particularly suitable for developing-country contexts, although political and cultural resistance may pose challenges.

4. Build a coordinated family-policy system integrating leave, childcare, flexible work and job protection

Countries with integrated, coherent family-policy systems consistently achieve higher and more sustainable FLFP than those with fragmented provisions. Effective coordination ensures a smooth transition between childbirth, leave, childcare access, and return to employment. Governments should embed maternity leave within a holistic framework that includes universal childcare, stronger enforcement of job protection, and flexible working arrangements. Such systems reduce long-term skill depreciation, promote gender equality, and enhance economic resilience.

Conclusion

Maternity leave is a powerful tool for supporting FLFP, but its impact is maximised only when paired with complementary policies. Evidence shows strong complementarities between maternity leave, paternity quotas, and childcare provision. As institutional capacity and cultural norms vary across countries, the optimal policy mix must be adapted to national context while maintaining the principle of coordinated, mutually reinforcing family policy.

References

Acemoglu, D., Gallego, F.A., and Robinson, J., A. (2014). Institutions, Human Capital and Development. *Annual Review of Economics*, 6, pp. 875-912.

Amin, M., and Islam, A.M. (2019). Paid Maternity Leave and Female Employment: Evidence Using Firm-Level Survey Data for Developing Countries. *World Bank Policy Research Working Paper No. 8715.*

Avichezer, O.F. (2025) Paternity Leave Policy: Implications for Female Labor Force Participation, *Georgetown University*.

Borjas, G 2023, Labor Economics, McGraw-Hill US Higher Ed ISE, New York. Available from: ProQuest Ebook Central. [7 December 2025].

Del Rey, E., Kyriacou, A. and Silva, J.I. (2020). Maternity leave and female labor force participation: evidence from 159 countries. *Journal of Population Economics*, 34. doi:https://doi.org/10.1007/s00148-020-00806-1.

Dobrotić, I., Blum, S., Kaufmann, G., Koslowski, A., Moss, P. and Valentova, M. (2025). International Review of Leave Policies and Research 2025. *Luxembourg Institute of Socio-Economic Research.*

Havnes, T. and Mogstad, M. (2011). Money for nothing? Universal child care and maternal employment. *Journal of Public Economics*, [online] 95(11-12), pp.1455–1465. Doi: HTTPs://doi.org/10.1016/j.jpubeco.2011.05.016.

Jaumotte, F. (2003). Female Labour Force Participation. *OECD Economics Department Working Papers*. doi:https://doi.org/10.1787/082872464507.

Lee, S.-T. and Jung, S.-M. (2024). The interactive effect of maternity leaves and child care enrollment on maternal employment. *Economic Analysis and Policy*, 84, pp.344–353. doi:https://doi.org/10.1016/j.eap.2024.08.034.

Low, H. and Sánchez-Marcos, V. (2015). Female labour market outcomes and the impact of maternity leave policies. *IZA Journal of Labor Economics*, 4(1). doi:https://doi.org/10.1186/s40172-015-0029-1.

Ruhm, C. (2025). The Economic Consequences of Parental Leave Mandates: Lessons from Europe. *The Quarterly Journal of Economics*, [online] 113(1), pp.285–317. Available at: https://econpapers.repec.org/RePEc:oup:qjecon:v:113:y:1998:i:1:p:285-317.

Schøne, P. (2004). Labour supply effects of a cash-for-care subsidy. *Population Economics*, 17(4), pp.703–727. doi: https://doi.org/10.1007/s00148-003-0176-8.

Social Pressure and Referee Bias in Italian Football

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Executive Summary

Assessing the extent the crowd influence the decision-making of the match official in favour of the home team in Italian football

The data used to construct this study is based on 4340 Italian football matches with no crowd restrictions played across the Serie A and B, over six seasons (between 2017/18 and 2023/24). This paper provides statistical analysis on the relationship between crowd size and density, and referee decision-making against the home team. In general, fouls, yellow cards, and total sanctions, awarded to the home team, decrease as crowd attendance increases, as referees succumb to social pressure and may seek to satisfy the home crowd in their decision-making. However, this study's findings cannot statistically prove crowd density as a referee decision-making heuristic across the study's whole sample period, for each decision measured. The study proposes the future research consideration in this analysis by investigating the effects of video assistant referees (VAR) on referee decision making biases. The structure of the report will include the following sections: (1) Introduction; (2) Literature Review; (3) Methodology and Data; (4) Results; (5) Conclusion; (6) Bibliography; and (7) the Appendix.

(1) Introduction

A balanced league would hold the expectation of an absence of home advantage, alluding to the home team winning 50% of their league games (exclusive of draws) (Nevill and Holder, 1999). A home advantage is observed as a crucial factor determining the success of football, basketball, baseball and ice hockey teams. Downward and Jones (2007) identify four main causal factors: familiarity with the location; the effects of travel[1]; location-related rules; and the crowd. Nevill et al (1999; 2002) concluded that, "crowd factors appeared to be the most dominant cause of the home advantage", and significant home advantages are determined in divisions with larger crowds (Nevill et al, 1996[2]). The crowd influences players' performance, particularly, they generate a boost and support for the home team and create a social pressure for the away team (Clarke and Norman, 1995). Moreover, crowd influences the referees' decision-making, who can succumb to the social pressures exerted from the home team supporting crowd, such that referees subconsciously reserve to the home team (Boyko et al, 2007).

To ensure that referees act in the interest of the sporting principal, agency theory allows us to align the incentives of the agent and the principal (Baker, 1992), where unbiased referee judgment is integral for achieving the principal's objective (Dohmen and Sauermann, 2015). Social studies have postulated that, individuals' decisions are not solely determined by material rewards, but also governed by non-material payoffs arising in the decision-makers' social environment, in the form of *social sanctions* or *approval* (Coleman, 1990). In terms of an individuals' utility function, Becker and Murphy (2009) imply an individuals' decision-making is affected by the avoidance of such social sanctions. Referees (agent) may make biased decisions to accommodate the preferences of a social group, even if such behaviour jeopardises their own material payoff interest.

A crowd can be propitious to a home advantage in sport, as crowds pressure referees to preference the home team in decisions (Souchon et al, 2013). Match officials are

highlighted as a cause of the intervention of home biases through the crowd, as the crowd can influence the astuteness of match officials. This bias is not presumed as directly correlated with officiating malfeasance, in lieu, it is a statistical outcome that reflects the circumstances that influence referees' decision-making and sanctions they award[3].

The focus for this report is to establish a hypothesis to test whether the crowd influence the decision-making of match officials, and to what extent the impact of social pressure has changed following the COVID-19 pandemic. This study will encompass a specific focus of the Italian Football leagues - a football league system that has been plagued with controversial match-fixing in the past.

[1] See Oberhofer *et al* (2009) evidence in German Football.
[2] See also, Dawson *et al* (2007) in English football and Schwartz and Barsky (1977) in baseball.
[3] Dawson *et al* (2020) insight on Carron, Loughhead & Bray (2005) study of home advantage in sports competitions, based on Courneya and Carron (1992) framework.

(1) Literature Review

Studies observing a home advantage is not a contemporary area of research, it has long been tested across many team sports (Carron et al, 2005), including, football (Nevill et al, 1996; Clarke and Norman, 1995), baseball (Adams and Kupper, 1994), ice hockey and basketball (Schwartz, 1977), but conflicting evidence is found in tests conducted on individual sports[4].

The behaviour of football referees is first examined in Garicano et al. (2001; 2005) study on whether referees make biased decisions in terms of allowance for stoppage time. They argue referee bias in stoppage time derives from incentives to satisfy the crowd for social approval; one standard deviation increase in match attendance increases referee bias by 20%. This is supported by literature on the probability of a yellow card being awarded against the home team decreased as crowd sizes increased (Downward and Jones, 2007, in the English FA cup competition), further highlighting the view referees may strive to appease crowds, particularly larger crowds. Conflicting with the view of Downward and Jones (2007) and too, Buraimo et al (2012), more recently Goumas (2014) indicated that crowd density, rather than crowd size (attendance), significantly impacts referee bias in UEFA European cup contests. However, Pollard (1986) finds no association between both crowd size and density and home advantages in performance.

Nevertheless, corroborating evidence to Garicano et al (2005) assessing other refereeing decisions is apparent in other studies: referee bias in awarding yellow cards[5], penalties[6] , and extra time, all in favour of the home team[7], has been examined. In contrast, Johnston (2008) research finds no statistical significance of referee bias in cautionary decision making in the English Premier League. But, referee home team favouritism, induced by crowd pressure[8], is also found in stadiums without a running track in the stadium in the German Bundesliga (Buraimo et al, 2010), where there is less distance between the crowd and the referee on the pitch.

[4] Nevill et al (1997) study finds little evidence of a home advantage in tennis and golf, in contrast to Balmer et al (2003) who observes a home advantage in the Summer Olympic games for individual sports such as gymnastics and boxing that are primarily subjectively judged.

[5] In European cup competitions (Goumas, 2014; Dawson and Dobson, 2010), and in the EPL (Boyko et al, 2007; Dawson et al, 2007;), the visiting team is cautioned more on average. All evidence is consistent with *pure* referee bias in the relative treatments of home versus away teams in officiating decisions.
[6] Research from the EPL (Boyko et al, 2007), and further evidence from Dohmen (2008) indicates home teams are more likely to be awarded penalty kicks that are deemed disputable in post-match analysis.
[7] The crowd effects referee's decisions to be biased in awarding injury time that favours the home team (Scoppa, 2008) in Italy, (Garicano, Palacios and Prendergast, 2005) in Spain, (Sutter and Kocher ,2004) in Germany, and (Morabito and Scoppa, 2024) in all top 5 European leagues.
[8] In the form of issuing yellow and red cards.

The possibility to study the effects of the crowd, or its absence, was presented by those matches played behind closed doors across 2020-2021, due to the COVID-19 pandemic. Sors *et al* (2021) found no referee bias in the absence of crowd noise. When significant effects of crowd pressure on referee behaviour were present in Europe's top 5 leagues, decisions to favour home teams in normal matches are more balanced in this period (Scoppa, 2021), and referee bias is unidentifiable (Sors *et al*, 2022). The view that biased decisions establish from the pressure exerted by home-team-supporting crowds, is predominantly supported across the findings relating to the COVID-19 period of games without a crowd. This bias notion is verified in the Italian leagues, where a significant decrease in the severity of punishments for the away team is observed (Reade *et al*, 2022).

Pettersson-Lidbom and Priks (2010) utilised the scenario of crowd absence on referee behaviour previously in the 2006-07 season in Italian football. In a substantial number of games, supporters were banned from attending due to referee corruption – known as the Calciopoli[9]. The authors concluded that referees are directly affected by social pressure of spectators, favouring the home team by punishing their players less, and the away team more, particularly when the game was attended by [more] spectators. This aligns with the general consensus in findings over a decade later in COVID-19-centred literature (Leitner et al, 2022[10]); a decrease in home advantage is due to less social pressure on match officials to make impartial decisions that favour the crowd.

This study will be based on the Italian Serie A and B, and will contribute to literature by providing contemporary findings to complement existing research (Pettersson-Lidbom and Priks, 2010; Reade *et al*, 2022) on Italian football. Motivated by the abundance of COVID-19 studies, this study will examine if there are observable differences between the impact of social pressure on referee decision-making, before and after the COVID-19 crowd-absence period.

[8] typically through the reduced number of yellow cards awarded to the visiting team.
[9] See Distaso *et al* (2012) and Boeri and Severgnini (2011) who analyse the Calciopoli case and the impacts of corruption and referee bias on match outcomes. Unlike the impartial officiating decisions that form from subconscious biases as highlighted, corrupt referees will consciously make decisions to distort match outcomes for their own benefit i.e., being paid off by clubs to 'fix' matches.
[10] A comprehensive literature review (Leitner et al, 2023) showed that the absence of crowd support in games played behind closed doors during the COVID-19 pandemic had a considerable impact on

home advantage observed in pre-existing studies, observing 20 out of 26 studies conducted at the time of review, highlight a significant decrease in home advantage in games played behind closed-doors.

(3) Data and Methodology

The dataset used for this study has been constructed in accordance to https://www.football-data.co.uk/ for referee sanctions and outcomes data and https://fbref.com/en/ for attendance data. All data has been cleaned to remove missing data and non-applicable information, in order to create the variables required to test the hypothesis. Due to the continuation of the pandemic, the end of the 2019/20, and the whole 2020/21 season took place under severe attendance restrictions. The vast majority of matches were played behind closed doors, and the remaining ones with limited attendance, will not be included in analysis. Thereby, the hypothesis will be computed for the two-sample periods: 2017/18-2018/19 and the 2019/20 season up-to the COVID-19 pandemic attendance restrictions, and the three most recent full seasons post-COVID: 2021/22-2023/24. This is observed for (*N*=) 2144 Serie A and 2196 Serie B observations, where the results will be compared to investigate whether there are observable changes in the impact of social pressure across these two periods.

The hypothesis is tested to estimate the predicted marginal effect on the three dependent (referee decision-making) variables: *Home Yellow Cards* (*Hyellow*), *Home Fouls* (*Hfouls*) and *Total Home Sanctions* (*Htotalsanctions*), against the social pressure focal points of *Crowd Size* and *Crowd Density*. The home values are taken for the three dependent variables to measure whether there is a home bias observed in the relationship between referee decisions against the home team and the values of *Crowd Density* and *Crowd Size*. The study takes the home values specifically, in order to provide results to support the notion that a home advantage derives from match officials' biases in decisions as a request of social acceptance.

The dependent variable of *Home Total Sanctions* mimics a similar construction of Dawson and Dobson (2007), where 1 point is awarded for a yellow card and 2 for a red card. The total sanctions for the home team in each game is the sum of the number of yellow cards and two times the number of red cards, to reflect the idea that a red card is valued as equivalent to two yellow cards. The focal point of *Crowd Size* is based on the raw attendance figures of each game. In turn, *Crowd Density* is measured as a percentage of the attendance figure out of the maximum capacity of the stadium the match was played in.

Subsequently, the baseline models are as follows:

$$(1)\ Hyellow_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + u_i$$
$$(2)\ Hfouls_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + u_i$$
$$(3)\ Htotalsanctions_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + u_i$$

The study also introduces explanatory control variables for all three models, including other measurable factors made or potentially impacting referee decision-making, as follows:

$$(4)\ Hyellow_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + CONTROLS_i + u_i$$
$$(5)\ Hfouls_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + CONTROLS_i + u_i$$
$$(6)\ Htotalsanctions_i = \beta_0 + \beta_1 CrowdSize_i + \beta_2 Crowd\ Density_i + CONTROLS_i + u_i$$

Where $CONTROLS_i$ represents the explanatory variables and $u_i$is the models error term. The full list of (*CONTROLS*) explanatory variables can be found in **Table A1 – Summary Statistics**.

The mean values for the three dependent variables are highlighted in **Figure 1**, which observes decisions against the home team are lower, on average, than against the away team, for both Serie A and B. The Models will be tested to understand if this outcome derives from a significant relationship between social pressure and referee decision-making against the home team.

Figure 1(a): Serie A (Mean) Averages of Dependent Variables

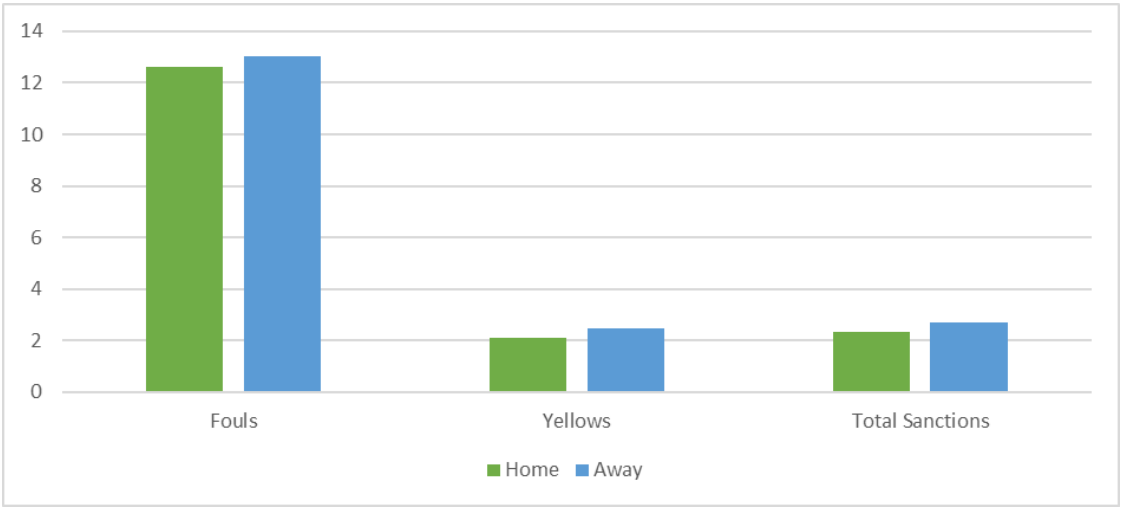
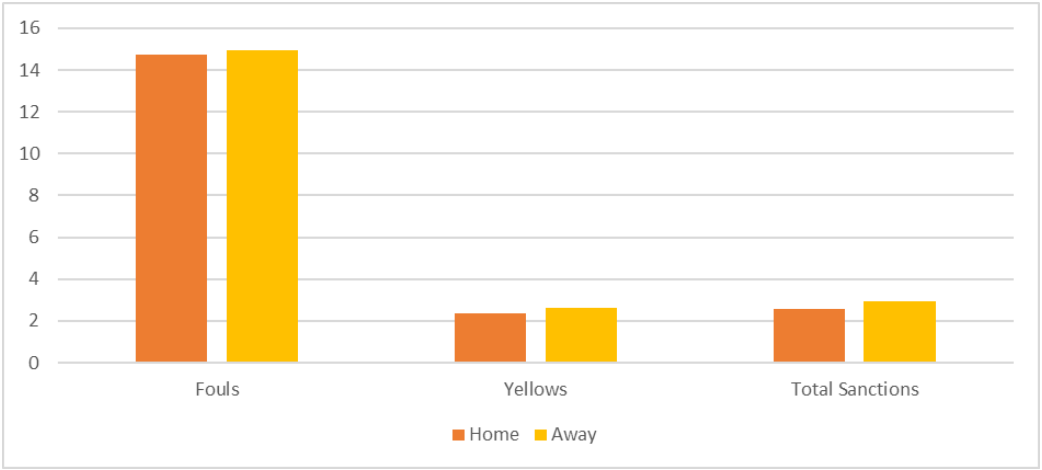


Figure 1(b): Serie B (Mean) Averages of Dependent Variables



(4) Results

Table 1 – Regression Results

	Post-COVID			Pre-COVID		
Serie A	(4) $Hyellow_A$	(2) $Hfouls_A$	(6) $Hsanctions_A$	(1) $Hyellow_A$	(2) $Hfouls_A$	(6) $Hsanctions_A$
Crowd Size	0.0059** (0.0029)	-0.021*** (0.007)	0.0075** (0.0036)	-0.0082*** (0.0030)	-0.044*** (0.0091)	0.012*** (0.0039)
Crowd Density	-0.0020 (0.0021)	-0.0095 (0.0057)	-0.0044* (0.0026)	0.0061*** (0.0023)	0.021*** (0.0068)	-0.0008 (0.0027)
R^2	0.12	0.025	0.11	0.010	0.024	0.19
CONTROLS		X		X	X	
N	1135	1136	1135	1008	1008	1008
Serie B	(4) $Hyellow_B$	(2) $Hfouls_B$	(6) $Hsanctions_B$	(1) $Hyellow_B$	(2) $Hfouls_{B1}$	(3) $Hsanctions_B$
Crowd Size	-0.0016 (0.0078)	-0.034 (0.023)	-0.0026 (0.0095)	-0.033*** (0.018)	-0.16*** (0.040)	-0.038*** (0.015)
Crowd Density	0.0004 (0.0021)	-0.014** (0.0066)	0.0018 (0.0026)	0.007*** (0.0025)	0.015* (0.0085)	0.0088*** (0.0031)
R^2	0.080	0.014	0.063	0.011	0.013	0.010
CONTROLS		X		X	X	X
N	1131	1131	1131	1064	1064	1064
Serie A&B	(1) $Hyellow_c$	(2) $Hfouls_c$	(3) $Hsanctions_c$	(4) $Hyellow_c$	(5) $Hfouls_c$	(3) $Hsanctions_c$
Crowd Size	-0.0091*** (0.0023)	-0.036*** (0.0065)	-0.010*** (0.0028)	0.0069*** (0.0026)	-0.046*** (0.0090)	-0.010*** (0.0032)
Crowd Density	-0.0018 (0.0015)	-0.017*** (0.0042	-0.0022 (0.0018)	0.0032** (0.0015)	0.0038 (0.0051)	0.0059*** (0.0019)
R^2	0.018	0.057	0.016	0.16	0.099	0.0062
CONTROLS	X	X	X			X
N	2267	2267	2267	2072	2072	2073

Foot Notes: Coefficients represent marginal effects. Standard errors in parentheses. Reported to 2 s.f. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full list of *CONTROLS* variables is detailed in appendix table A1 – summary statistics. Full Regression Results given in appendix table A2-4.

The condensed regression results are tabulated in **Table 1**, across all six models, for the sample periods of post- and pre-COVID, for the Serie A, Serie B, and then both leagues combined. This analysis takes on one of the two models for each dependent variable, either including or not including, the control variables detailed in Table A1. This decision is motivated by the significance of results found, and the quality of the model given by its r-squared value.

In the Serie A, statistically significant relationships between *Crowd Size* and all three referee decision variables are found for both periods, of which *Yellow Cards* and *Fouls* post-COVID coefficients are less negative (or more positive) than that of pre-COVID. In the Pre-COVID sample, a marginal increase in *Crowd Size*, leads to a (0.044 and 0.0082) decrease in number of *Fouls* and *Yellow Cards* awarded to the home team respectively. These findings support existing findings in literature on the pure relative bias towards the home team, induced by crowd pressure, in awarding yellow cards (Downward and Jones, 2007; Buraimo *et al*, 2012). This result also contributes to the existing effects documented on Italian football, which are based on referees' injury time decisions that favour the home team due to crowd effects, (Scoppa, 2021).

This referee home team favouritism is not reflected in the findings of *Total Sanctions* awarded to the home team for both periods. In the pre-COVID sample period, a marginal increase in *Crowd Size*, leads to a 0.012 increase in *Total Sanctions*. This coefficient decreases (but remains marginally positive) in the more recent sample period, highlighting that social pressure from crowds does not influence the referee to make decisions in favour of the home team, regarding referees' decisions in awarding yellow and red cards collectively in a game.

Additionally, the coefficients of *Home Yellow Cards* and *Home Fouls* with respect to *Crowd Density* are significantly positive pre-COVID, but there is no statistical significance to suggest that the negative coefficients observed post-COVID are true, and thus no difference in the impacts of social pressure between the two sample periods can be suggested. Therefore, *Crowd Density*, as an indicator of social pressure, is not significant in representing home bias in the Serie A, conflicting the findings of Goumas (2014) and Buraimo *et al* (2012).

A similar outcome is found in the models of the Serie B, where statistically positive coefficients are apparent for a rise in *Crowd Density*, for all three referee decisions. However, this outcome is not supported over time in the post COVID sample, where no positive coefficients can be statistically proven. Contrasting this view, the coefficient for *Home Fouls* awarded statistically decreases (from a positive to a negative coefficient) in the Serie B in the more recent sample, highlighting a marginal increase in *Crowd Density*, will lead to a 0.014 decrease in fouls awarded to the home team.

Moreover, in the Serie B, statistically significant negative relationships are observed for *Crowd Size* for all three referee decision variables, in the pre-COVID sample *only*. The findings of the Serie B reflect similar findings of Boyko *et al* (2007) who find results of yellow card differentials explained by referee effects are inconsistent over time, where

crowd density d In this sample, the coefficients are more negative, of which a marginal increase in *Crowd Size*, leads to a 0.033, 0.16, and 0.038 decrease in *Home- Yellow Cards*, *Fouls*, and *Total Sanctions* awarded, respectively. This pre-COVID evidence supports the notion that variations in *Crowd Size* imply greater social pressure causes the referee to succumb to the crowd, awarding decisions that favour the home team (Garicano *et al* 2005). Such as the marginal coefficients observed between *Home- Total Sanctions* and *Yellow Cards*, and *Crowd Density*, this relationship for *Crowd Size* and all three dependent variables cannot be statistically proven in post-COVID.

Increasing the sample size by combining the leagues, Serie A and B, generates the largest absolute value of negative statistical results at 1% significance for all *Crowd Size* marginal coefficients. The results highlight that referee bias in awarding home decisions is still present post-COVID, and coefficients are more negative. This suggests that, the extent social pressure (from increased *Crowd Size*) generates more referee bias, in awarding fewer decisions against the home team, is greater. These results do not replicate those found for the Serie A and B separately, but the results for crowd density do pose a similar conclusion to those of the Serie B. A marginal increase in *Crowd Size*, cause referees to reduce *Home Yellow Cards* by 0.0091, *Home Fouls* by 0.036, and *Total Sanctions* against the home team by 0.010. This complements the results of Pettersson-Lidbom and Priks (2010) who exhibit home bias caused by social pressure is greater when (more) spectators were present in the Serie A and B. This is consistent with the belief, acknowledged in this study's introduction, that referees will change their behaviour under the influence of greater social pressure.

(5) Conclusion

In this study, the impact of social pressure on the outcomes of Italian football matches has been investigated. After dismissing the period of matches that were played behind closed doors, this study's results compare the estimated effects of crowd size and density on referee decisions against the home team. Statistically significant results are more prominent in the estimated coefficients of crowd size, and are primarily consistent with the broad spectrum of results on the topic. The notable effects of this discussion are the significant decreases in decisions against the home team when crowd size marginally increases, primarily in the pre-COVID period.

Thus, one limitation of this studies analysis is the presence of VAR post-COVID that is unaccounted for, which may be one plausible factor underlining the lack of significance in the more recent samples' coefficients. Spitz, J. *et al* (2020) report the predictive odds for referees making the correct decision, after VAR intervenes, were significantly more accurate than for the initial referee's decision. The intervention of VAR, ultimately correcting potentially biased decisions, may mislead the conclusion that initial referee bias is less observable post-COVID. Future research as to whether referee bias persists in decisions made before VAR intervenes, or comparing leagues with/without VAR in the same season, may pose interesting conclusions to support this discussion.

Despite providing statistically significant conclusions in some areas of analysis, this study can still be developed further. Encompassing a greater sample size of games may increase the significance in models lacking conclusiveness. Moreover, including a third comparative period of during-COVID with crowd absences would have provided more recent evidence on home team biases in support Reade *et al* (2022) study of the Italian football leagues. Nevertheless, the results of this paper contribute to literature that observe a home advantage in football, which has been attributed to impartial biases of referees, induced by (social) crowd pressure.

(6) Bibliography

Adams, R.D. and Kupper, S.J., 1994. The effect of expertise on peak performance: the case of home-field advantage. *Journal of Sport Behavior*, *17*(2).

Baker, G.P., 1992. Incentive contracts and performance measurement. *Journal of political Economy*, *100*(3), pp.598-614.

Balmer, N.J., Nevill, A.M. and Williams, A.M., 2003. Modelling home advantage in the Summer Olympic Games. *Journal of sports sciences*, *21*(6), pp.469-478.

Becker, G.S. and Murphy, K.M., 2009. *Social economics: Market behavior in a social environment*. Harvard University Press.

Boeri, T. and Severgnini, B., 2011. Match rigging and the career concerns of referees. *Labour Economics*, *18*(3), pp.349-359.

Boyko, R. H., Boyko, A. R., & Boyko, M. G., 2007. Referee bias contributes to home advantage in English premiership football. *Journal of Sports Sciences*, *25*(11), pp.1185–1194.

Buraimo, B., Forrest, D. and Simmons, R., 2010. The 12th man? Refereeing bias in English and German soccer. *Journal of the Royal Statistical Society Series A: Statistics in Society*, *173*(2), pp.431-449.

Buraimo, B., Simmons, R. and Maciaszczyk, M., 2012. Favoritism and referee bias in European soccer: Evidence from the Spanish League and the UEFA Champions League. *Contemporary Economic Policy*, *30*(3), pp.329-343.

Carron, A.V., Loughhead, T.M. and Bray, S.R., 2005. The home advantage in sport competitions: Courneya and Carron's (1992) conceptual framework a decade later. *Journal of sports sciences*, *23*(4), pp.395-407.

Clarke, S.R. and Norman, J.M., 1995. Home ground advantage of individual clubs in English soccer. *Journal of the Royal Statistical Society: Series D (The Statistician)*, *44*(4), pp.509-521.

Coleman, J.S., 1990. *Foundations of social theory*. Harvard university press.

Courneya, K.S. and Carron, A.V., 1992. The home advantage in sport competitions: a literature review. *Journal of Sport & Exercise Psychology*, *14*(1).

Dawson, P. and Dobson, S., 2010. The influence of social pressure and nationality on individual decisions: Evidence from the behaviour of referees. *Journal of Economic Psychology*, *31*(2), pp.181-191.

Dawson, P., Dobson, S., Goddard, J. and Wilson, J., 2007. Are football referees really biased and inconsistent? Evidence on the incidence of disciplinary sanction in the English Premier League. *Journal of the Royal Statistical Society Series A: Statistics in Society*, *170*(1), pp.231-250.

Distaso, W., Leonida, L., Maimone Ansaldo Patti, D. and Navarra, P., 2012. Corruption and referee bias in football: the case of Calciopoli. *Available at SSRN 2004385*.

Dohmen, T.J., 2008. The influence of social forces: evidence from the behavior of football referees. *Economic Inquiry*, *46*(3): pp.411–424.
Dohmen, T. and Sauermann, J., 2015. Referee Bias. J*ournal of Economic Surveys*, *30*(4), pp.679–695.
Downward, P. and Jones, M., 2007. Effects of crowd size on referee decisions: Analysis of the FA Cup. *Journal of sports sciences*, *25*(14), pp.1541-1545.
Garicano, L., Palacios-Huerta, I. and Prendergast, C., 2005. Favoritism under social pressure. *Review of Economics and Statistics*, *87*(2), pp.208-216.
Goumas, C., 2014. Home advantage and referee bias in European football. *European Journal of Sport Science*, *14*, pp.243-249.
Johnston, R., 2008. On referee bias, crowd size, and home advantage in the English soccer Premiership. *Journal of sports sciences*, *26*(6), pp.563-568.
Leitner, M.C., Daumann, F., Follert, F. and Richlan, F., 2023. The cauldron has cooled down: a systematic literature review on home advantage in football during the COVID-19 pandemic from a socio-economic and psychological perspective. *Management Review Quarterly*, *73*(2), pp.605-633.
Morabito, L. and Scoppa, V., 2024. Inequity Aversion in Subjective Evaluations: Evidence from Referees' Decisions in Soccer.
Nevill, A.M., Balmer, N.J. and Williams, A.M., 2002. The influence of crowd noise and experience upon refereeing decisions in football. *Psychology of sport and exercise*, *3*(4), pp.261-272.
Nevill, A.M., Holder, R.L., 1999. Home advantage in sport: An overview of studies on the advantage of playing at home. *Sports Medicine*, *28*, pp.221-236.
Nevill, A.M., Holder, R.L., Bardsley, A., Calvert, H. and Jones, S., 1997. Identifying home advantage in international tennis and golf tournaments. *Journal of Sports Sciences*, *15*(4), pp.437-443.
Nevill, A.M., Newell, S.M. and Gale, S., 1996. Factors associated with home advantage in English and Scottish soccer matches. *Journal of sports sciences*, *14*(2), pp.181-186.
Oberhofer, H., Philippovich, T. and Winner, H., 2010. Distance matters in away games: Evidence from the German football league. *Journal of Economic Psychology*, *31*(2), pp.200-211.
Pettersson-Lidbom, P. and Priks, M., 2010. Behavior under social pressure: Empty Italian stadiums and referee bias. *Economics Letters*, *108*(2), pp.212-214.
Pollard, R., 1986. Home advantage in soccer: A retrospective analysis. *Journal of sports sciences*, *4*(3), pp.237-248.
Reade, J.J., Schreyer, D. and Singleton, C., 2022. Eliminating supportive crowds reduces referee bias. *Economic Inquiry*, *60*(3), pp.1416-1436.
Schwartz, B. and Barsky, S.F., 1977. The home advantage. *Social forces*, *55*(3), pp.641-661.
Scoppa, V., 2008. Are subjective evaluations biased by social factors or connections? An econometric analysis of soccer referee decisions. *Empirical Economics*, *35*, pp.123-140.
Scoppa, V., 2021. Social pressure in the stadiums: Do agents change behavior without crowd support? *Journal of economic psychology*, *82*, p.102344.
Spitz, J. *et al.* 2020 'Video assistant referees (VAR): The impact of technology on decision making in association football referees', *Journal of Sports Sciences*, *39*(2), pp. 147–153.

Sors, F., Grassi, M., Agostini, T. and Murgia, M., 2021. The sound of silence in association football: Home advantage and referee bias decrease in matches played without spectators. *European journal of sport science*, *21*(12), pp.1597-1605.
Sors, F., Grassi, M., Agostini, T. and Murgia, M., 2022. A complete season with attendance restrictions confirms the relevant contribution of spectators to home advantage and referee bias in association football. *PeerJ*, *10*, p.e13681.
Souchon, N., Fontayne, P., Livingstone, A., Maio, G.R., Mellac, N. and Genolini, C., 2013. External influences on referees' decisions in judo: The effects of coaches' exclamations during throw situations. *Journal of Applied Sport Psychology*, *25*(2), pp.223-233.
Sutter, M. and Kocher, M.G., 2004. Favoritism of agents–the case of referees' home bias. *Journal of Economic Psychology*, *25*(4), pp.461-469.

(6) The Appendix

Table A1 – Summary Statistics

		Serie A					Serie B				
Variables	**Definition**	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Obs.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Dependent											
Hfouls	Home fouls conceded	2143	12.62	3.84	1	28	2195	14.72	4.28	0	30
Hyellows	Home yellows conceded	2144	2.10	1.33	0	7	2196	2.34	1.35	0	8
Hsanctions	Home total sanctions conceded	2143	2.31	1.63	0	11	2196	2.56	1.65	0	11
Explanatory											
CrowdSize	Crowd Attendance (in 000's)	2144	25.68	17.20	0.906	78.32	2195	7.26	5.22	0.46	83.55
CrowdDensity	Crowd Attendance as a % of Stadium Capacity	2144	65.11	22.21	3.46	116.64	2195	38.81	20.01	2.36	170.38
Afouls	Away fouls conceded	2143	13.04	4.06	3	29	2195	14.93	4.31	0	30
Ayellows	Away yellows conceded	2143	2.47	1.41	0	8	2195	2.61	1.38	0	8
Asanctions	Away total sanctions conceded	2143	2.71	1.73	0	11	2195	2.91	1.73	0	12
Hprob1	Home team quality (Based on B365 pre-match odds of final outcome)	2143	0.44	0.19	0.056	0.90	2195	0.43	0.099	0.14	0.80
Hprobsq1	*Hprob1* squared	2143	0.23	0.18	0.003	0.81	2195	0.20	0.087	0.02	0.64

Table A2 – Regression Results for Serie A

	Post-COVID Seasons						Pre-COVID Seasons					
	(1) $Hyellow_{A1}$	(4) $Hyellow_{A2}$	(2) $Hfouls_{A1}$	(5) $Hfouls_{A2}$	(3) $Hsanctions_{A1}$	(6) $Hsanctions_{A2}$	(1) $Hyellow_{A1}$	(4) $Hyellow_{A2}$	(2) $Hfouls_{A1}$	(5) $Hfouls_{A2}$	(3) $Hsanctions_{A1}$	(6) $Hsanctions_{A2}$
Crowd Size	-0.005* (0.0027)	0.0059** (0.0029)	-0.021*** (0.007)	-0.0068 (0.008)	-0.0048 (0.0033)	0.0075** (0.0036)	-0.0082*** (0.0030)	0.0091*** (0.0031)	-0.044*** (0.0091)	-0.022** (0.010)	-0.0076** (0.0037)	0.012*** (0.0039)
Crowd Density	-0.0010 (0.0021)	-0.0020 (0.0021)	-0.0095 (0.0057)	-0.014** (0.0060)	-0.0031 (0.0026)	-0.0044* (0.0026)	0.0061*** (0.0023)	-0.0002 (0.0021)	0.021*** (0.0068)	0.021*** (0.0070)	0.0057** (0.0028)	-0.0008 (0.0027)
R^2	0.0072	0.12	0.025	0.038	0.0087	0.11	0.010	0.22	0.024	0.075	0.0058	0.19
CONTROLS	X	✓	X	✓	X	✓	X	✓	X	✓	X	✓
N	1136	1135	1136	1135	1136	1135	1008	1008	1008	1008	1008	1008

Foot Notes: Coefficients represent marginal effects. Standard errors in parentheses. Reported to 2 s.f. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full list of *CONTROLS* variables is detailed in appendix table A1 – summary statistics.

Table A3 – Regression Results for Serie B

	Post-COVID Seasons						Pre-COVID Seasons					
	(1) $Hyellow_{B1}$	(4) $Hyellow_{B2}$	(2) $Hfouls_{B1}$	(5) $Hfouls_{B2}$	(3) $Hsanction_{SB1}$	(6) $Hsanction_{SB2}$	(1) $Hyellow_{B1}$	(4) $Hyellow_{B2}$	(2) $Hfouls_{B1}$	(5) $Hfouls_{B2}$	(3) $Hsanction_{SB1}$	(6) $Hsanction_{SB2}$
Crowd Size	-0.0058 (0.0079)	-0.0016 (0.0078)	-0.034 (0.023)	-0.035 (0.023)	-0.010 (0.0095)	-0.0026 (0.0095)	-0.033*** (0.018)	-0.011 (0.016)	-0.16*** (0.040)	-0.13*** (0.041)	-0.038*** (0.015)	-0.016 (0.014)
Crowd Density	-0.0008 (0.0023)	0.0004 (0.0021)	-0.014** (0.0066)	-0.013* (0.0066)	0.0004 (0.0027)	0.0018 (0.0026)	0.007*** (0.0025)	0.005** (0.0023)	0.015* (0.0085)	0.014* (0.0084)	0.0088*** (0.0031)	0.0076** (0.0029)
R^2	0.001	0.080	0.014	0.029	0.001	0.063	0.011	0.10	0.013	0.039	0.010	0.10
CONTROLS	X	✓	X	✓	X	✓	X	✓	X	✓	X	✓
N	1131						1064					

Foot Notes: Coefficients represent marginal effects. Standard errors in parentheses. Reported to 2 s.f. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full list of *CONTROLS* variables is detailed in appendix table A1 – summary statistics.

Table A4 – Regression Results for Serie A and B (combined).

	Post-COVID Seasons						Pre-COVID Seasons					
	(1) $Hyellow_{C1}$	(4) $Hyellow_{C2}$	(2) $Hfouls_{C1}$	(5) $Hfouls_{C2}$	(3) Hsanction s_{C1}	(6) Hsanction s_{C2}	(1) $Hyellow_{C1}$	(4) $Hyellow_{C2}$	(2) $Hfouls_{C1}$	(5) $Hfouls_{C2}$	(3) Hsanction s_{C1}	(6) Hsanction s_{C2}
Crowd Size	-0.0091*** (0.0023)	0.0017 (0.0024)	-0.036*** (0.0065)	-0.025*** (0.0071)	-0.010*** (0.0028)	0.0016 (0.0030)	-0.036 (0.0074)	0.0069*** (0.0026)	-0.07*** (0.0083)	-0.046*** (0.0090)	-0.010*** (0.0032)	0.008** (0.0033)
Crowd Density	-0.0018 (0.0015)	-0.0011 (0.0015)	-0.017*** (0.0042)	-0.016*** (0.0043)	-0.0022 (0.0018)	-0.0015 (0.0018)	0.0022 (0.0013)	0.0032** (0.0015)	0.0012 (0.0050)	0.0038 (0.0051)	0.0059*** (0.0019)	0.0036* (0.0019)
R^2	0.018	0.11	0.057	0.071	0.016	0.094	0.0015	0.16	0.059	0.099	0.0062	0.14
CONTROLS	X	✓	X	✓	X	✓	X	✓	X	✓	X	✓
N	2267	2266	2267	2266	2267	2266	2073	2072	2072	2072	2073	2072

Foot Notes: Coefficients represent marginal effects. Standard errors in parentheses. Reported to 2 s.f. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Full list of *CONTROLS* variables is detailed in appendix table A1 – summary statistics.

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