

Institution: University of Edinburgh
Unit of Assessment: UoA 16 Economics and Econometrics
<p>1. Unit context and structure, research and impact strategy</p> <p>1.1 Unit context and structure</p> <p>Economics at Edinburgh comprises 34 staff, all members of the School of Economics. Over the REF period, we have made strategic investments to recruit outstanding new staff and to support colleagues in achieving ambitious goals in research and impact. We have strengthened our links with a network of world-leading research collaborators from Europe and the US and policymakers in the UK and overseas. This has enabled us to significantly expand our size and grant income, whilst driving up the quality of our outputs and the impact of our research.</p> <p>In comparison to our submission to REF2014:</p> <ul style="list-style-type: none"> • The submitted FTE has nearly doubled from 17.5 to 31.6, with two further early career researcher (ECR) appointments in place for the year 2020/2021. • 25% of the submitted outputs are published in the “top-5” journals compared to just under 10% at REF2014 and 10 of the 34 submitted staff having a top-5 publication. • Our research income has risen from just under £1.4m in the previous REF period to just under £7.2m. • We have transformed our support for impact, including through new strategic partnerships with the Bank of England, the Department for Work and Pensions, the Industrial Strategy Council, and the Alan Turing Institute. • We have increased the size of our PhD programme, maintaining entrant quality and improved our training. Doctoral completions have nearly doubled from 21 in the previous REF period to 39. <p>1.2 Research strategy</p> <p>Cohesive Research Agenda: Our overarching strategic goal is to produce rigorous, high-impact research that helps address key challenges in labour and macroeconomics. Fundamental to this strategy is developing a cohesive research programme, which focuses on the big picture questions of how frictions in the labour and financial markets aggregate up to the macroeconomy. We aim to lead new developments from a foundational understanding of underlying markets including labour and credit markets, development, human capital formation, trade, health and inequality, institutions, theories of individual and group behaviour. To achieve this, we have assembled a team of theorists and empiricists with microeconomic, macroeconomic, empirical, and behavioural perspectives who share a common ambition to work at the interface between fields to study the aggregate economy: a team that works collectively and collaboratively (in-house, nationally, within Europe and internationally) to pursue this study through a common lens of informational, contractual, and institutional frictions, heterogeneity and inequality (see Figure 1 for a schematic representation of our research structure and research awards). We use a wide variety of novel and traditional data sources, including administrative, survey, census and, increasingly, big data to underpin our aims. We involve policymakers and practitioners (from the UK, Europe and the US) to help co-create our research questions and ensure their policy-relevance (see sections 3 and 4). We believe we are one of the very few economics research units in the UK or beyond with such a coherent and collective ambition.</p> <p>To deliver our ambitious research agenda, we have prioritised four main enablers.</p> <p>Developing the Next Generation: First, we have made a significant effort to identify and nurture the next generation of leading economists. We have appointed 12 ECRs over the REF period (see section 2). This has enhanced our expertise in applied microeconomics (Giardili,</p>

Nuevo-Chiquero, Steinhauer), mechanism and information design (Ollár, Taneva, Ziegler) and development and regional economics (Bai, Potlogea), and enhanced our strengths in macroeconomics (Gottfries, Olsson) and labour economics (Battiston, Lopes de Melo).

Expanding Research Income: Second, building on our plans in the REF2014, we have significantly increased our research income (as measured in REF4), from just under £1.4m over the previous REF Cycle to just under £7.2m in the current REF cycle, corresponding to more than a doubling per FTE per year (see section 3 for details). To support our cohesive research agenda, we obtained an ESRC large grant to study Credit and Labour Market Foundations of the Macroeconomy (MacCaLM) in 2015, worth £6.4m over five years. The grant has enabled us to support the development of our central research theme. It brings researchers from within the UoA (PI plus nine Co-Is) together with international co-investigators from the US and Europe to investigate how interactions in the labour and credit markets are aggregated up to the macroeconomy. It has further enabled us to pursue our strategy of breaking down barriers between researchers from different subfields with the common purpose of studying the aggregate economy. Building on this success, staff across all career stages have been awarded a range of medium and smaller-sized grants, including from the ESRC, ERC, British Academy, Leverhulme, Carnegie Trust and other sources (see section 3).

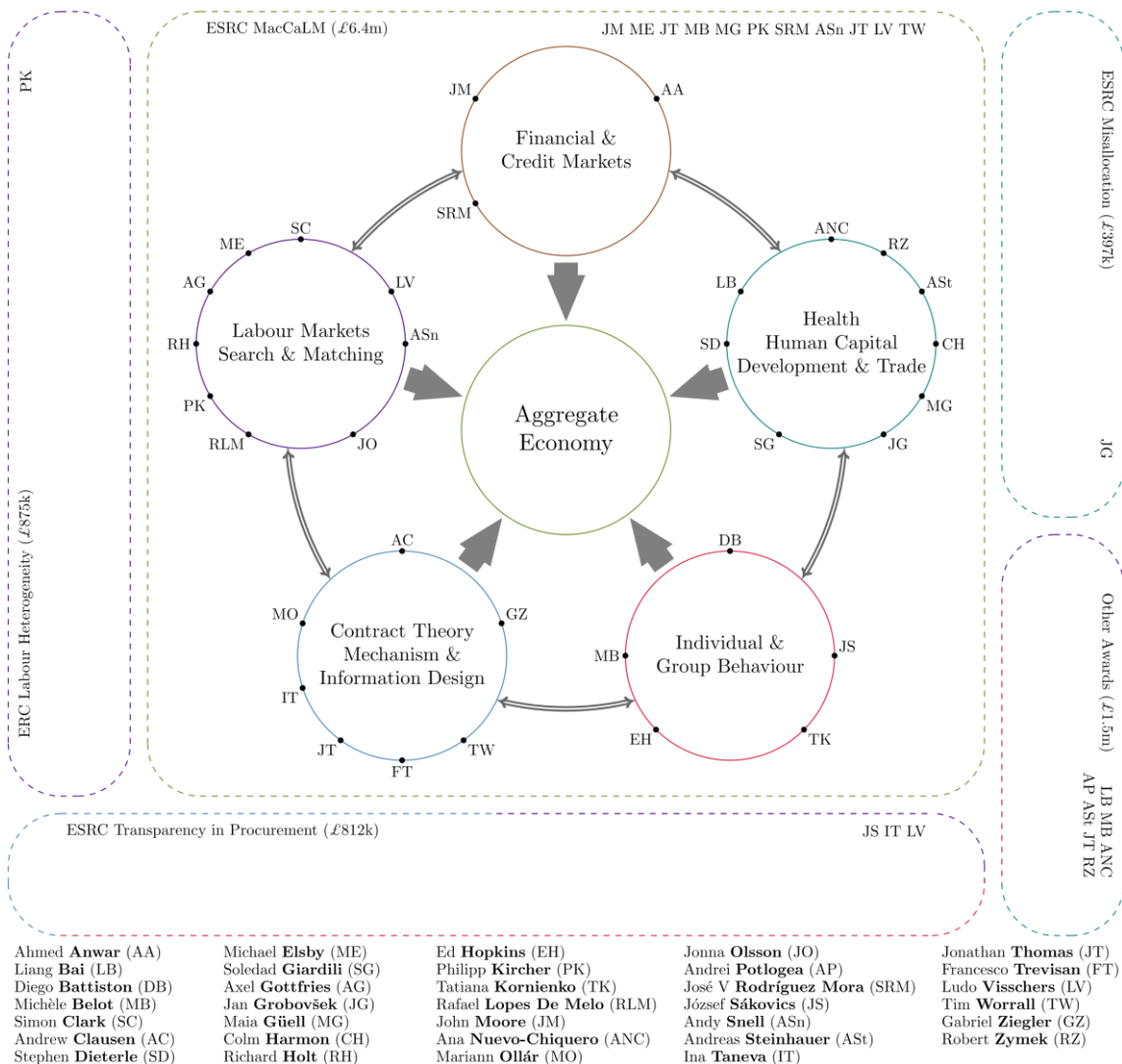


Figure 1: Researchers, Research Awards and Research Structure

Collaborating internationally: Third, we have encouraged and supported international collaboration and links. Approximately two-thirds of the outputs included in this submission have

international co-authors, roughly equally split between Europe and North America. We have hosted over 20 visitors over the REF period for stays of between one week and up to one year, including regular visits from Christina Romer and David Romer (Berkeley). We benefit from a strong partnership with the Centre for the Study of Money and Finance (CEMFI) in Madrid, which developed into a joint ERC Synergy bid (Moore and Thomas together with Pijoan-Mas and Repullo from CEMFI as PIs), the Bank of England (Zymek is a visiting researcher and consultant), the Alan Turing Institute (Rodríguez Mora is a fellow), and many other institutions including Arizona, Cornell, Michigan, Princeton, San Diego, Paris, and Zurich (see section 4 for more details). This helps ensure that our research is at the forefront of current thinking and techniques, widely and internationally known and disseminated.

Supporting staff: Our fourth focus has been to support staff (see section 2 for details) to be rigorous in their research, ambitious in their publication strategy and proactive in generating impact and research funding. The success of this approach is evidenced by the spread of submitted staff with publications in “top-5” or leading field journals and the fact that two of our three impact case studies are based on work published in a “top-5” journal. Submitted outputs are published in: *American Economic Association Journals* (7); *Journal of Political Economy* (6); *Economic Journal* (6); *Review of Economic Studies* (5); *Journal of Economic Theory* (5); *Econometrica* (3); *Journal of the European Economic Association* (3); *Games and Economic Behavior* (3) and other general interest, field and policy journals. Not only has our grant income increased but more staff are engaged in grant-funded research. Approximately 53% of the staff submitted have received external grant funding during the REF period, up from around 39% during the previous REF period.

1.3 Research Highlights

Significant and original contributions have been made in four main areas, including both empirical and theoretical advances.

Labour Markets: UoA staff have made important contributions in labour economics and the implications for the aggregate economy. For example, Elsby (*Journal of Monetary Economics*, 2019) asks the simple question of how microeconomic adjustment costs aggregate up to affect overall employment dynamics. Using a mass-balance approach, the distribution of employment across firms is decomposed into a flow of firms that adjust to a given size and those that adjust away from it. Adding an adjustment cost reduces both flows but for small adjustment costs, the changes are approximately symmetric, leaving the distribution of employment unchanged. Using matched-panel data sets from Germany and Portugal, Snell and Thomas (*Journal of Labor Economics*, 2018) re-examine returns to tenure. They show how co-movements in wages and employment decisions at the firm level, caused, for example, by firm-level shocks and an equal treatment property for wages, significantly impact measure of returns to tenure. Güell and Rodríguez Mora (*Economic Journal*, 2018) use province-level tax data from Italy and the informational content of surnames to examine intergenerational mobility. The variability in intergenerational mobility across provinces allows them to correlate mobility with macroeconomic variables such as economic prosperity, educational attainment and inequality. UoA staff are also at the forefront of research on search and matching. For example, Kircher (*Econometrica*, 2018) provides a unifying theory of production where management resolves a trade-off between hiring more versus better workers. Lopes de Melo (*Journal of Political Economy*, 2018) explores why firms pay different wages unrelated to skill and he combines the Abowd-Kramarz-Margolis methodology with a job matching process that allows for both firm and worker heterogeneity to match US data.

Credit Markets: Research on financial and credit market frictions aims to answer fundamental questions of macroeconomics. For example, Rodríguez-Mora (*Economic Journal*, 2020) asks not if well-functioning financial markets lead to efficient final goods markets, but assesses the reverse causality. An efficient productive sector creates incentives for financial intermediation because there are large gains from allocating resources well in a competitive environment. He finds evidence that rich countries have a large financial sector because the productive sector is efficient, not the other way around. Moore (*Journal of Political Economy*, 2019, one of the most

highly read articles in that journal in 2019 and 2020), provides a rationale for unconventional monetary policy. The paper sets out a simple model in which money functions because it is more liquid than any other asset. This combined with a borrowing constraint means a saver may choose to hold money to provide liquidity in case of a productive opportunity. A decrease in asset liquidity can reduce asset value and decrease investment and aggregate activity. A central bank can counteract this effect by buying private equity (quantitative easing).

Economic Theory: The UoA has key strengths in contract theory, mechanism and information design. Taneva is at the forefront of the growing literature on information design. Her paper on “Information Design” (*American Economic Journal: Microeconomics*, 2019) is considered one of the foundational papers of the field with over 100 Google Scholar citations. Ollár (*American Economic Review*, 2017) shows how full implementation can be achieved with simple mechanism design. Clausen (*Journal of Economic Theory*, 2020) establishes a reverse calculus result, deriving the differentiability of component functions from the differentiability of an aggregate function, a result that is applied to solving recursive optimisation problems. Thomas and Worrall (*Journal of Economic Theory*, 2018) consider dynamic contracts with limited commitment and two-sided actions. They establish the trade-off between risk sharing and efficiency that is absent in simpler models of limited commitment contracts. Hopkins (*Games and Economic Behavior*, 2018) shows how risk-taking behaviour can be determined endogenously in a tournament environment by the inequality of initial wealth and the inequality in tournament rewards. He shows that risk-taking behaviour is increasing in inequality of final rewards, even though it is decreasing in the inequality of initial wealth. Steiner (*Econometrica*, 2017) provides a tractable model of dynamic rational inattention that can be applied to many macroeconomic models. Sákovics, together with Taneva and Visschers, and Roberto Burguet (University of Central Florida) have worked on transparency and procurement. In work supported by an ESRC award of £778k (see section 3), they have built upon information design and simple auctions, working with the National Health Service in Scotland, to improve procurement practices in the public sector.

Trade, Health, Development and Behaviour: UoA researchers have made significant contributions to the understanding of trade flows and the aggregate economy, as well as investment in human capital, health, and development, and individual and group behaviour. Bai (*American Economic Review: Insights*, 2020), Potlogea (*Journal of Urban Economics*, 2018) and Zymek (*Journal of International Money and Finance*, 2018) examine US-China trade, left-behind towns and measuring productivity differences. Harmon (*Labour Economics*, 2017), Nuevo-Chiquero (*Journal of Human Resources*, 2018, the most highly read article in that journal in 2018) and Steinhauer (*Review of Economic Studies*, 2014) examine parental behaviour, child development and labour market outcomes. Güell (*Journal of Political Economy*, 2020) studies school choice mechanisms. Bai (*Review of Economics and Statistics*, 2020), Belot (*European Economic Review*, 2020) and Politi (*Journal of European Economic Association*, 2017) examine nutrition and preventative health care interventions. Belot (*Experimental Economics*, 2017) and Hopkins and Kornienko (*Games and Economic Behavior*, 2019) examined social learning, information gathering, and private information in experimental games. This work was supported by a range of grants (see section 3 for details).

1.4 Research Response to Covid

Covid raises urgent questions about the economy and the interaction of economic behaviour and the pandemic. Our cohesive structure, partnerships and support for impact have enabled our researchers to respond in an agile way, building on our existing research agenda. The paper by Kircher with Greenwood, Santos and Tertilt on HIV/AIDS in Malawi (*Econometrica*, 2019) is one of the first to consider the interaction between policy, behavioural responses and infectious disease. They consider a rational search model and find, for example, that better condoms can increase infection rates because of increased promiscuity and that good public health information has significant beneficial effects. Building on this pre-existing research interest, UoA staff have already published three articles in Covid Economics, the new rapid response journal of the Centre for Economic Policy Research in London. These articles address

the potential for home-working around the world (Grobovšek), international survey evidence on the impact of Covid-19 (Belot), and the modelling of the regional spread of epidemics (Zymek). Other work has been presented at prestigious international conferences: Kircher presented his work on testing for Covid-19 at the Search and Matching Workshop in May 2020, and Rodríguez-Mora presented his work on the economic effects of the lockdown in Spain at the NBER Summer Institute in June 2020. The UoA also organised a virtual workshop on the “Economics of Covid-19” in June 2020.

1.5 Research Integrity, Ethical and Open Research

The UoA, along with the University, operates within the framework of the UUK Concordat to Support Research Integrity and ethical issues are fully integrated into our research culture and support. Our research ethics policy applies to all researchers including students, visiting academics and research assistants. There is a three-level procedure for ethical approval. While much of our research is theoretical and uses only publicly available information or datasets (level 1), some research involves experiments or fieldwork (level 2) and other research involves RCTs or fieldwork in developing countries, including with vulnerable groups (level 3). The UoA has approved approximately 20 research proposals at level 3 through these procedures during the REF period -- for example, an RCT that used a sample of pregnant women and low-income families with young children to examine the long-term impact of a dietary intervention (see, Belot, *European Economic Review*, 2020) required researchers to obtain basic disclosure status.

We embrace the open science agenda and are committed to the DORA framework and Plan S to allow open access (OA) to all outputs. We have adopted a policy which goes beyond REF requirements, requiring all outputs published since January 2015 to be recorded in PURE, the University’s research information system, in compliance with relevant OA conditions of the outlet. The UoA has achieved 100% OA compliance. We have supported gold OA for 18 articles published over the REF period (for staff of all grades and PhD students) including eight of the submitted outputs. *The Edinburgh School of Economics Discussion Paper Series* is fully OA in RePEc.

All researchers have an ORCID identifier. It is standard practice for staff to maintain personal websites and they are encouraged to upload non-sensitive data and/or code to their own websites or sites such as ICSPR, the UK Data Archive, GitHub, Mendeley Data or the local Edinburgh DataShare for open access sharing. For example, datasets available on Edinburgh DataShare include data on food basket choice and survey data (Belot), a survey of Ugandan village chiefs (Grobovšek) and the provision of emergency contraception in Chile (Nuevo-Chiquero). Contributions to code development include refinement of the JuliaNLSolvers and JuliaMath packages for non-linear optimisation and root solving (Clausen) that are available on GitHub.

1.6 Knowledge Exchange and Impact Strategy

Over the REF period, we have introduced a range of improvements to how we support Knowledge Exchange and Impact (KEI). In 2014 we created the post of Director of KEI, supported by a team of professional support staff in our Research Office. Three key changes have been undertaken. First, we stressed the importance of KEI as a core responsibility of all research staff, ensuring that all staff submit a brief KEI report once a year, ahead of their annual review. The report feeds into individual planning conversations between researchers and the Director of KEI. These conversations seek to explore possible pathways to impact and any additional resources needed to unlock them (such as, for example, support and training for KEI, new seed funding opportunities through an ESRC Impact Acceleration Accounts (IAA) and internal Knowledge Exchange and Impact grants and additional administrative support). For example, Bai was awarded an IAA (£15k) to analyse the impact of financing and credit constraints on the adoption of new technologies in India, as was Zymek (£19k), who undertook a six-month part-time secondment at the UK Government’s Industrial Strategy Council (see

section 4). Secondly, we have improved information flows, with the Director and Research Office acting as a conduit of information about relevant resources and maintaining an up-to-date register of on-going and concluded research impact within the UoA. Thirdly, we have actively sought to develop our ties with institutions at the intersection between academia, economic policy and civil society to facilitate the two-way conversation between researchers and research users.

All three of our submitted impact case studies (ICS) have been developed through this process. The ICS on international trade (Rodríguez-Mora and Zymek) was bolstered by a strategic secondment funded through ESRC Impact Acceleration Account. The ICS on the provision of information to job seekers (Belot and Kircher), benefited from policy fora with the Department for Work and Pensions, organised as part of the School's effort to build ties in the UK policy community beyond academia. Early reviews of the progress of the case also revealed the need for additional administrative support to manage the relationship with the private-sector partner organisation at which the key impact ultimately occurred. The evidence base for the ICS on school choice mechanisms (Güell) was curated in line with best practice. The UoA provided dedicated support for two rounds of evidence collection as the case evolved. The variety of these ICSs is representative of the broad spectrum of the UoA's knowledge exchange activities.

We have developed close ties with the Bank of England, NHS Scotland, the Fraser of Allander Institute at the University of Strathclyde, the David Hume Institute (DHI) and the Scottish Government. This has led to direct collaboration and research activities. MacCaLM hosts policy forums with researchers from the Bank of England and the Swedish Central Bank, amongst others (typically two per year, one in Edinburgh and one in London or elsewhere). Sákovics, Taneva and Visschers worked on the design of procurement practices in collaboration with staff from NHS Scotland. Zymek, together with Mark Mitchell (an Edinburgh PhD student and research assistant at the Fraser Allander Institute) compiled existing and new evidence on Scottish labour productivity – its recent evolution and how it compares with other countries and regions in the OECD – which was published in a DHI report entitled "Wealth of the Nation - Scotland's Productivity Challenge". Hopkins and Kornienko organised a policy forum on behavioural economics and inequality in Edinburgh in 2019 and jointly organised with Cornell University and the Scottish Government.

1.7 Strategic Aims beyond 2020

Over the next REF period, we will focus on three main priorities. First, we will develop our research on how health, development and trade impact the aggregate economy. This will build on our core research strengths. We believe that our approach of analysing how frictions in the labour, financial and other markets aggregate up to the macroeconomy will become even more relevant and important over the next five-ten years following the disruption caused to labour and other markets across the globe by the coronavirus pandemic.

Second, we will expand our ongoing research in Economic Data Science, exploiting the potential of big data to significantly aid our understanding of financial and labour market interactions and social trends. Examples of the type of research already underway include the use of bank transaction data to map economic flows at a local or regional level and through the supply chain (Rodríguez Mora); digitising large-scale historical church records to understand the relationship between fertility and major shocks such as wars and pandemics (Steinhauer); and using the information of travel companions on immigrant ships to understand the impact of social interactions on labour market outcomes (Battiston). The UoA is ideally positioned to develop its research in this area, capitalising on the University's leading role in the Edinburgh and South East Scotland City Region Deal, a £1.3bn investment to establish Edinburgh as the data capital of Europe. As part of the City Deal, the University has invested £140m to build the Edinburgh Futures Institute (EFI), which will open in 2023. Within the EFI, the Centre for Data, Culture and Society (launched March 2019) supports cross-disciplinary, data-driven research in the Arts, Humanities and Social Sciences, while the Global Open Finance Centre of Excellence (launched June 2020) is a collaboration with FinTech Scotland and the Financial Data and Technology Association that is compiling a big data longitudinal study of consumer and

business transactions. We will work closely with these new developments and build on our existing links with the Economic Data Science programmes at the Alan Turing Institute to position our UoA as an international leader in the economic analysis of big data.

Our third priority will be to further develop our research links with our international collaborators and partners. For example, we will build upon the close collaboration with CEMFI in Madrid that resulted in an ERC Synergy bid in 2019 and 2020. This collaboration will enhance our ability to compete for grant income in the future and improve our links to policymakers in Europe.

2. People

2.1 Staffing strategy and staff development

Staffing: We aim to bring together talented and ambitious researchers at all career stages with a common vision for the development of the field. To realise this aim we devote resources to ensure we recruit, develop, and nurture the next generation of leading researchers.

Over the REF period, we have recruited 13 permanent staff, including 12 ECRs. Our collegiality is attested by our low turnover rate. Only four staff submitted to REF2014 have departed. Of staff not previously submitted, one has moved to the private sector in the US, two have retired and a further five staff have been successfully supported through sabbatical leave and mentorship to develop their research profile.

Early career recruitment: Early career recruitment is led by the Head of School and a hiring co-ordinator (a member of staff with recent experience of the job market) who work together with a broadly constituted recruitment committee comprising staff from different fields and all levels of seniority. We adopt the American system of holding preliminary interviews at professional meetings and flying out shortlisted candidates. This is an intensive process, but it has resulted in high-quality recruitment. Twelve new lecturers have been appointed since 2014. They are (with their doctoral school): Bai (Berkeley); Battiston (LSE); Giardili (QMUL); Gottfries (Cambridge); Lopes de Melo (Yale); Nuevo-Chiquero (Boston); Ollár (Wisconsin Madison); Olsson (Stockholm); Potlogea (Pompeu Fabra); Steinhauer (Zurich); Taneva (Texas Austin); Ziegler (Northwestern). From the start of session 2020/21, we have hired two additional ECRs, Cederlöf (Uppsala) and Sun (LSE).

The success of our ECR recruitment and the support we offer (see below) is demonstrated by the fact that four of the twelve lecturers hired over the period (Lopes de Melo, Ollár, Steinhauer, Taneva) each have a publication in a “top-5” journal. Furthermore, those hired have been supported to move onto the grant ladder. Bai has received a grant of £152k (UoE share) from the National Institutes of Health in the US (joint with Tadeja Gracner of RAND); Potlogea and Bai have received a joint BA Leverhulme award (£61k); Taneva was Co-I on the ESRC Transparency in Procurement grant (see below) and Nuevo-Chiquero and Steinhauer have received awards from the Carnegie Trust (£9k and £14k).

Development and Support: ECRs have a one-third reduction in teaching/admin duties in their first year, tapering to a zero reduction in the fourth year (senior hires get a reduction for their initial year). ECRs receive a £3k personal research fund for each of their first three years.

There is a formal three-year mentoring scheme for ECRs with a team of mentors covering research, teaching, administration, and career planning. Female ECRs have at least one female mentor. After the formal three-year period, supportive relationships with mentors invariably continue. Importantly, mentors are only one source of advice; all experienced staff provide guidance (including discussing ideas, reading drafts, advising on submission, and interpreting referee reports). The University’s Institute for Academic Development provides specialist support for all staff as well as targeted support for ECRs, including courses on teaching practice and professional development, and organises networking events.

All academic staff have an annual review together with the Head of School or senior delegate. The review includes an evaluation of progress, KEI report and the formulation of plans for

research, professional and personal development. The process ensures that the allocation of workload meshes with the individual's personal and professional development needs.

Staff can apply for research leave of one semester or a whole year. Approximately one semester in seven is supported, but staff can apply at any stage to suit their research needs. Applications are considered with a view to encouraging and supporting staff to undertake high-quality research. Fifteen of our staff have had research leave in this REF period. Following the leave, staff produce a report detailing their research outputs, impact, grant applications and other research activities, which is reviewed by the Research Committee to identify further opportunities and support needs.

To foster the exchange of ideas, we host on-demand "Quaker sessions", developed from a tradition originally started in Cambridge in the 1970s. In our variant, we have an hour set apart each week, so that sessions can be convened through a simple e-mail. Sessions are designed for brainstorming and slide presentations are eschewed in favour of a discussion of key insights. There are also two PhD reading groups, attended by students and faculty: a general group, which is mandatory for all PhD students, and an optional macro-reading group. In these reading groups, students present their own work as well as leading the discussion of a seminal or frontier paper. In addition, we organise specialist guidance and training sessions as demand requires. For example, we have recently organised sessions on promotion procedures and requirements and on grant application procedures and how to write a good research proposal.

All staff, including ECRs, are encouraged to disseminate their research at an early stage, including through the *Edinburgh School of Economics Discussion Paper Series* (circa 60 over the REF period), and through presentations at international conferences (circa 150 over the REF period). Financial support for conference attendance and other research needs is funded through grant income, individual research allowances or the School budget (see section 3).

Promotions: The UoA has made several improvements to the support it offers to staff for career planning and promotion. The UoA's expectations of research performance are explicitly documented and discussed with staff at the start of their employment. When a potential promotion case is identified, there is a thorough deliberation phase conducted by a representative group of senior staff that carefully assess how potential candidates meet the criteria for excellence in research, impact, teaching and citizenship. The views of external referees may be sought at this preliminary stage. The purpose of these deliberations is to provide feedback and support to staff and their mentors to prepare a stronger promotion case, or to identify areas that need strengthening before a promotion case is taken forward. This rigorous procedure and our improved mentorship scheme have yielded positive results, with five promotions in the last two years and two of those being awarded to female candidates. Taneva was promoted to Reader in 2019. Clausen, Dieterle, Nuevo-Chiquero and Steinhauer were promoted to Senior Lectureships in 2020.

2.2 Support for Research Students

Aim: Our PhD programme provides comprehensive training in quantitative and research methods in microeconomics, macroeconomics, and empirical economics to enable students to undertake high-quality research. All students are fully funded, either from external or internal funds. We have a high-quality programme of training and supervision and maintain a critical mass of students.

Admissions: Eligibility for admission to the PhD programme is rigorous training in the core curriculum at MSc level. Our main source of intake is the flagship Scottish Graduate Programme in Economics (SGPE), run by the School of Economics in collaboration with seven other Scottish universities. This MSc programme attracts around 80 students per year. Amongst the Scottish universities, there is a competitive bid process, held every five years, to run the programme. Edinburgh has run the programme since 2000 and successfully rebid to continue for the period 2020-25. We admit between five and nine students to the PhD programme each year, of whom more than half enter having taken the SGPE. The student body is highly

international, with approximately 43% from the EU, 33% from overseas, including Africa, Asia and Australia, and 24% from the UK. Nearly all students (over 95%) are full-time.

Structure: The PhD programme is a four-year programme (three years plus one “writing-up” year) with a substantial coursework element in the first year. In the first year, students take courses in research methods in microeconomics and research methods in macroeconomics, together with a core course in econometrics (either micro-econometrics or Bayesian econometrics or time series econometrics). They take two advanced options from the SGPE and a “Frontiers in Economics” reading group, at which they present both a recent frontier article and their preliminary research topic to Faculty and peers. They submit a draft first paper at the end of the year, which they present to a panel of Faculty as part of the progression decision. Students who do not meet the progression hurdle may exit with an MRes in economics provided their coursework and draft paper satisfy the minimum requirements. There is also a formal annual review at the end of years two and three.

All of our PhD students are affiliated with the SGPE doctoral programme, which organises an annual residential conference for both MSc and affiliated doctoral students from throughout Scotland. All present at the conference in each of the first three years of their programme. A faculty member from another Scottish university is allocated as a discussant for each presentation. This provides useful practice and external exposure that students find particularly valuable.

The SGPE provides the core disciplinary training with the economics pathway of the Scottish Graduate School of Social Sciences (SGSSS), which is Scotland’s ESRC Doctoral Training Partnership funded jointly by the ESRC and the Scottish Funding Council. The SGSSS provides generic training on a range of topics including social science methods, wider transferable skills, collaboration and knowledge exchange, and interdisciplinary working, as well as internship opportunities and cohort building events for all PhD students in social sciences across the 16 partner institutions including students on our programme. For example, one of our PhD students was placed through the SGSSS as an intern at a care home investment company to deliver them a first UK-wide study on the demand for old-age-care.

Funding: All PhD students are fully funded at the UKRI stipend level. Over the REF cycle, eleven have been funded by the ESRC through the Scottish Graduate School of Social Sciences, Doctoral Training Partnership. A further six have been funded by the ESRC directly through the MacCaLM grant. Approximately two per year are supported by the University of Edinburgh Principal’s Career Development Scholarship scheme. We also benefit from a generous legacy, the Minto fund, that can support one scholarship per year for students from Australia, Canada, Scandinavia, or New Zealand. The UoA offers its own Research and Teaching Scholarships, which cover fees and UKRI stipend in return for some teaching duties. In the REF period, this funding has supported 22 students during the first three years of their programme and about 40 students in their writing-up year.

The UoA introduced a career development postdoctoral fellowship scheme in 2014. These fellowships are advertised internally to our recent and about-to-be graduates. They have been awarded to the best students from the graduating cohort, to help them develop their job market paper and teaching portfolio to improve their prospects in the academic job market. We have funded eleven of these fellowships (five female, six male) over the REF period and the 2020 fellow (Trevisan) is included in our submission.

This postdoctoral fellowship scheme, and the work of the UoA’s placement officer, have been important factors in improving our placement record. The placement officer has worked closely with the postdoctoral fellows, and other PhD graduates wishing to go on the academic job market, providing advice, mentoring and support to hone their job market paper together with their elevator pitch and job market spiel. Candidates give their job market presentation to faculty, who provide constructive feedback.

Support: All UoA staff and PhD students are housed in the same building. Each student is supported by at least two supervisors, generally a lead and second supervisor. All new supervisors take a training course, followed up with a refresher every five years on new

developments in research supervision, including regulations and procedures. We complement this through in-house training sessions at regular intervals that cover subject-specific issues. PhD students and their supervisors agree on a personalised structure of individual and joint meetings, together with the frequent submission of written material. Students working in the same area sometimes have joint sessions with their supervisors and they also share an office (typically four-six students per office) to encourage cross-fertilisation and discussion. We encourage (and financially support) our PhD students to attend at least one extra-curricular short course, master class or workshop in economics per year whether in Scotland, the rest of the UK, or Europe.

All students are strongly encouraged to take on some teaching as part of their professional development, even where it is not required by the terms of their studentship. They are supported through a series of initial training and induction events as well as a peer support network for tutors.

Success, Publications and Placement: The number of PhD completions over the REF cycle has nearly doubled from 21 to 39. Over 90% of entrants progress from the MRes stage to the PhD stage and the only withdrawals thereafter (two during the REF period) are for non-academic reasons. The average time from programme start to thesis submission for the 39 completions is 46 months, with a standard deviation of four months. The average time from the viva to award, to allow for thesis revisions and administrative processing, is three months. Publications by, and placements of, our PhD students have improved over the REF cycle. During their PhD studies, our graduates have published as sole authors in leading journals, including, *European Economic Review* (2); *Experimental Economics*; *Journal of Economic Behavior and Organization*; *Scandinavian Journal of Economics* (2); *Social Choice and Welfare*. In the REF period, graduates of the programme have secured positions at many UK universities (such as Bath, Birmingham, St Edmund's Oxford, Strathclyde, St. Andrews), universities in Europe and elsewhere (such as Aarhus, Düsseldorf, Linz, New York at Abu Dhabi, Penn State and Milan) and national and international organizations (such as Barclays Bank; Behavioural Insights Team; Copenhagen Economics, Danish Central Bank, Department for Business, Energy and Industrial Strategy, HSBC and National Institute for Economic and Social Research). Graduates have also obtained prestigious post-doc positions, including two at the European University Institute and one at Nuffield College, Oxford.

Ongoing developments: Starting from September 2020 we have modified the programme in line with changed University regulations to offer a five-year integrated PhD programme (four years plus one year of writing-up). As well as core courses, students will have a choice of advanced field courses. These changes will enable us to better match the typical US PhD system and rival the best PhD programmes in the UK. We will continue to offer career development postdoctoral fellowships to our very best students to hone their job market papers.

2.3 Equality and Diversity

We were the first UK Economics department to secure an Athena SWAN Bronze Award in November 2015 and building on the progress made we will apply for a Silver Award in November 2021. This reflects the importance we have always placed on equality, diversity and inclusion. Our EDI strategy is led by Professor Simon Clark, a former Head of School (2009-2017) and we are fully committed to the Principles of the Researcher Development Concordat. Our goal is that all staff, whatever their role for the UoA, feel valued, respected, and supported and that dignity and respect are at the forefront of our daily interactions.

Recognising the challenges faced by our discipline in improving diversity, we have actively sought to promote equality of opportunity for all members of our research community. Led by our EDI committee, our strategy explicitly commits us to the ten principles of Athena Swan. We have adopted a range of measures to improve the transparency of procedures. These include our recruitment and appointment processes, how we develop staff and prepare them for promotion, how we facilitate flexible working and sabbatical arrangements for those with caring responsibilities, and how we address issues of gender equality, diversity and inclusion in our

decision making, training of key decision-makers and committee members. Equality impact assessments and progress on the Athena Swan action plan are considered as a standing item on all the UoA's main committees. We have begun a review of the inclusivity of our undergraduate curriculum and how it can be informed by our own research on inequalities and barriers to mobility.

Seminars and committee meetings are held in core hours (10 am to 4 pm). We have met our target for 30% of our external seminar speakers to be female and we are setting an additional target for 50% of our speakers to be from underrepresented groups from 2021/22. Staff are actively encouraged to use their full annual leave entitlement and our workload allocation model is flexible enough to accommodate changed circumstances, for example, for those with caring responsibilities and those returning from parental leave. Staff can draw on a raft of health and well-being activities promoted more generally by the University of Edinburgh, including from the Counselling Service and Occupational Health. During the lockdown in April/May 2020, we undertook a local staff survey including gathering information about changing working patterns and consequently have improved the support for flexible working particularly for PhD students and ECRs.

Over the REF period, 45% of the PhD graduates have been female (compared to 39% in the previous REF period), demonstrating that there is a pipeline of talented female economists for the future. We have employed 15 postdoctoral researchers over the REF period (seven female and eight male), including the 11 career development postdoctoral fellowships (mentioned above) and four postdoctoral researchers linked to grants (two female, two male). PhD and postdoctoral researchers are offered the same support, including arrangements for parental leave. We have offered additional support for PGR students during the pandemic period, including access to equipment and software for home working, financial support through a College hardship fund and funded programme extensions. We have an internationally diverse faculty – including academic staff from twenty countries across five continents – 26% from the UK, 53% from Europe and 21% from elsewhere. Approximately 88% of the submitted staff are full-time and 12% are on fractional contracts; 96% are full-time and 6% are on fixed-term contracts; 47% of staff are under 40, 23% aged 40-50 and 29% over 50. Approximately 23% of staff are female (two professors, one reader, two senior lecturers and three lecturers) and 9% of staff are from BME groups. Although the percentage of female and BME staff is typical for the discipline and only slightly higher than our REF2014 submission, two of the four new lecturers appointed in 2020 are female, and we believe that the measures we have taken are putting us on the right trajectory.

Beyond practices and procedures, the UoA held an international Gender Conference in November 2017 (circa 40 delegates), which explored the topics of gender quotas, wage gaps, the promotion of economic development based on female empowerment, career outcomes and tax incentives, with a keynote from Claudia Olivetti (Boston College) on gender roles and economic opportunity and sixteen other speakers and discussants from Europe and the UK. Gender was also a key theme of our policy forum on behavioural economics and inequality held in Edinburgh in 2019 (see section 1) including a talk from Muriel Niederle (Stanford) on affirmative action in competitive chess.

In line with the UoE REF2021 **Code of Practice**, we have adopted an inclusive approach to defining 'independent researcher', and adopted a rigorous, fair and transparent approach to selecting outputs, accounting for staff special circumstances which have affected their research activity. The process took full account of EDI considerations, building in unconscious bias and EDI training. We set up an independent EDI group to review the distribution of outputs across staff by gender and career stage (noting that we were unable to access accurate data on other protected characteristics because of the voluntary nature of the information and constraints to updating personal details). The result of this review demonstrated a balanced spread of outputs across gender and career stage. Using the gender and grade of the first-named UoA author, 23.1% of the submitted outputs are by female authors and 35.9% of submitted outputs are by ECR or Grade 8 authors. This compares to the 23.5% of submitted staff that are female and 47% of submitted staff that are ECR and Grade 8 colleagues.

3. Income, infrastructure and facilities

3.1 Grant Income

During the REF period, we adopted a dual approach to increasing our research income. First, we built on our cohesive research agenda to bid for an ESRC large grant. This had the advantage of involving ten UoA staff as Co-Is whilst concentrating the fixed cost of the application process. This process was successful, and we were awarded the MacCaLM grant in 2015. Second, we supported and encouraged a range of smaller and medium-sized grant applications, and all staff were encouraged to apply for seed funding to support the development of larger projects.

This has led to research income of just under £7.2m over the REF period, up from under £1.4m in the previous REF period. This corresponds to an approximate doubling of research income per FTE per year. Approximately 53% of the staff submitted have received external grant funding during the REF period, up from around 39% during the previous REF period.

The main grants awarded during the REF period are:

- Moore (PI), Elsby, Thomas, Belot, Güell, Kircher, Rodríguez Mora, Snell, Visschers, Worrall: ESRC large grant “Credit and Labour Market Foundations of the Macroeconomy”, 2015-21 (£6.38m).
- Sákovics (PI), Taneva and Visschers: ESRC grant “Transparency in Procurement: The design and use of information in trading mechanisms”, 2016-18 (£812k).
- Grobovšek: ESRC grant “Misallocation, Agriculture and Aggregate Productivity - The Role of Insecure Land Rights and Missing Financial Markets”, 2014-17 (£397k)
- Kircher: ERC Starting Grant “Labour Heterogeneity” 2012-17 (£875k).

In addition to these larger grants, Belot was a Co-I in an interdisciplinary ERC grant (“Neurobiology of Decision Making in Eating” 2014-19, UoA share £1.48m). Thomas was a Co-I on a European Commission grant with collaborators in Queen Mary University of London, Crete, and Milan (“Collective Bargaining Extensions”, 2017-19, UoA share £50k) and is Co-I on the two-year European Commission follow-up project 2020-2022 (UoA share £31k). Bai, together with Tadeja Gracner (RAND Corporation) has received funding from the US-based National Institutes of Health to study the effect of sugar consumption during childhood on lifetime health outcomes using data from the UK 2020-2022 (UoA share £87k).

A wider pool of staff has been successful with small grants, and we are supporting them in scaling up to larger applications in the future. Bai received funding from a BA/Leverhulme small grant (£10k), and together with Potlogea, was awarded a BA/Leverhulme small grant to study financial crises and political attitudes (£61k). Grobovšek received a BA/Leverhulme small grant for a project on cross-country evidence on job durations (£9k). Nuevo-Chiquero and Steinhauer both received small grants from the Carnegie Trust (£9k and £14k) to study birth order effects and a pilot to digitise Austrian parish records. Zymek received an ESRC Impact Accelerator Award (£19k) for a secondment to the UK Industrial Strategy Council to work on regional productivity and local growth.

3.2 Research Support

The UoA has substantially improved its support over the REF period, to provide comprehensive support for grants, data management, open access, research ethics and integrity and knowledge exchange as well as administrative support for seminars and other events. The UoA’s Research Office works closely with the University-level Edinburgh Research Office (ERO) including through fortnightly liaison meetings. The ERO helps the local team with pre-awards including application procedures and costings. The Research Grants Service (RGS) provide central post-award research grant administration and support to the UoA research office. From January 2020, RGS and ERO have come together to provide an end-to-end

service for the research community.

The UoA Research Office works closely with the Research Director to provide information to staff about funding opportunities in a targeted manner based on individual research interests. The Director has annual research conversation meetings with staff at which funding opportunities are discussed. There is support for grant applications, including information on funder requirements, budget development and the application and submission processes. Larger applications are reviewed by two internal peer reviewers and small grants are typically reviewed by one internal peer reviewer to provide supportive feedback. Support is offered to grant holders including help with management and budgeting. The Research Committee holds regular discussions on grants, grant applications and support for research, including funding for main and international conferences, cooperation with other Schools and Institutes across the University. These improved support mechanisms have not only increased our research income but have increased the breadth and diversity of grant applications.

We encourage and mentor ECRs to step onto the grant ladder and apply for seed funding as a precursor to obtaining external grants. Bai and Zymek have received legacy funding (£12k and £16k) from the Scottish Institute of Research in Economics (a Scottish Funding Council initiative that ran from 2006-15) and Bai and Nuevo-Chiquero have benefited from internal funding from the College of Arts Humanities and Social Science (Bai: Global Challenges Award, £5k and Impact Accelerator Award, £20k; Nuevo-Chiquero: Challenge Investment Fund, £15k). This seed funding led to external funding (mentioned above) being secured by Bai, Nuevo-Chiquero and Zymek from the British Academy, Carnegie Trust and ESRC.

3.3 Infrastructure and Facilities

All staff are co-located in a listed Victorian tenement building, refurbished in 2012, which we share with our postgraduate research students and our administrative staff. We have space for workshops and seminars, a common room, and offices for short- and long-term visitors. There are study and social spaces for taught postgraduate and undergraduate students within the building. The University of Edinburgh Main Library, which is a leading member of Research Libraries UK, has around 2m print books, 185k e-journals and 1.4m e-books and is just a two-minute walk away.

In 2013 we established a local laboratory to support our research in experimental economics. The Behavioural Laboratory at the University of Edinburgh (BLUE), with space for 15 subjects opened in our building in late 2013. The laboratory has been used by staff, PhD students and external academics (from the University of Edinburgh Business School, European University Institute and Essex University). Four outputs included in the submission have directly resulted from BLUE lab experiments and have been published in the *European Economic Review*, *Experimental Economics*, *Games and Economic Behavior*, and the *Review of Economic Studies*. The latter was an experiment on providing information to job seekers that is a core part of one of our Impact Case Studies.

Staff are provided with state-of-the-art IT equipment, all necessary and specialist software (such as Eviews, Mathematica, Matlab, Stata), and ergonomic office furniture when required. The University of Edinburgh Computer and Data Facility (Eddie) provides facilities for staff who require above-standard computing power for research with large data sets and comprehensive research data management infrastructure and services and the University's Datavault provides researchers with immutable and safe storage for research data. During the pandemic, extra equipment has been provided for home working, including additional screens, ergonomic adjustments, microphones and tablets.

The University's 2017-2027 estates vision sets out an ambitious plan to invest £1.4bn over the next ten years to enhance learning support, research, innovation, and interaction. As part of the central area development plan, the College of Arts, Humanities and Social Sciences is expanding its capacity, including the new Edinburgh Futures Institute. It is planned that the School of Economics will move to a new or renovated building during this development period.

4. Collaboration and contribution to the research base, economy and society

4.1 Collaboration, networks, and partnerships

The UoA is committed to producing internationally excellent research supported by an array of national and international collaborations and partnerships.

Three of the four main grants (listed in section 3) have international collaborators. The MacCaLM grant has several external co-investigators: Pieter Gautier (Amsterdam); John Hassler (Stockholm); Nobuhiro Kiyotaki, (Princeton); Iouri Manovski (Pennsylvania); Ryan Michaels (Federal Reserve Bank of Pennsylvania); David Miles (Imperial College London); Matthew Shapiro (Michigan); and Gary Solon (Michigan). MacCaLM runs a series of annual conferences (of typically 50-60 participants) bringing world-leading figures in macroeconomics to Edinburgh including Christina Romer and David Romer (Berkeley), Mark Gertler (NYU) and Paul Beaudry (UBC). The Transparency in Procurement grant has a co-investigator at the University of Central Florida and the Misallocation grant has a Co-Investigator from St Gallen.

The European Commission grant on “Employer Representation in Collective Bargaining: Extent, form, structure and impact” for which Thomas is a Co-I, is a follow up to the EC grant on Collective Bargaining and Extensions and is a two-year collaboration with the University of Crete, Università Cattolica del Sacro Cuore (Milan), Paris School of Economics and Queen Mary University of London. The ERC grant on “Neurobiology of Decision-Making in Eating” is an interdisciplinary project that brought together researchers from neuroscience, psychology, and economics from 16 institutions across six European countries, the US and New Zealand. It involved economists from Harvard and Copenhagen as well as Edinburgh. Bai’s research in India collaborates with PANI (People’s Action for National Integration), an Indian social development agency, and IFMR Graduate School of Business at Krea University in Chennai.

The UoA co-hosts an annual Macro-Finance workshop with the Bank of England that attracts internationally leading academics and policymakers. In addition, there have been bi-annual two-way exchange visits between researchers from the UoA and the Bank of England. The resulting interactions have both influenced the direction of our research, and allowed Edinburgh-based researchers to advise on, and contribute to, economic thinking at the Bank. As a leading example, Zymek is now a visiting researcher and consultant at the Bank.

The Scottish Graduate Programme in Economics (see section 2) allows us to maintain close links with other departments of economics in Scotland, including at the SGPE annual conference.

There are strong links with the Centre for the Study of Money and Finance in Madrid (Moore, Thomas), the Alan Turing Institute (Rodríguez Mora is a fellow working on projects on regional evolution and economic activity and immigration and labour markets), and with the Centre for Data, Culture and Society, a multidisciplinary centre at the University of Edinburgh.

Staff are well networked with researchers in Europe and the US, including Arizona, Berkeley, Cornell, St Gallen, San Diego, Zurich among many others and this is reflected in our submitted outputs (see section 1). Our staff are well represented on research and policy institutes: Belot, Güell, Harmon, Kircher, Neuvo-Chiquero and Visschers are members of the Institute for Labor Economics (IZA); Güell, Rodríguez Mora, Steiner, Steinhauer and Taneva are members of the Centre for Economic Policy Research (CEPR). Bai, Elsby and Steinhauer have had working papers published by the National Bureau of Economic Research (NBER).

We continually seek to expand our networks. We have hosted three major international conferences: the Search and Matching meeting 2014 (circa 120 delegates), the European Winter meeting of the Econometric Society 2016 (circa 200 delegates) and the annual meeting of the Society for Economic Dynamics 2017 (circa 650 delegates). Besides these major conferences, we have hosted nineteen other mini-conferences and workshops, including on the socioeconomic determinants of health, field experiments in labour, health and development, procurement, food and nutrition, development economics, and behavioural economics and inequality. Almost all have included international speakers, such as Robert Frank (Cornell),

Karla Hoff (World Bank), Michèle Tertilt (Mannheim), Chris Udry (Northwestern) and Lise Vesterlund (Pittsburgh).

Nobuhiro Kiyotaki was awarded an honorary doctorate from the University of Edinburgh in November 2019. Esther Duflo and Abhijit Banerjee (MIT) gave a special lecture in 2018 ahead of their Nobel Prize award in 2019. Of the approximately 300 seminar speakers we have hosted over the REF period, 45% come from outside Europe, mostly North America, with the rest split evenly between the UK and the rest of Europe (details are available on the webpage: <https://www.ed.ac.uk/economics/school-events/academic-events>). Seminars have continued online since March 2020, whilst maintaining virtual post-seminar coffee discussions and virtual individual meetings with speakers. This has worked well and enabled us to broaden our networks and reduce the financial and environmental cost of transatlantic and European flights.

4.2 Impact and Engagement with Society

During the REF period, staff have been recognised for their achievements. Moore was appointed CBE in 2017 and his work with Hart was prominently cited when Hart was awarded the Nobel Memorial Prize in Economic Sciences in 2016. Elsbj was the recipient of the *American Economic Journal: Macroeconomics* Best Paper Prize in 2015 and Kircher received the 2019 IZA Young Labor Economist Award.

Zymek undertook a six-month part-time secondment (with IAA funding) at the UK Government's Industrial Strategy Council in 2019. During this secondment, he led an evidence review of the nature and origins of UK regional productivity differences. The review was published as an official position paper of the Industrial Strategy Council in February 2020. Following on from this and his work with the Bank of England, he is seconded to HM Treasury from November 2020.

To engage with students and the public, we have introduced a series of “An evening with ...” events at which a member of staff discusses their research with a general audience. The first two events were an evening with John Moore (on the role of trust in money in facilitating trade) and an evening with Robert Zymek (on the US-China trade war). Kircher gave the Royal Economic Society Annual Public Lecture (aimed primarily at school pupils who are considering studying economics at university) held at the Royal Institution and the University of Manchester in November 2016 on the topic of search and matching markets.

Apart from the examples mentioned in our impact case studies, our research has attracted significant media attention. Most noteworthy is the research of Nuevo-Chiquero on the advantages of first-born children in terms of educational attainment and earnings. The research finds that most of this advantage is due to extra parental investment in the very early years. The results attracted worldwide media attention from nearly 100 outlets, including The Daily Telegraph, The Daily Mail, The Guardian, The New York Post, Iran Daily, The Times of India online, BBC online. Other media attention has included an experiment on speed dating (The Times, The Guardian), gender inequality (The Daily Telegraph), and the psychology of supermarket layout (The Times). Güell, Belot, Kircher, Rodríguez Mora, Snell, Visschers, Worrall and Zymek have all had blogs published on prominent platforms including VoxEU, Microeconomic Insights and the Conversation on a variety of topics, including measuring inequality, Scottish Independence and Brexit.

4.3 Contribution to the discipline

Our researchers contribute significantly to the leadership of the discipline. Moore served as President of the Royal Economic Society 2015-2016 and Belot, Güell and Worrall have served as RES Council members; Belot was elected as President of the European Association of Labour Economists in June 2020; Güell is a Member of the European Economic Association Women in Economics Committee; Kircher was a Member of the Council of the European Economic Association 2012-2017. Thomas was a member of the REF2014 subpanel for Economics and Econometrics.

In addition to the conferences hosted in Edinburgh, staff have been members of the programme committee for international conferences: Güell (Committee member of the SERIEs AWARD 2014, 2016, 2018 and 2020); Hopkins (European Economic Association, 2017; Royal Economics Society 2014-15); Kircher (NBER Summer Institute, Micro and Macro Perspectives of the Aggregate Labor Market, 2015-2019); Sákovics (European Association for Research in Industrial Economics, 2014-2018).

UoA colleagues hold significant editorial roles and fellowships. Kircher is Chair of the editorial board of the *Review of Economic Studies*. Elsby is a member of its board of directors and was appointed Director of the *Review of Economic Studies* in 2019. Elsby was Associate Editor, *European Economic Review*, 2013-15. The following are editorial board members: Hopkins: *Journal of Economics*, the *European Economic Review* and *Journal of Economic Behavior and Organization*, 2011-2016; Rodríguez-Mora: *Macroeconomic Dynamics*; Sákovics: *Journal of Mechanism and Institution Design*; Steiner: *American Economic Review* and *Review of Economic Studies*; Thomas: *Scottish Journal of Political Economy*. Moore and Thomas are Fellows of the British Academy, and the Econometric Society. Kircher is a Fellow of the Econometric Society and the European Economic Association.