Newsletter

NUMERO 15 - SUMMER 2022

News

SUCCESS

Stéphane Benveniste, PhD student at AMSE from 2016 to 2021 and now associate faculty, won the AFSE 2022 prize for his thesis "Grandes Écoles in the 20th century, the field of the French elites: social reproduction, dynasties, networks".

Georgios Angelis, **AMSE** postdoctoral fellow, received the "Prix jeune chercheur 2021" by the fondation Banque de France.

Elie Vidal-Naquet, PhD student at AMSE, received the ADRES Best Young Paper Award 2021 for his paper entitled "Why are low-skilled workers less mobile ? The role of mobility costs and spatial frictions".

EVENTS TO COME

AMSE Summer School – The Summer School on "The economics of growth" will take place in Aix-en-Provence from July 5 to 7. Lectures will be given by: Philippe Aghion, Raouf Boucekkine, Cecilia Garcia-Peñalosa and Stelios Michalopoulos.

Workshop AMSE-Banque de France – The workshop will take place at AMSE on June 24.

Graduation Ceremony – The graduation ceremony of cohorts 2020 and 2021 will be held on June 24. Mario Nava, Director-General "Structural Reform Support" at the European Commission, will host the ceremony.

Conférences Sciences Echos – Lectures by researchers for high school and undergraduate students to present the diversity of economics topics:

- October 2022, Charles Figuières on vote and democracy
- November 2022, Elisa Dienesh on pollution
- January 2023, Alain Trannoy on equality of opportunity
- March 2023, Miriam Teschl on economic philosophy

Outline

Visiting researchers at AMSE

VERA EICHENAUER

KOF Swiss Economic Institute - ETH Zurich

From September 2021 to August 2022

Vera Eichenauer is a postdoctoral researcher at the Swiss Economic Institute KOF at ETH Zurich in Switzerland. She currently studies the motives and effects of screening foreign direct investments, fiscal federalism during Covid-19, and population sorting as consequence of regional autonomy.

MORGAN RAUX

University of Luxembourg

From March to July 2022

Morgan Raux is a postdoctoral researcher at the department of economics and management at the University of Luxembourg. His research focuses on recruitment issues with a micro applied perspective.

JOAO CARLOS DE OLIVEIRA DE SOUZA

Federal University of Piauí

From March 2022 to February 2023

João Carlos de Oliveira Souza is an assistant professor at the Federal University of Piauí. His interest lies in theoretical and algorithmic aspects of optimization in Riemannian manifolds, theory of monotone operators, multiobjective optimization, equilibrium problems and convex analysis.

MIHIR BHATTACHARYA

Ashoka University

June 2022

Mihir Bhattacharya is an assistant professor of Economics in Ashoka University. His research focuses on social choice theory, decision theory and political economy, specifically the existence of constitutionally consistent voting rules, and representatively consistent voting rules which are immune to manipulative partitioning of voters by political parties.

SANJEEV GOYAL

University of Cambridge / NYU Abu Dhabi

June 2022

Sanjeev Goyal is Arthur Pigou professor of economics and fellow of Christ's College at the University of Cambridge and visiting professor at NYU Abu Dhabi. He is a pioneer and a leading international researcher in the economics of networks.

RAJEEV DEHEJIA

NYU Wagner, IZA, CESifo

From June to July 2022

Rajeev Dehejia is professor of public policy and professor of economics at New York University. He is affiliated with the National Bureau of Economic Research, the Institute for the Study of Labor Economics (IZA), and CESifo.

GARANCE GENICOT

Georgetown University

From June to July 2022

Garance Genicot is a professor at the department of economics of Georgetown University. She uses microeconomic tools to study key issues in development economics such as aspirations, informal credit and insurance markets, intra-household bargaining, social networks, tolerance and inequality.

JAKOB MADSEN

University of Western Australia

From June to July 2022

Jakob Madsen is a macroeconomist at the department of economics of UWA and a fellow of the Australian Academy of Social Sciences. He studies macroeconomics, endogenous and unified economic growth, the macroecomics of inequality, history of economic growth, and applied econometrics.

YULIN HSWEN

University of California San Francisco

From July to December 2022 at IMéRA

Yulin Hswen is an assistant professor at the University of California San Francisco. She studies the application of behavioral economic theories to enhance the acceptance and adherence of healthy behaviors and the willingness to share private data.

FANNY HENRIET

Paris School of Economics / CNRS

From September 2022 to September 2023

Fanny Henriet is a CNRS researcher and professor at Paris School of Economics. Her research focuses on energy transition and its implication on fossil fuel resources and stranded assets. She also studies the properties of climate policies and their acceptability.

SULTAN MEHMOOD

New Economic School, Moscow

From September to December 2022

Sultan Mehmood is a professor of economics at the New Economic School in Moscow and lead researcher at the World Bank's DE JURE Program. His research interests are in development economics and political economy.

HARUTAKA TAKAHASHI

Kobe University / Meiji Gakuin University

From September 2022 to February 2023 at IMéRA

Harutaka Takahashi is a research fellow at the Graduate School of Economics at Kobe University, and professor emeritus at Meiji Gakuin University. His recent research interests include the application of econometrics to the analysis of the Covid-19 pandemic.

DONALD DAVIS

Columbia University, New York

October 2022

Donald Davis is the Ragnar Nurkse professor of economics at Columbia University. His research ranges over international trade, economic geography, regional and urban economics. He is a Research Associate at the National Bureau of Economic Research and a past president of the Urban Economics Association.

Welcome !

Air pollution and health*

By **Olivier Chanel**

> **“As a result, disadvantaged populations may suffer more from the health effects of Ambient Air Pollution.”**

In December 2020, for the first time ever, a court recognized that air pollution (AP) was the cause of the tragic death of a black 9-year-old girl with asthma who had lived 30 meters from a major ring road, in London. This ruling is “one giant leap” for public health, for several reasons. It makes an invisible killer like ambient AP (AAP) visible, by shifting from “association with adverse health effects in a population” to “causality at the individual level.” It confirms that long-term exposure to AP can provoke the onset of chronic diseases like asthma, and opens the door to other complaints likely to bring about change. Finally, it draws attention to the fact that AP disproportionately affects minorities and deprived areas, and that the public health issue is not restricted to older people or developing countries.

Anthropogenic AP emissions are conditioned by our political, energy and consumer choices, by the increasing movement of goods and people and by population growth, and represent a negative externality. First, through environmental effects on water, forests, biodiversity and ecosystem services, visibility impairment, contributions to climate change, agricultural yield losses and effects on buildings. Second, through the health burden imposed on society, the monetary valuation of which needs to take into account both market-related costs for the health care system and firms (production or productivity losses) and non-market-related effects on the population (loss of well-being including premature mortality, suffering, psychological effects, restrictions on activity and quality of life). AAP is considered the primary environmental risk to health worldwide in terms of number of premature deaths. Overall, associated welfare losses worldwide expressed in terms of gross domestic product amount to about 4.2% for mortality, 0.6% for morbidity and 0.07% for production losses. Without additional pollution control measures, these figures are expected to increase by about 50% by 2050, in particular due to urban population growth in Asia.

The following briefly focuses on three of the many health topics related to AAP: inequities, uncertainties and possible ways to improve knowledge.

Olivier Chanel

Olivier Chanel is a CNRS directeur de recherche at AMSE since 2011. He obtained his PhD in 1993 from EHESS and joined CNRS in 1994 after 18 months at Université Libre de Bruxelles. His main research interests are health and environmental economics, especially the economic assessment of (non-market) components. He regularly acts as policy advisor to public, national and international bodies.

INEQUITIES ISSUES AT NATIONAL AND TRANSNATIONAL LEVELS

Vulnerabilities associated with exposure to AP manifest themselves in several ways. First, some people are more exposed to AAP, for professional reasons (bus drivers, people in contact with traffic, road users), or because of their location (houses or other places close to major emission sources). Second, individuals of low socioeconomic status are at higher health risk, for two reasons. First, they may be more exposed to AP than more advantaged populations. Second, they may be more vulnerable to the effects of AAP than more advantaged populations, due to a comparatively worse health status and less access to health care. As a result, disadvantaged populations may suffer more from the health effects of AAP.

Besides higher vulnerability, individuals of low socioeconomic status also experience other negative environmental externalities at home (water pollution, toxic wastes, noise, natural hazards), worse working conditions (jobs requiring few or no qualifications, involving shift work) and poor housing conditions. Moreover, it is harder for them to combat negative environmental externalities through costly behaviors like prevention, avoidance or moving away from AAP exposure. In low - and middle - income countries, the consequences of AAP on health are worsened by the lower socioeconomic status on average: higher incidence of comorbidities due to chronic, infectious and non-communicable diseases, higher rate of social deprivation, lower health care quality. In addition, once the health effects have occurred, the lack of access to (affordable) treatments, with high out-of-pocket fees, implies a stop to working (or studying), which intensifies poverty.

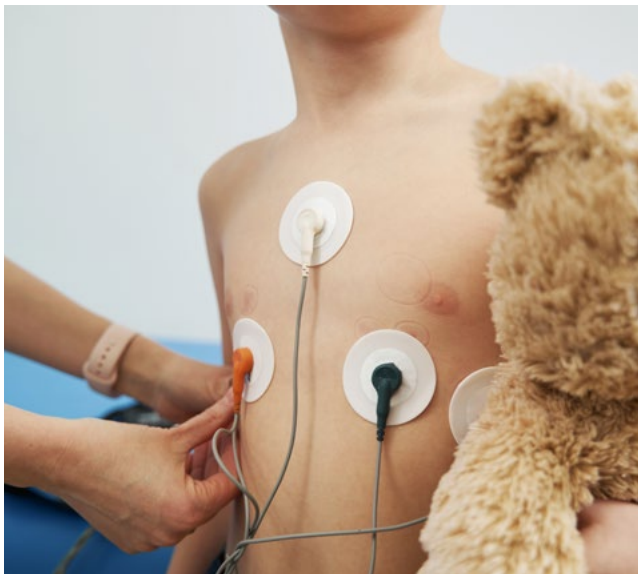
At the international level, two sources of inequity are particularly worth noting.

First, high-income countries escape some of the AAP associated with production processes by having their goods manufactured in less developed and more polluted countries. Multinational polluting firms tend to move there because of lower land and labor costs as well as the weaker local capacity to mobilize against pollution, further weakened by poor local environmental regulations. The production of batteries for electric vehicles in China, for instance, is a case in point. The processes consume a huge amount of heavily coal-generated electricity and require the extraction of rare metals, both contributors to AAP in less developed countries, in order to improve air quality for the urban population of the richest countries.

Second, it needs to be borne in mind that country-specific monetary values are used by supranational agencies to assess AAP-related mortality effects. Thus, because the monetary value of a premature death in high-income countries is more than one hundred times larger than in low-income countries, we should be on the lookout for any potential plutocratic international environmental policy that appears promising but would actually tend to shift premature deaths avoided from high- to low-income countries.

DEALING WITH UNCERTAINTIES IN AN INTERDISCIPLINARY APPROACH

The economic evaluation of the health-related effects of AP adds uncertainties from the two main upstream disciplines to its own, which calls for an interdisciplinary approach.



Firstly, there are uncertainties in the characterization of population exposure, mainly from measurement of concentrations, from modeling to cover the geographical area under study and from assessment of both initial exposure and the exposure in the scenario under consideration. The quality of the modeling depends on the quality of the input data, the topography of the studied area, the availability of measurement data, etc., making the uncertainty spatially heterogeneous. This type of uncertainty can be examined, in particular by comparing the measured concentrations with the modeled values.

> **“The World Health Organization decided in September 2021 to strengthen its air quality guidelines for the protection of health, which suggests that the threat to health was substantially underestimated”**

Secondly, the epidemiological uncertainties pertain to the quality of health data, the choice of an exposure-risk function and their transposability to the population studied, which depends on lifestyle, climate or the nature of the emission sources. Part of this uncertainty is provided by the confidence interval, which reflects the statistical variability specific to the relationship between exposure and health effect.

Finally, the quantification of economic uncertainties differs, since the underlying knowledge is more subjective than scientific, leading to an approach more normative than positive. The differences relate to the choice of the effects to be taken into account (market and non-market, direct and indirect, short- or long-term), the valuation method, the unit monetary values used (in particular for mortality, the greatest fraction of health effects) and technical parameters like discount rate, etc.

These three types of uncertainty are generally considered either independently or jointly, by including their respective sources in a methodologically preferable but more complex Monte Carlo simulation approach.

Reduced uncertainties are one explanation for the rising economic valuation of AAP-related health effects over time despite the decreasing concentrations of most pollutants experienced for the last 20 years. Firstly, the quality of measurements is improving: the pollution indicators adopted better reflect the compounds most harmful to health, the number of ground monitoring stations has increased and satellite data are being used more frequently. Secondly, epidemiological knowledge is evolving, thanks to more complex modeling, a growing number of cohort studies, the use of causal inference methods and better knowledge of the effects of low-level exposure. The scope of the effects accounted for is also widening, from short - to long-term effects, first for mortality and then for morbidity. Finally, monetary evaluation is evolving too, with increasing consideration of non-market components or higher values used to assess mortality. Based on the last decade of research and the classification of AAP in 2013 as carcinogenic to humans, the World Health Organization decided in September 2021 to strengthen its air quality guidelines for the protection of health, which suggests that the threat to health was substantially underestimated.

WHAT WILL THE FUTURE BRING?

Regarding data, better knowledge of the composition of particulate matter would be useful, as its nature seems to be a factor in health impacts. Measuring the size and chemical mass loading for sub-micron aerosol particles and black carbon would help determine their exact contribution to health impacts, so as to design the best policies from a regulatory and public health perspective. Increasing the number of ground-level measurement stations in developing countries would provide more accurate data for health impact assessments. Improvements are also expected on personal exposure, with individual monitoring to provide accurate real exposure data.

> **“With improved knowledge, an interdisciplinary approach adopting the widest possible perspective on the issues at stake could be expected to offer a picture closer to the real air pollution - health relationship.”**

The exposome (which tackles all nongenetic factors) and epigenetics are beginning to be explored within the AAP framework, and that will shed light on individual susceptibility. A better understanding of in utero exposure and pregnancy outcomes is also important, given the huge potential loss in life years. Likewise the impacts of exposure on mental health and degenerative illnesses, involving major loss of well-being.

Regarding methodological advances, causal inference methods are evolving very rapidly. Over the past 20 years, interventional and quasi-experimental studies have been used to tackle very diverse health (and non-health) issues at a city, county, regional or national level, thanks to wider access to data. They usually proceed by exploiting exogenous variations in pollution due to weather (changes in wind, atmospheric temperature inversions, oceanic weather events), wildfires, variations in traffic (on air, road or sea), lockdowns or disruptive events (volcanic eruption, strikes, bans etc.). Combined with machine learning, they can help to reevaluate previous analyses, include more data, disentangle complex relationships (multi-pollutant mixtures, multiple exposures, multiple health effects) via intermediate variables (principal stratification and causal mediation), accounting for long-lasting and long-term effects. They can also tackle the complexity of the relationships between energy, transport, climate change, indoor pollution and (indirect) health impacts. For instance, higher temperatures and heatwaves are likely to have synergistic effects, especially on cardiovascular disease, and ozone seems to cause a fraction of heat-related deaths.

From an economic perspective, all the above advances will obviously improve economic assessments, which come at the final stage. In addition, standard health impact assessments frequently ignore the fact that some chronic diseases may not only be exacerbated but also be caused by AAP exposure. Acknowledging this would greatly increase the overall burden of disease found to be attributable to AAP. Re-evaluating policies or regulations (such as emissions trading schemes or transportation choices) in the light of methodological advances might improve decision-making. A more integrated approach jointly considering urbanism, AP and health would certainly be an interesting step toward tackling climate change issues (increase in temperature, flash floods) simultaneously with issues of health and well-being. A better understanding of the relationship between socioeconomic status and AAP exposure is also relevant. Disadvantaged populations, in addition to suffering higher exposure to AAP, might well be more sensitive or susceptible to the related health effects than the better-off.

To conclude, with improved knowledge, an interdisciplinary approach adopting the widest possible perspective on the issues at stake could be expected to offer a picture closer to the real AP-health relationship.

**This text is adapted from the chapter "Air pollution and health: economic implications", in preparation for the Springer Handbook of Labor, Human Resources and Population Economics.*

Machine learning for credit scoring: improving logistic regression with non-linear decision-tree effects

Elena Ivona Dumitrescu, **Sullivan Hué,** Christophe Hurlin & Sessi Tokpavi, 2022, *European Journal of Operational Research,* 297(3), 1178-1192

> **“Is it possible to develop a credit-scoring model combining the accuracy of machine learning algorithms with the interpretability needed by financial regulators?”**

Sullivan Hué

Sullivan Hué joined AMSE as a post-doc in 2021. He obtained his PhD from the University of Orléans in 2020 and has been a post-doc at the University of Orléans in 2020-2021. His research focuses on financial econometrics and big data.

RESEARCH PROGRAM

Over the last decade, machine-learning developments have considerably modified traditional professional practices. Algorithm-based decisions are becoming dominant in many areas and the financial industry is no exception. Currently, for instance, credit scoring is being greatly impacted by machine-learning techniques. Historically, credit scoring relied on a simple logistic regression to discriminate between borrowers based on their credit-worthiness. But many recent studies have shown that sophisticated machine-learning algorithms achieve higher predictive performance and can improve measurement accuracy on borrowers' default probability since, unlike the logistic regression, they automatically capture many complex non-linear relationships. However, one very important issue is their lack of explainability and interpretability. Indeed, most of these algorithms are considered to be “black boxes” because of the opacity of their underlying decision process. With credit scoring, these algorithms lead to scorecards and credit approval processes that financial practitioners cannot easily explain to customers and regulators. Yet explainability is essential in credit-scoring models. This is currently the main weakness of such algorithms, limiting their use in the credit-scoring industry despite the accuracy of their predictions. Is it possible to develop a credit-scoring model combining the accuracy of machine learning algorithms with the interpretability needed by financial regulators? We show in this paper that an answer to this question comes from the combination of machine learning and econometrics.

PAPER'S CONTRIBUTION

This paper introduces a hybrid credit scoring approach called the Penalised Logistic Tree Regression model (PLTR), whose main objective is to avoid the trade-off between performance and interpretability. More precisely, the model improves the predictive performance of the logistic regression model through data pre-processing and feature engineering based on

machine-learning techniques. The model proceeds in two steps. The objective of the first step is to build new predictors from original variables. Formally, short-depth decision-trees of one split (two splits) are built for each original variable (couple of original variables) to capture endogenous univariate (bivariate) threshold effects. In the second step, the endogenous univariate and bivariate threshold effects are plugged into a logistic regression so as to increase its predictive performance. To prevent overfitting issues due to a potential high number of threshold effects, the model relies on an adaptive lasso penalisation for both estimation and variable.

This approach has several advantages. First, it makes the most of the main advantage of machine-learning algorithms: it captures non-linear effects arising in credit-scoring data through short-depth decision trees, allowing the model to reach high predictive performance. Second, it addresses the lack of interpretability of machine-learning approaches by relying on econometrics, leading to an interpretable model as recommended by financial regulators. Finally, the approach can be viewed as a systematisation of common practices used in the industry. Credit risk modellers usually introduce non-linear effects into the logistic regression by using ad hoc or heuristic pre-treatments and feature engineering methods (discretisation of continuous variables, identification of non-linear effects with cross-product variables, etc.). In contrast, we propose a systematic and automatic approach for modelling unobserved non-linear effects based on short-depth decision trees.

We illustrate through Monte-Carlo experiments and empirical applications that the PLTR model predicts credit risk significantly better than the industry's current benchmark model. Moreover, we show that the model compares competitively to state-of-the-art machine-learning algorithms in terms of predictive performance while allowing a simple interpretation of the credit approval process. The scoring decision rules of the PLTR model remain easily interpretable and similar to those of the standard logistic regression. Finally, we show that the PLTR model is valuable from an economic perspective, as it generates large cost reductions compared to the industry's benchmark credit-scoring model.

FUTURE RESEARCH

This paper proposes a way to avoid the trade-off between performance and interpretability by combining econometrics and machine-learning algorithms. However, many other unanswered challenges to the use of machine-learning techniques in the credit-scoring industry could also be solved by this combined approach, such as the fairness of machine-learning algorithms. Indeed, black-box algorithms can systematically discriminate against a particular group of individuals, which is illegal in some cases but in any case perceived as unethical and detrimental to the reputation of the firms involved. A recent example is the Apple Pay app that discriminated against credit applications from women and led to major public criticism of Apple. A combination of econometrics and machine learning could be used to detect such unfair algorithm behaviour so as to prevent potential discrimination.

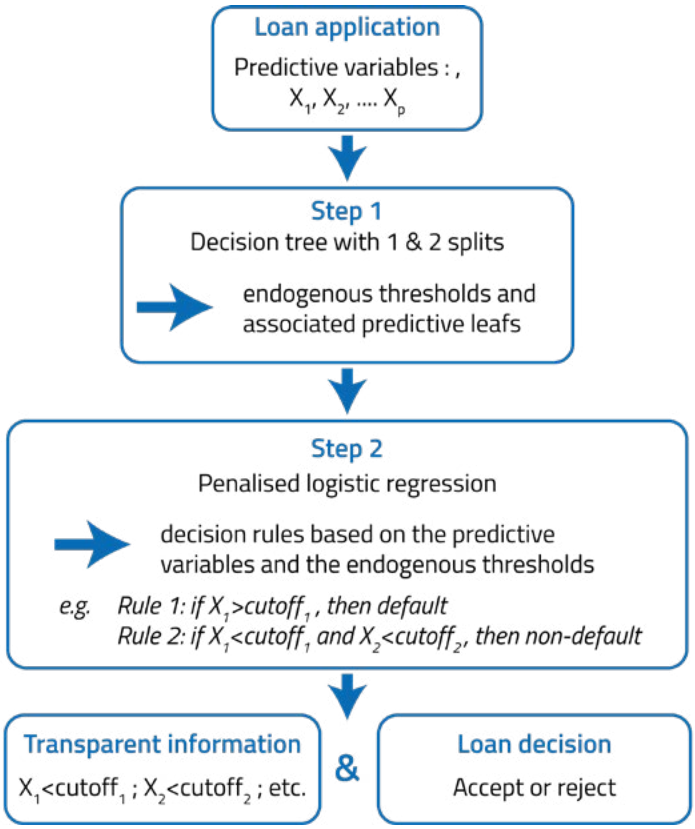


Figure 1. PLTR inference process

REFERENCE

Denant-Boemont, L., C. Gaigné, and R. Gaté (2018). "Urban spatial structure, transport-related emissions and welfare." *Journal of Environmental Economics and Management*, 89, 29-45.

Urbanisation and the onset of modern economic growth

Liam Brunt & **Cecilia García-Peñalosa,** 2022, *The Economic Journal,* 132 (642), 512-545

> **"Such timing raises the question of the extent to which urbanisation was a *cause* – rather than a consequence – of economic growth."**

Cecilia García-Peñalosa

Cecilia García-Peñalosa is a CNRS directrice de recherches and a member of AMSE since 1999. She holds a PhD from Oxford University and has taught in Germany, Spain, Switzerland, and the UK. She works on long-term growth and various aspects of inequality, has been a member of the Conseil d'Analyse Economique and is part of the European Economic Advisory Group.

Urbanisation and technological progress are closely linked. Economic historians and development economists have widely documented how workers are drawn to cities from the traditional sector in order to profit from the modern technologies that are created and adopted there. Models of long-run growth thus tend to see urbanisation as a consequence of economic growth. Yet a vast literature on economic geography maintains that urbanisation itself generates productivity gains. Going back to Marshall, economists have explored the idea that high density in cities results in learning – and thus in both skill upgrading and innovation. This suggests that agglomeration can cause economic growth through its impact on technological change.

Our analysis seeks to examine the two-way relationship that can emerge between urbanisation and innovation, in order to understand how they interacted at the onset of modern economic growth. Our interest in this question is motivated by a somewhat surprising stylized fact: that Western Europe was unusually urbanised before the Industrial Revolution. Many historians regard China as the most technologically advanced country in the Middle Ages. However, despite an early upsurge in the share of the population living in cities, Chinese urbanisation rates remained low throughout the modern period. By contrast, Europe experienced a marked increase in the share of the population living in cities during the early modern period, already exhibiting an urbanisation rate of 5% by 1700, more than twice that prevailing in China, as shown in Figure 1.

Within Europe, the UK had the highest urbanisation rate. It had started to rise well before the First Industrial Revolution, tripling from 6 to 18% between 1600 and 1750, the latter date usually being considered the starting point of the Industrial Revolution. Examining the population in the four largest cities in England, Scotland and Ireland, we find that the UK experienced an urban growth spurt before 1750. Whilst the English population increased by 14%, the population of major cities, notably Liverpool, Manchester, Dublin, Glasgow

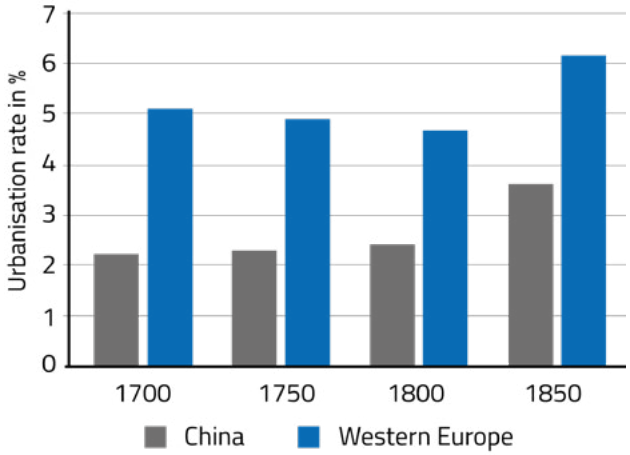


Figure 1. Urbanisation rates in Western Europe and China

and Edinburgh, doubled or tripled in size in the first half of the 18th century. Such timing raises the question of the extent to which urbanisation was a *cause* – rather than a consequence – of economic growth.

Our paper develops a model of growth consistent with the idea that urbanisation precedes industrialisation. First, we argue that the economy consists of two sectors: agriculture in rural areas and manufacturing in cities. Manufacturing is assumed to be a traditional artisan activity rather than factory-based, without the use of physical capital and with a worker's productivity depending only on the number of ideas that he holds. As the average number of ideas available grows, manufacturing productivity increases and the incentive to leave the countryside rises, leading to higher manufacturing employment. Second, we also consider how ideas are created and transmitted. Transmission between agents occurs through imitation: individuals in cities may acquire an idea by meeting someone who already possesses it. A novel idea is created through observing the ideas of others, thus endogenously inventing new ways of production. In either case, idea acquisition results from meetings between individuals; and, following Marshall, we suppose that the number of meetings is an increasing function of urban density. Under these assumptions, urbanisation becomes the determinant of manufacturing productivity.

The feedback mechanism between city size and technology generates a novel set of growth dynamics. A shock to urbanisation results in knowledge creation and diffusion, higher manufacturing productivity and a flow of labour into manufacturing (and thus cities). The resulting higher urban density further increases manufacturing productivity, setting off a process of sustained growth. Our model hence makes urbanisation – as opposed to industrialization – the key element in a theory of development. Figure 2 reports the evolution of urbanisation and output in the model (continuous lines), as well as those observed in the actual data (dots). The trigger for the growth process is an exogenous shock to agricultural productivity that shifts labour into manufacturing, increasing urban density and thus raising productivity. The shock can hence create a virtuous circle, in which urbanisation and productivity keep increasing. Note that the model reproduces the acceleration in urbanization and in output that we see in the data.

These accelerations are the result of the microfounded process of knowledge generation that we postulate, which allows us to dissociate the creation of ideas from their diffusion. Ideas are invented by an individual and then transmitted to the next generation through imitation. As a result, innovations will increase productivity only slowly, as imitation by subsequent generations occurs. Thus, a key contribution of our work is that our model simultaneously delivers fast technological change and slow overall productivity growth in manufacturing, in line with existing estimates for Britain in the 18th and 19th centuries.

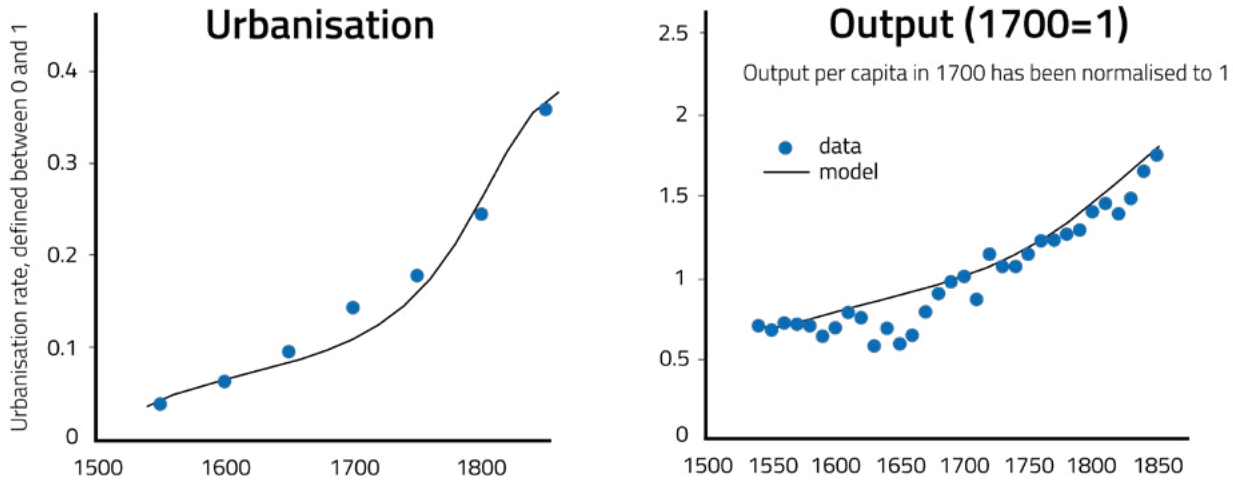


Figure 2. Output and population: data and simulation results

Preferences and strategic behavior in public goods games

Gilles Grandjean, **Mathieu Lefebvre** & Marco Mantovani, 2022, *Journal of Economic Behavior and Organization*, 195, 171-185

> **“In this paper, we study both preferences and strategic ability in a finitely repeated public goods game within the same experimental design.”**

Mathieu Lefebvre

Mathieu Lefebvre obtained a PhD in economics from the University of Liège in 2009. Before joining AMSE as a full professor in 2021, he was a research fellow at HEC-Liège, an assistant professor at the University of Montpellier and and a full professor at University of Strasbourg. His research focuses on the determinants of social preferences and the impact of social policies on individual behaviour.

RESEARCH PROGRAM

In finitely repeated public goods games, each participant has to decide how much to contribute, out of a private endowment, to the production of a public good which is shared within the group. The private marginal return on the public good is below one and the social marginal return is above one such that the dominant strategy for each player is to contribute zero, while the social optimum is achieved if everybody contributes all of the endowment. However, highly replicable experimental evidence shows that contributions are initially high, and gradually decrease over time.

These findings are commonly attributed to the existence of heterogenous (non-standard) preferences. According to this “preference-based” explanation, these empirical patterns are due to interaction between conditional cooperators and free riders. Conditional cooperators are willing to contribute to the public good only if the other group members also contribute. Since free-riders do not contribute to the public good, contributions decrease over time because conditional cooperators reduce their contributions when they interact with free riders.

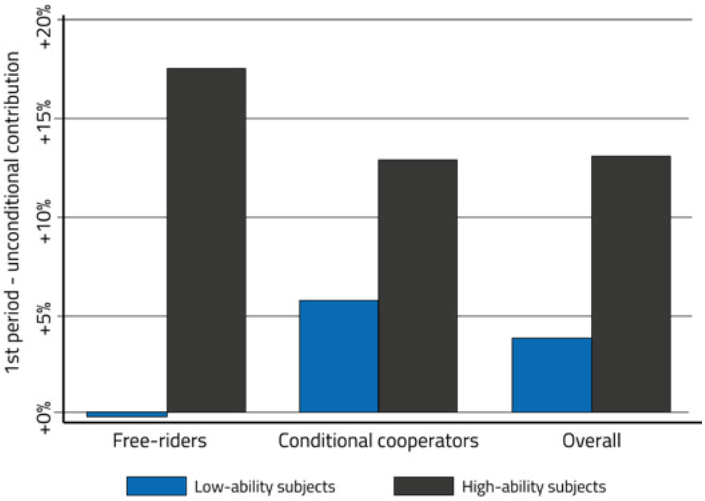


Figure 1. Difference between repeated (first-perdiod) and one-shot game

A second explanation is based on individual strategic motivations. According to this 'strategy-based' explanation, participants contribute larger amounts in the initial periods because of the likelihood that current contributions will sustain mutually beneficial future cooperation. These incentives are higher when the future is distant and vanish as the game approaches its end.

While the literature has typically focused on one of these two dimensions, preferences and strategic ability provide distinct intrinsic and extrinsic motives to contribute and shape individuals' reaction to others' contributions. Investigating potential complementarities between the two can yield insights into behavior in repeated public goods games.

PAPER'S CONTRIBUTIONS

In this paper, we study both preferences and strategic ability in a finitely repeated public goods game within the same experimental design. We categorize participants in the experiment as free-riders, unconditional cooperators, and conditional cooperators based on their choices in an unconditional one-shot public goods game. In addition, we determine their level of strategic ability by averaging their scores on a cognitive reflection test, a race game, and a beauty contest. We then manipulate group formation and study groups that are homogenous either in terms of preferences (treatment PREF) or in terms of strategic ability (treatment STRAT). A random group formation treatment (RAND) serves as a baseline. The participants are not informed of the group composition and our framework allows us to identify the effect of group composition, disentangling it from the effect that information about group composition may have through beliefs.

Overall, our results show that strategic ability is crucial to sustain cooperation even in a context where cooperation cannot be sustained under standard equilibrium notions. Comparing contributions in the first period of the repeated public goods game with those in the one-shot version used to classify participants (Figure 1), we find that high-ability subjects respond to repeated interaction by increasing their contributions more than low-ability ones, whatever their preferences. Also, placing high-ability subjects together boosts their contributions: Figure 2 shows that individuals of high ability respond positively to treatment STRAT by contributing more when matched with other high-ability individuals than when matched at random. Surprisingly, we do not find that conditional cooperators contribute more when placed in homogenous groups. However, we observe a positive interaction between preferences and strategic ability, with groups of

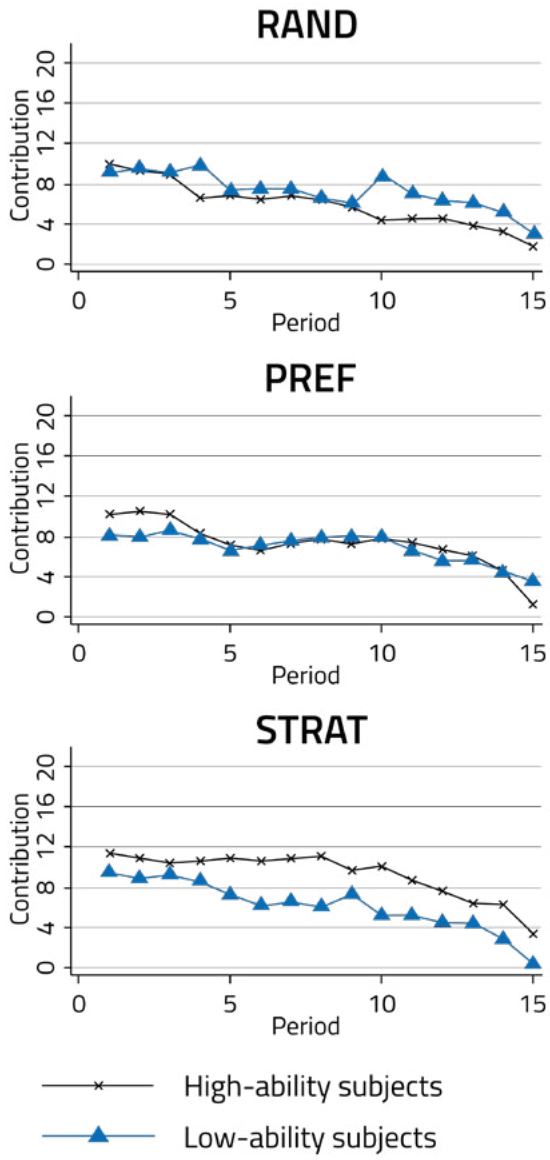


Figure 2. Average contributions by strategic ability and treatment

high-ability conditional cooperators sustaining high levels of contributions until the final rounds. The data suggest that a shared inclination toward cooperation combined with the strategic ability to recognize and reap the benefits of enduring cooperation enable a group to sustain high levels of cooperation in finitely repeated public goods games.

FUTURE RESEARCH

While previous studies had highlighted the relevance of matching similar people to sustain cooperation in repeated interactions, our results show the importance of also taking into account forward-looking strategic thinking and anticipations of others' choices. However, the question of which type of ability is key to sustaining cooperation in such games remains open. The evidence also points to a relevant interaction between preferences and ability. New experimental treatments where participants are matched according to both their preferences and their ability would be a welcome development to validate our finding.

Child development in parent-child interactions

Avner Seror, *Journal of Political Economy,* forthcoming

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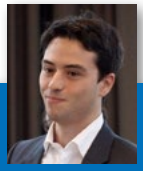


Avner Seror

Avner Seror is an assistant professor at AMSE since 2019. He received his Ph.D in economics from the Paris School of Economics in March 2018 under the supervision of Thierry Verdier, and was a research associate at Chapman University in 2018-2019. His work focuses on identity, religion, institutions, and political economy.

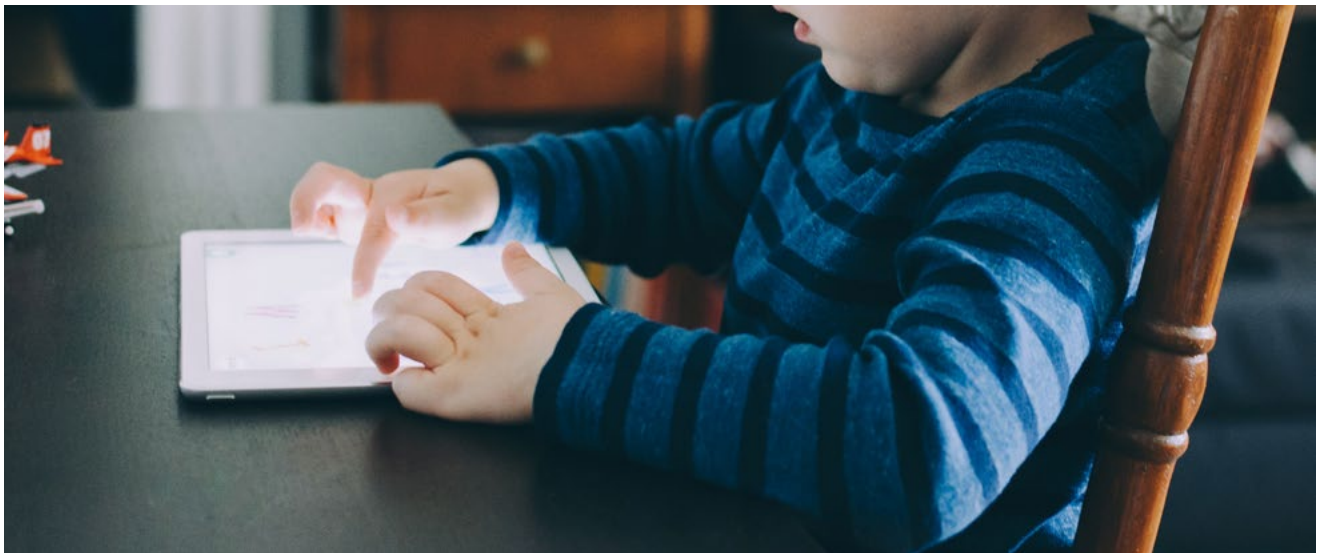
RESEARCH PROGRAM

Understanding how children develop is a fundamental challenge for academic research in many disciplines, from medicine to economics. Since the pioneering works of James J. Heckman and co-authors in the early 2000s, a vibrant economic literature on child development has emerged. Through estimations of the technology of skill formation, economists working in this field demonstrated that gaps in child development reflect large differences in parents’ investment in their children. They also showed that parents profoundly affect children’s personality and other skills not captured by cognitive abilities. Undoubtedly, these findings have enabled social scientists to better understand how children develop, and policy makers to design public policies that foster human development.

Focused on the technology of skill formation, however, the economic approach to child development says little about the interactions through which parents shape children’s multiple skills. This appeared to me as an important gap in the economic literature. I started to investigate this issue during my PhD at the Paris School of Economics, around 2016. As often in my research, I began with readings well beyond the (usual) scope of economics: Anna Freud, Donald Winnicott, and John Bowlby. Although their views of child development differ on several important points, they all describe the incredibly powerful link that parents and children develop. A link that emerges from care, and that literally becomes the backbone of a child’s emerging identity. In the words of François Mauriac, which I used to open the paper: “We are, all of us, molded and remolded by those who have loved us, and though that love may pass, we remain none the less their work” (*The Desert of Love*, 1949).

PAPER’S CONTRIBUTIONS

In the paper, I introduce a theoretical model of how parent-child interactions impact child development. My approach is rooted in developmental psychology. It is based on the idea, first introduced by John



Bowlby, that through care, sensitivity, and positive feedback, a parent enables her child to build mental representations of himself as loved and competent. These mental representations shape the child's noncognitive skills by increasing his motivation to learn and explore his surroundings. Hence, the parent's interactions with the child create a fundamental complementarity in the formation of cognitive and noncognitive skills. As the child learns from the parent, he forms cognitive skills while acquiring noncognitive skills that increase his motivation to further learn.

This model explains the evidence from a vast literature, at the same time generating new insights. First, the model provides a single unifying explanation for well-known properties of the production function of skills. It is well established that (a) skills are self-productive, (b) noncognitive skills foster cognitive skills, and (c) there is a dynamic complementarity between early and later investments. All these properties can be explained by the mechanism of the model.

Beyond the established properties of the production function of skills, I show that a child who increases his noncognitive skills by interacting with his parent is better equipped to learn from his surroundings. This prediction echoes the celebrated first experiments that enabled generations of psychologists to classify different types of parent-child relationships, depending on children's observed behavior. Indeed, a child's exploration of his surroundings while his parent is absent reflects a secure attachment to the parent, which is built through the parent's care, sensitivity, and positive feedback. Conversely, limited exploration reflects a parent-child relationship where the child is insecurely attached to the parent.

I also use this model to study the effect of early exposure to the media devices that are ubiquitous in most economies. There is a growing consensus that early media exposure is negatively associated with a variety of child outcomes. This negative association is not straightforward, since media devices (e.g. smartphones and tablets) stimulate children and can often foster substantial learning through game apps or educational content. Additionally, children growing up in more disadvantaged families appear to be particularly exposed to media devices. The model provides an intuitive explanation for these phenomena. First, I find that parents expose their children to media devices as a substitute for their own caring effort. The more a child is exposed to media devices, the less effort he puts into learning from the parent. Thus, he is less able to see himself as competent and loved, he acquires less noncognitive skills, and he becomes less motivated to further learn from his surroundings. Second, according to the model, a parent's caring effort is less likely to be replaced by early exposure to media devices when the parent has "better" characteristics, which implies that such exposure can amplify child development inequalities.

FUTURE RESEARCH

I see at least two potentially interesting avenues for future research. The first is related to causal estimates of the effect of early exposure to media devices on various measures of child development. To my knowledge, little attempt has been made to explore this issue, although there is a consensus in the medical literature that early media exposure is negatively associated with child development outcomes. As long as we lack rigorous evidence, we will remain unable to provide clear guidelines for policy makers or to estimate the cost of early media exposure on a variety of societal outcomes.

Second, this theory is grounded in the attachment theory, which enabled generations of psychologists and psychiatrists to study the complex linkage between children's mental health and parent-child relationships. It could also serve as a starting point for quantitative analysis of the socio-economic determinants of parent-child relationships and early childhood mental health.

AMSE team at the Econometric Game in Amsterdam, April 2022

By **Elisabeth Barthélemy,** Head of communications and school administrative support at AMSE

A team consisting of a PhD and three Master Economics students was selected to participate in the Econometrics Game 2022. A very rewarding team experience.

AMSE enters students in competitions organized both by leading companies and by universities because these are great opportunities to confront the field, apply what they've been learning, and add to their knowledge. Every year, the VSAE student association of the University of Amsterdam organises the Econometric Game, launched in 1999. For three days, an Olympics-like competition gathers teams from nearly thirty universities around the world in Amsterdam to compete for the coveted prize of best econometrics team. Participants Ulrich Aiounou (M2 track Empirical and Theoretical Economics), Pierre Dumontel (M2 track Quantitate Finance and Insurance), Antoine Pinto (M2 track Econometrics, Big Data, Statistics), and Federico Gonzalez-Etchebehere (PhD) recall their experiences at the game.

Antoine Pinto, Captain of the AMSE team during the game, had already participated in the "Machine Learning" Hackathon initiated by Airbus Helicopters and in the "Artificial Intelligence & Machine Learning" game at Paris-Dauphine University. He explains that "my appetite for econometrics and competition drove me to participate and represent AMU-AMSE". The same goes for Pierre Dumontel, who had previously taken part in Deloitte's DRIM GAME challenge. Federico Gonzalez-Etchebehere, currently a PhD student, wanted to test the econometrics knowledge he has been acquiring through research and as a teaching assistant in econometrics courses at Universidad de la República in Uruguay. He says he thought the Econometric Game "would help me practice my research skills in a different setting, closer to the demands of jobs in the policy and industry sectors".

The VSAE association engages with professors and professionals to create a case-study that is both challenging and relevant. "The organization team of the Game chose what they called a 'case-maker' team of university professors and economists from the Dutch Central Bank, who developed a case to be solved", explains Federico Gonzalez-Etchebehere. Each year, the game is held in two parts, the first lasting two days. This year, university teams competed on an econometrics topic applied to macroeconomics. "The objective was to estimate the Phillips curve, which describes the relationship between inflation and the unemployment rate, by considering the external factors which have affected this relationship in the euro zone over the last 20 years" specifies Antoine. The deliverable was a research paper from which the jury selected 10 universities for the final. "The objective of the second part was to estimate a set of 3 equations, respectively the supply, the demand and the interest rate, using the Phillips curve equation obtained in the first part".

Antoine Pinto et Pierre Dumontel were able to apply knowledge acquired through their macroeconomics courses to develop their arguments and implement the models. In this setting, Mrs Céline Poilly's course was "particularly valuable, as we repeatedly used techniques such as the Hodrick-Prescott filter to dissociate business cycles from the long-term trend or the study of the impact of macroeconomic shocks". Programming skills were also required, with exclusive use of the R software taught in the master and magistère programmes' curriculum. Federico Gonzalez-Etchebehere explains that "my theoretical econometrics knowledge and applied skills were essential to answer the question; most of them were learned in my master's at Sussex University, at KU Leuven university, and my research".

This experience is particularly positive and enriching for the students in terms of developing their technical skills as well as their interpersonal and teamwork skills. "I had never really experienced the efficiency that can be obtained from working in a group. We built a great team", confirm all the students. In addition to the competition, Amsterdam was a discovery for some of them and they "had a lot of fun!".

Federico Gonzalez-Etchebehere's natural ambition is to "finish my PhD in one piece! But seriously, I want to continue researching to contribute to understanding and tackle the main obstacles to building a more egalitarian, environmentally friendly, and socially integrated society for everyone".

Currently doing his end-of-study internship as an actuarial research officer at AXA, Pierre's ambition is to become a Data Scientist.

After his internship as a Data Scientist at Equancy, Antoine is hesitating between "entering the job market, doing a CIFRE thesis in machine learning, and taking a holiday. Social debate and thinking about progress are also important in my life: I will continue in this direction alongside my professional activity".

The motivation, thoroughness, and scientific diligence of Antoine, Pierre, Ulrich, and Federico led them to write a fifteen-page article during the first part of the competition, and this put AMU-AMSE into the final alongside nine other universities (out of the twenty-nine delegations) such as Harvard, Oxford, and Toronto. HEC Lausanne won the competition but "It was the first year AMSE qualified for the final". Congratulations, guys!

Participating universites:

Aix-Marseille University (AMU/AMSE), University of Cambridge, University of St. Gallen, Universita Degli Studi Firenze, University of Copenhagen, Vrije Universiteit Amsterdam, Harvard University, Tilberg University, Aarhus University, University of Bristol, Université d'Orléans, University of Oxford, Lund University, Alma Mater Studiorum Universita di Bologna, Liebniz Universitat Hannover, Universidad del Rosario, Universiteit Stellenbosch, Ensae, Université de Nantes, SGH Warsaw School of Economics, Université de Lausanne, Universidad Carlos III de Madrid, Maastricht University, University of Amsterdam, University of Antwerp, University of Toronto, Tor Verata University of Rome

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If there is no struggle, there is no progress

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Frederick Douglass

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