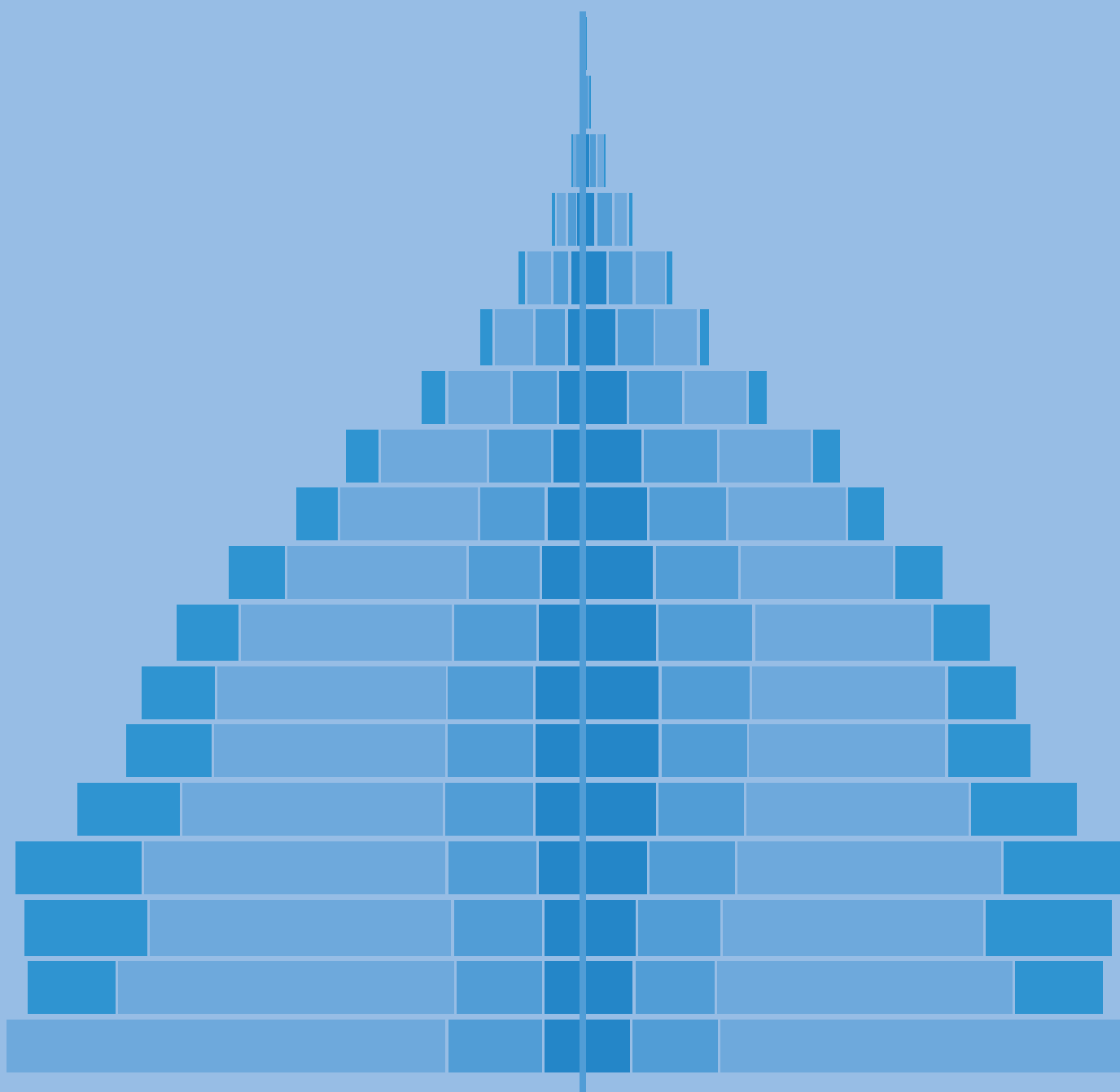


Report of Activities 2018–2022

Wittgenstein Centre: Advancing Demography and Global Human Capital Research



Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL



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Website:
www.wittgensteincentre.org

Contact:
Katja Scherbov, IIASA, scherb@iiasa.ac.at
Barbara Simunics, OeAW, barbara.simunics@oeaw.ac.at
Heike Barakat, University of Vienna, heike.barakat@univie.ac.at

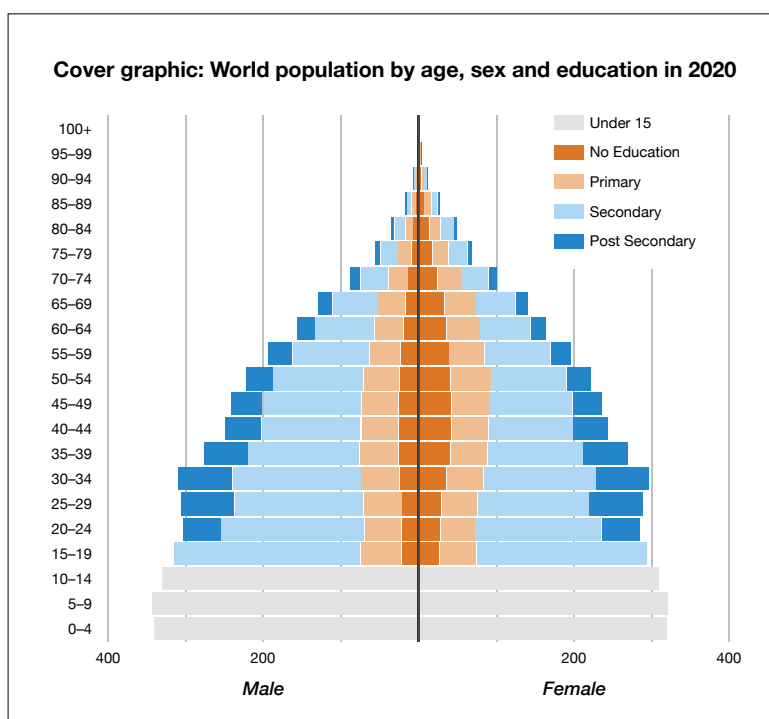
Editors:
Wolfgang Lutz and
Alexia Fürnkranz-Prskawetz

Graphic design:
Christian Högl, creativbox.at

Author of the narrative text:
Landis MacKellar

Printing:
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Managing editor:
Stefanie Andruchowicz



Note: Population pyramid in millions. Medium Scenario (SSP2).

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and Global Human Capital Research

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About us

Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna) – WIC

The Wittgenstein Centre for Demography and Global Human Capital (WIC) is a collaboration among the International Institute for Applied Systems Analysis (IIASA), the Austrian Academy of Sciences (OeAW), and the University of Vienna. It was made possible by the funding associated with the Wittgenstein Award – the highest Austrian science prize – which, in 2010, was awarded for the first time to a social scientist: Wolfgang Lutz. In the application for the prize, the establishment of such a joint centre had been stated as the explicit goal; and in December 2010, a Memorandum of Understanding was signed among the three founding pillar institutions: IIASA, the OeAW and the Vienna University of Economics and Business (WU). The foundation of the WIC was further facilitated by the fact that Wolfgang Lutz was serving as head of all three pillar units. In 2019, with the establishment of the new Department of Demography, the University of Vienna became the university-based pillar of the WIC.

The Wittgenstein Centre funding available for 2011–2017 has been strategically invested to strengthen the coherence of the three research groups, and to cover new fields that advance the unique research focus of the WIC, such as the demography of education. This approach has helped to increase the value of the core funding from the three

institutions together with third party funding, which has so far included 12 ERC grants.

The Centre combines the partners' strengths in the fields of demography, human capital formation and analysis of the returns to education. It builds on a highly successful collaboration that has already generated significant scientific advances. "Human capital" refers to the human resource base in terms of the number of people and their changing structures by age, gender, location, education, labour force participation, health status, cognitive skills and other relevant characteristics. Our intent is to use this broader multi-dimensional demographic approach to provide sound analyses, including model-based forecasting, as a basis for decisionmaking at various levels.

Our Mission Statement

The Wittgenstein Centre aspires to be a world leader in the advancement of demographic methods and their application to the analysis of human capital and population dynamics. In assessing the effects of these forces on long-term human wellbeing, we combine scientific excellence in a multidisciplinary context with relevance to a global audience.

The Wittgenstein Centre was established in 2010. This report describes the consolidation of its work and further progress achieved over the 5-year period 2018–2022.

The Three Pillars

International Institute for Applied Systems Analysis Population and Just Societies Program



IIASA headquarters Schloss Laxenburg © IIASA

IIASA (founded in 1972) is an international research institute that advances systems analysis and applies its research methods to identify policy solutions to reduce humanity's footprint, to enhance the resilience of natural and socio-economic systems, and to help achieve the Sustainable Development Goals.

“Human demography is a key determinate of our collective future. IIASA has for many years played a leading role in understanding demographic and migration patterns and will continue to develop novel approaches to promote human wellbeing.”

Director General Albert van Jaarsveld

policies that will enable their societies to face these challenges.

IIASA is non-governmental in nature, and currently has 23 member organisations. Funded by research funding agencies in Africa, the Americas, Asia, Europe and Oceania, IIASA is independent, and is unconstrained by political or national self-interest. IIASA is governed by a Council that is made up of one representative of each of the Institute's member countries. Along with various external advisory bodies, the Council also regularly evaluates the Institute's work.

The **Population and Just Societies (POPJUS) Program** continues and builds upon research activities previously undertaken in the IIASA World Population and Risk and Resilience programmes. Gaining insight into current and future population sizes, structures and distributions is fundamental to understanding the human impacts on ecosystems, and, at the same time, the effects of environmental changes on human wellbeing, differentiated by sub-populations.

Since 1974, the IIASA's research agenda has included an explicit focus on population analysis. Wolfgang Lutz followed Andrei Rogers (1974-84) and Nathan Keyfitz (1984-94) in 1994 as leader of the World Population Program. Since 2022, Anne Goujon has taken over the leadership of the POPJUS program from Raya Muttarak.

In the context of the Wittgenstein Centre, the POPJUS program focuses primarily on global population trends and the analysis of the link between population and sustainable development. Human population matters for sustainable development in two important ways. First, it is an agent of change, bringing about many of the environmental, economic and social changes that continually challenge the sustainability of our current development paths. Second, human population and its living conditions are the ultimate objects of development, with long-term human survival, health and wellbeing serving as criteria for judging whether development is sustainable.



Through its research programmes and initiatives, the International Institute for Applied Systems Analysis (IIASA) conducts policy-oriented research into issues that are too large or complex to be solved by a single country or academic discipline. These issues include pressing concerns that affect the future of all of humanity, such as climate change, energy security, population ageing and sustainable development. The results of IIASA research and the expertise of its researchers are made available to policy-makers in countries around the world to help them produce effective, science-based

Austrian Academy of Sciences Vienna Institute of Demography

Founded in 1847 as a learned society, the OeAW is currently Austria's central non-university research and science institution. Its statutory mission is to "promote science in every way".

The Austrian Academy of Sciences (OeAW) has over 760 members and 1800 employees dedicated to innovative basic research, the interdisciplinary exchange of knowledge, and the dissemination of new insights with the aim of contributing to progress in science and society as a whole. The OeAW operates 25 research institutes that conduct innovative basic research in the arts and humanities and the social and natural sciences. The Academy stimulates pioneering research by taking up future-oriented topics, and by promoting the preservation and interpretation of cultural heritage.

The **Vienna Institute of Demography (VID)** was founded in 1975 under the name "Institut für Demographie". At that time, it was closely linked to the Austrian Central Statistical Office, whose president was also the first director of the institute. Later, the head of the demographic branch of the Statistical Office, Richard Gisser, became the director. In 2001, when the OeAW received additional government funding, the demographic insti-



Austrian Academy of Sciences main building © Bwag/Commons

In the context of the WIC, the VID also undertakes basic research on the key drivers of demographic change, in particular fertility, health/mortality and migration; and on economic demography. The internationally leading comparative and cutting-edge research the VID conducts in these fields

"The Austrian Academy of Sciences is happy to host the Vienna Institute for Demography (VID) and to support the cooperation with IIASA. For many decades, they have been researching demographic topics at the highest scientific level. The VID and IIASA thus make an important contribution to national and global management of the future."

President Heinz Faßmann

tute broadened its focus and became more international, with Wolfgang Lutz appointed as (external) director. In 2002, the institute changed its name to the Vienna Institute of Demography. Since then, the VID has been recruiting scientists from around Europe, and developing a specific focus on comparative European demography.

directly informs the population forecasting and teaching work at the other WIC pillars. In addition, the VID has a research group focusing on the demography of Austria that provides the WIC with the expertise needed to perform Austria-specific studies, and to serve as the Austrian hub of larger international surveys.

University of Vienna

Department of Demography



University of Vienna main building © Alex Schuppich/University of Vienna

Founded in 1365, the University of Vienna is currently one of the oldest and the largest universities in Europe. It has more than 60 locations in Vienna, 15 faculties, and five centres.

Together with cooperating university colleges of teacher education, the University of Vienna is also the largest teacher education institution in Austria.

The **Department of Demography (DoD)** was established in 2019, and combines demographic research and teaching at the University of Vienna. The DoD addresses demography in all its dimensions, with a special focus on multi-dimensional demography, and on the relevance of demographic change for sustainable development. This research involves studying the multiple structures of human populations by age, sex, place of residence, level of educational attainment, labour force participation and other relevant demographic characteristics of individuals. The focus is on the determinants of such changes – in particular, fertility, mortality and migration – and the aggregate-level effects of past, current and future population changes on society, the economy and the environment.

In the context of the WIC, this new Department of Demography serves as the university-based teaching pillar of the Centre. In addition to its research, the Department

“Demographic developments are at the center of societal challenges that will shape our futures. The University of Vienna is proud to host our new Department of Demography and offer world class training at the Master and PhD level to shape the next generation of researchers in this field“

Dean, Faculty of Social Sciences Hajo Boomgaarden

The University of Vienna aims to strengthen its position in interdisciplinary and internationally prominent fields of research that are not only eligible for funding, but are also relevant to society, and to which it is connected through the achievements of its excellent academics. The university offers 184 degree programmes (bachelor's, master's, diploma, and doctoral programmes), has 28 teaching subjects/specialisations, and has around 89,000 enrolled students.

of Demography offers a specialisation in Demography within the Vienna Doctoral School of Social Sciences (ViDSS), and the English-language master's programme in Global Demography, which welcomed its first cohort of students in October 2021.

Scientific Leadership



© Markus Lauboeck

Wolfgang Lutz

“ The Wittgenstein Centre builds on four specific and unique intellectual traditions. Two that come from IIASA are multi-dimensional (multi-state) demographic modelling, as spearheaded by Andrei Rogers and Nathan Keyfitz; and the comprehensive study of complex population-development-environment interactions (PDE models), globally and through PDE case studies. Another inspiration came from the work of Gustav Feichtinger and his disciples on the mathematical and economic modelling of complex population processes, with a focus on heterogeneity and inter-generational equi-

ty. The fourth tradition is the VID's core focus on comparative European demography, as developed after its internationalisation in 2002. What all four of these intellectual strands have in common is that they focus primarily on the macro level of population change, which is stratified by more dimensions than just age and sex; that they follow the classic definition of demography as the study of changing population size and structures; and that they tend to have an international perspective. These traditions have provided a powerful intellectual basis for the work of the WIC. ”

Wolfgang Lutz is the founding director of the Wittgenstein Centre (based on the 2010 Wittgenstein Prize, the highest science award in Austria). He joined IIASA in 1985, where he was the director of the World Population Program from 1994-2020, and where he currently serves as the interim deputy director general for science. Since 2002, he has also been the director of the VID; and, since 2019, he has been professor of demography at the newly established Department of Demography of the University of Vienna. He is a member of six academies of science, including the US National Academy of Sciences, The World Academy of Sciences and the Austrian Academy of Sciences.



© Puiu

Alexia Fürnkranz-Prskawetz

“ The Wittgenstein Centre unifies the three pillars (IIASA, OeAW, University of Vienna), which together offer an enormous range of demographic expertise. What the three pillars have in common is their strong focus on quantitative research, ranging from advanced statistical analysis of population trends to complex modelling of the mechanisms linking demographic developments to the environment and the economy. Personally, having been trained as an applied mathematician, and having conducted research

in population economics, I highly value the multidisciplinary approach of the WIC, and its clear focus on the links between macro-level population changes and social and environmental constraints. Since there is no “one-size-fits-all” policy, it is important that we consider in our research the heterogeneity of population processes across social groups, regions and time. This is a guiding principle of the WIC in its efforts to provide evidence-based scientific advice. ”

Alexia Fürnkranz-Prskawetz is one of the five directors at the Wittgenstein Centre, professor of Mathematical Economics at the TU Wien (since 2008), and deputy director at the VID (since 2020). Since July 2013, she has also been a research associate at IIASA. She is a member of the Austrian Academy of Sciences, the German National Academy of Sciences Leopoldina and Academia Europaea.



© primephoto

Jesús Crespo Cuaresma

“ The interdisciplinary nature of the questions that demography aims to answer implies that finding a common methodological language is challenging. With the framework provided by the concept of demographic metabolism and its focus on rigorous quantitative methods, the WIC has been able to create such a language, and to successfully overcome the existing barriers across the different fields of expertise of researchers in the pillar institutions. The intensity of cooperation among

members of the WIC, and the continuous shifts in the scientific frontier that have taken place over the last decade, would not have been possible without a common understanding of how demographic change affects (and is affected by) socio-economic developments. The “Vienna School” of Demography, built around the WIC, has contributed to this understanding, and has created the trunk of a tree of knowledge from which many branches will develop in the future. ”

Jesús Crespo Cuaresma is director of economic analysis at the Wittgenstein Centre, and has an oversight function for three WIC research groups. He is professor of economics at the Vienna University of Economics and Business (WU), and is a research scholar at IIASA.



© IIASA

Raya Muttarak

“ One unique contribution of the WIC’s research activities is that they connect demography with the environment, climate change and sustainability research communities. The central focus of the research is on the reciprocal relationship between human population and the environment, which is interdisciplinary by nature. The aim of rigorously and empirically connecting human, economic and environmental systems can only be achieved through close collaboration between the different WIC pillars, with each contributing their complementary strengths and exper-

tise. While IIASA acts as a bridge between demography and environmental sciences, the VID facilitates the development of solid demographic analysis and modelling approaches through the capacity-building resources of the University of Vienna, which, in turn, enables the WIC to foster the intellectual development of the next generation of global demographers. This ambitious effort to expand the frontiers of population, environment and sustainable development research needs an organisation like the WIC to succeed. ”

Raya Muttarak is director of population, environment and sustainable development at the Wittgenstein Centre. Since 2022, she has been professor of demography at the University of Bologna. She is a PI of the ERC consolidator grant project “Population Dynamics under Global Climate Change” (grant no. 101002973), and is an editor of Population and Development Review. In 2021, she was IIASA’s Population and Just Societies (POPJUS) Program director.



© Barbara Simunics/VID

Sergei Scherbov

“ Being under one ‘roof’ helped to facilitate joint research among scientists from the different pillars. Certain results could be achieved only through joint efforts (synergy). A good example of such joint efforts are the human capital projections, which were produced mainly at IIASA using data produced by the data lab at the VID. Expertise missing in one pillar could easily be found in one of the other pillars. Among the demographic community, the WIC has achieved a higher level of visibility

than any single pillar could have reached on its own. This has, in turn, created a higher level of visibility in the media, which has made it easier to get WIC research to decision-makers. The future of the WIC depends on the willingness of the administration of each pillar to continue sharing its resources, and especially its human resources, with the other pillars. Joint applications for external funding would also strengthen the WIC. ”

Sergei Scherbov is director of demographic analysis at the Wittgenstein Centre. He is principal research scholar and project leader of the Social Cohesion, Health and Wellbeing Research Group at IIASA. Between 2013 and 2020, he was deputy program director of IIASA's World Population Program (POP); and from 2002 to 2021, he was leader of the Population Dynamics and Forecasting Research Group at the VID. He received an honorary doctorate from Chulalongkorn University in Bangkok, where he is an affiliated professor.



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The Wittgenstein Centre for Demography and Global Human Capital and the “Vienna School”: An Appreciation of their Contributions to Demographic Research

Written by Landis MacKellar

Introduction

In the first decade of its existence, the Wittgenstein Centre for Demography and Global Human Capital (IIASA, OeAW, University of Vienna) – in the following called WIC – has established itself as a global centre of excellence in demography, and as the centre of a distinct approach that can credibly now be called the “Vienna School” of demographic research; not a bricks-and-mortar institution, but an approach to demography with a clear geographic centre of gravity at the WIC. The WIC and its network of external collaborators comprise a leading producer of population research and analysis,

known for global projections of the size and the composition of the human population. At the core of all WIC research has been policy relevance to resilience and sustainability in the context of global change.

The WIC is responsible for demographic aspects of the Shared Socioeconomic Pathways (SSP) scenarios (see page 15) that informed the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report in 2021, and are a resource for climate change research and policy debate worldwide. The WIC’s nearly two dozen user-friendly

data bases and data sheets, notably the Human Capital Data Explorer (see page 15) and the Human Fertility Database (see page 26), have become go-to resources, not only for researchers, but for students, the policy community, journalists and the interested public. The WIC is an important convener of policy-relevant conferences and colloquia (see page 49), and the Vienna Yearbook of Population Research (see page 45) has become a respected research outlet. Finally, with the founding of the Department of Demography at the University of Vienna in 2019, which offers both master’s and PhD degrees

in global population (see page 47), the WIC has become a centre of global training and instruction for the field.

A foundational contribution of the “Vienna School” has been to emphasise the role of the human population as capital – not just a demographic cost centre when people are young (upbringing and education) and old (health care and pensions), and an exploitable profit centre when in between these two life stages (labour). Instead, WIC research has studied the human population as a heterogeneous stock of human capital to be combined with natural (resources and the environment) and physical (infrastructure and machinery) capital. The origins of the “Vienna School” can, indeed, be traced to the pathbreaking IASA forecast (2001) of global population by education level, which explicitly considered education differentials in its fertility and mortality scenarios.¹ The contrast between this forecast and the then-prevailing high-medium-low growth scenarios – reflective of traditional actuarial science, with its reluctance to address behavioural issues – was striking. Since then, the proliferation of survey data and computational power has encouraged members of the School to extend “multi-state” to “multi-dimensional” population analysis, incorporating characteristics such as literacy, cognitive skills, self-assessed wellbeing and life satisfaction, religious affiliation and religiosity, poverty status – and potentially anything else that can be accurately measured by age and sex, and that has a credible connection to those two basic biological demographic variables. For the moment, this approach is a simple expansion on extensive margin, but it offers researchers the opportunity to explore simultaneous and lagged links between, for example, education and fertility, literacy and poverty status, and others as the dimensions expand.

A second foundational contribution of the “Vienna School” has been to revitalise Norman Ryder’s (1965) concept of “demographic metabolism”, i.e., the process of generational replacement

as a driver of socio-economic changes triggered by (and triggering) changes in the composition of the population over time. Metabolism, in biology, is the bundle of processes through which an organism regenerates itself until, when those processes eventually weaken, it dies. Like the individual biological organisms that comprise it, a population must regenerate itself at the individual and the aggregate level. Yesterday’s children are today’s youth; today’s youth are tomorrow’s adults and labour force; today’s adults are tomorrow’s aged; and, in the end, tomorrow’s aged are tomorrow’s dead. As indicated by the current popularity of generational jargon – Baby Boomers, Millennials,

tribution of income.

Rather than simply summarising the output of WIC research groups, this essay is organised along thematic lines. It starts with a description of the forward-looking, policy-relevant work of WIC researchers on future human capital, and on education and health as factors determining the worth of that resource. This discussion naturally leads to the theme referred to here as the demography of sustainability.

These three themes – the shifting composition of the human population, its role as human capital, and its links with sustainability – can be considered the highly visible tip of the WIC ice-

About the author

Landis MacKellar is an economist and lawyer whose research and writing have spanned demography, the economics of the social sector, and environmental economics. From 2013–2021, he was editor of *Population and Development Review*. He also served as Executive Director of the International Union for the Scientific Study of Population (IUSSP) and as Directeur d’études at the Institut national d’études démographiques (INED) in Paris. He is currently an independent international development consultant specialising in strategic evaluation.

Gen-X, Gen-Z – demographic cohorts long bear the marks of events that occurred during their younger years – even in their months spent in utero (e.g., the documented lingering impacts of the 1918–20 influenza pandemic on babies born in those years).

Taken together, the demographic metabolism approach and multi-dimensional population projections with an emphasis on human capital have put the WIC at the forefront of the sustainable development field. As the inevitability of climate change impacts becomes clearer, WIC research is a vital source of insights into the complex links between demographic parameters (fertility, mortality and migration), policies (especially regarding education and health), and the resulting resilience to climate change. Also relevant to sustainability is the demographic future of the ageing global North. The WIC has contributed to important research on low-fertility regimes, longevity and population ageing, and their effects on the sustainability of social protection systems and the intergenerational dis-

tribution of income. While the massive global policy implications of these issues make this tip the most media-attractive and publicised aspect of the Institute, underlying it is a wide range of research on the forces shaping demographic development. The following sections deal with components of demographic change: fertility and family; mortality, longevity and population ageing; and migration.

Even in a field more grounded in empiricism than theory, the WIC’s demographic research programme stands out for its strong policy orientation. Policy needs to evolve quickly, and WIC has responded flexibly. Thus, a final thematic section, entitled “Demography in time of crisis”, describes the WIC’s immediate response to COVID-19 and the 2015 asylum-seeker / refugee wave. The report closes with some thoughts on the WIC’s contributions, role and future; and on why the term “Vienna School” is justified.

¹ Lutz, W., & Goujon, A. (2001). The world’s changing human capital stock: Multi-state population projections by educational attainment. *Population and Development Review*, 27(2), 323–339. <https://doi.org/10.1111/j.1728-4457.2001.00323.x>



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Projecting Human Capital

Unsurprising given its origins in multi-state population projection and promotion of the demographic metabolism approach, the WIC's research agenda has placed a heavy emphasis on modelling and forecasting – i.e., quantitatively capturing, reconstructing and forecasting the changing composition of

populations by age, sex, level of educational attainment, religion and place of residence, health status and labour force participation. One of the earliest contributions of the WIC was the production, in 2011–13, of the first consistent set of world population scenarios by age, sex and six levels of educational attainment for individual countries to the end of the century². These data have been disseminated in the form of data sheets, and as internet tools for data exploration and visualisation.

Incorporating future fertility, mortality, migration and education assumptions generated from a survey of 500 population experts, alternative scenarios were defined to conform to the narratives of the Shared Socioeconomic Pathways (SSPs) being used by a broad consortium of international modelling teams in the context of integrated assessment and climate change. One of the most important findings is that female education, and, in particular, the speed of fertility decline in Africa, is a major driver of

Advanced Introduction to Demography

Wolfgang Lutz



(From the text on the cover): Highlighting the power of multi-dimensional demography, this Advanced Introduction addresses the most consequential changes in our societies and economies using quantitative approaches. It defines three demographic theories with predictive power – demographic metabolism, transition and dividend – and repositions the discipline at the heart of social science. This Advanced Introduction is a must-read for demographers around the globe, as well as students of demography at all levels. It will also be useful to academics in other social sciences, including human geography, development studies and sociology scholars interested in what state-of-the-art demography has to offer their fields.

Lutz, W. (2021). *Advanced Introduction to Demography*. Edward Elgar Publishing. <https://www.e-elgar.com/shop/gbp/advanced-introduction-to-demography-9781789901481.html>

² Lutz, W., Butz, W. P., & KC, S. (Eds.) (2014). *World Population & Human Capital in the Twenty-First Century: An Overview*. Oxford University Press. <https://doi.org/10.1093/oso/9780198813422.001.0001>

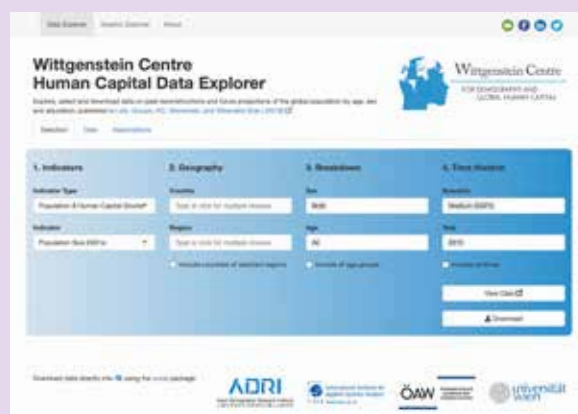
future world population growth. Depending on the speed of education expansion among women in the future, world population scenarios differ by more than one billion people. The explicit information about education also points to the potential for economic growth and resilience to climate and environmental change in the future. In recent work, WIC researchers have even succeeded in producing downscaled U.S. county-level population projections consist-

ent with the SSPs. This work represents a major step forward in producing the spatially-explicit population projections by age that are increasingly needed for understanding human–environment interactions.³ Results suggest that wide variations in the spatial

³ Striessnig, E., Gao, J., O'Neill, B. C., & Jiang, L. (2019). Empirically based spatial projections of US population age structure consistent with the shared socioeconomic pathways. *Environmental Research Letters*, 14(11), 114038. <https://doi.org/10.1088/1748-9326/ab4a3a>

Global Projections: The Wittgenstein Centre Data Explorer

The Wittgenstein Centre Human Capital Data Explorer presents population and educational attainment projections for a set of scenarios covering 201 countries from 1950 to 2100. The scenarios follow the narratives of the Shared Socioeconomic Pathways (SSPs), which are widely used in the climate change research community. The results of the population projections by levels of educational attainment were published in 2018 in Lutz, Goujon, KC, Stonawski and Stilianakis (2018, see page 33). The authors provided an update of the projections (scope, coverage and quality) presented in Lutz, Butz and KC (2014)², based on the work of a large team of researchers at the Wittgenstein Centre and at other institutions. The present version (2.0) benefited from the Wittgenstein Centre's partnership with the Joint Research Centre in the Centre of Expertise on Population and Migration (CEPAM), and includes alternative migration scenarios in addition to the scenarios of future trends in fertility, mortality and education. The 2.0 version also includes the reconstruction of population by levels of educational attainment from 1950 to 2015 for 185 countries. The projections and reconstruction results can be viewed in the graphic explorer in the form of pyramids, maps and graphs.

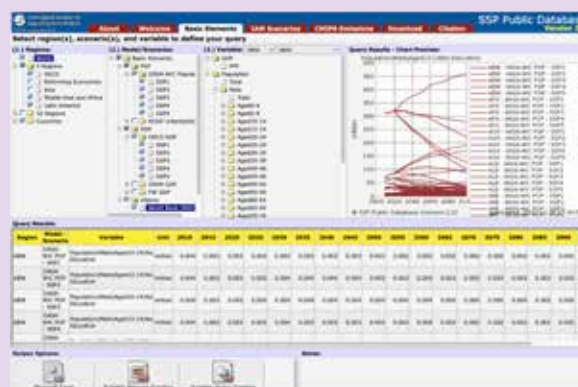


It is currently planned that further updates will be published in December 2022 and 2024. Version 3.0 will present a revision of the projections based on additional and improved base year data and trends. Version 4.0 will include the urban/rural variable (in addition to education) as a new dimension that will enable the projections to better cover the heterogeneity within the population.

Wittgenstein Centre Data Explorer Version 2.0. Available at: <http://www.wittgensteincentre.org/dataexplorer>

Broader Shared Socioeconomic Pathways (SSP) Database

The aim of the SSP database is to document quantitative projections of the Shared Socioeconomic Pathways (SSPs) and related Integrated Assessment scenarios. The SSPs are part of a framework that the climate change research community has adopted to facilitate the integrated analysis of future climate impacts, vulnerabilities, adaptations and mitigation efforts. In addition to the population and human capital scenarios described above (the “human core” of the SSPs), the projections include urbanisation projections and many other economic, technological and environmental variables. The framework is built around a matrix that combines climate forcing on one axis and socio-economic conditions on the other. Together, these two axes describe situations in which the effects of mitigation, adaptation and residual climate damage can be evaluated.



SSP Public Database Version 2.0. Available at: <https://tntcat.iiasa.ac.at/SspDb>

patterns of county-level age structure are plausible, with the possibility of substantial ageing clustered in particular parts of the country. The urban concentration of younger people, as well as the absolute number of vulnerable elderly people, can vary strongly by SSP.

Returning to the global level, China and India are of special concern because of their demographic and geopolitical weight. Two WIC studies have examined the demographic developments in these two Asian countries in more detail. In India, there are enormous differences in fertility between educated and uneducated women. However, India is expected to catch up to the more developed countries of Asia in terms of human capital if the recent pace of educational expansion is maintained and fertility declines accord-

ingly.⁴ In China, where the main fears revolve around very low fertility, a WIC analysis found that while fertility has indeed fallen to low levels, human capital accumulation has been very strong, especially among the younger cohorts.⁵ Factoring in the effects on productivity of labour force participation and educational attainment, a much more optimistic picture of the economic (and social) future can be envisaged for China.

⁴ KC, S., Wurzer, M., Springer, M., & Lutz, W. (2018). Future population and human capital in heterogeneous India. *Proceedings of the National Academy of Sciences*, 115(33), 8328–8333. <https://doi.org/10.1073/pnas.1722359115>

⁵ Marois, G., Gietel-Basten, S., & Lutz, W. (2021). China's low fertility may not hinder future prosperity. *Proceedings of the National Academy of Sciences*, 118(40), e2108900118. <https://doi.org/10.1073/pnas.2108900118>

Building Human Capital: Education and Health



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■ **Education.** The insight driving the WIC's human capital modelling is that, after age and sex, the individual characteristic that gives rise to the most population heterogeneity is educational attainment.

This implies that, data permitting, education should be routinely included in demographic analyses, and particularly in projections. Moreover, because fertility, mortality, migration and labour force participation are closely associated with education, including education as a parameter in demographic analyses opens the door to endogenising the complexity of feedback loops into what would otherwise be simple, linear, annual step-wise population projections. It has, for example, been demonstrated that in selected European countries between 2000

and 2010, the labour force participation rates of adult women would have increased even more had it not been for the downward pressure from the shift in the age composition towards older age groups with relatively lower levels of participation.⁶ The increase in labour force participation among older people was mainly explained by the increase among those with non-tertiary education, and was reinforced by a general shift towards higher levels of educational attainment.

Focusing on educational attainment also adds the “quality dimension” to demographic analysis, thus making demography more relevant for a large number of economic, social and political issues. Learning and formal education, including technical and vocational education, are the major forms of investment in human capital. As its full name would imply, the WIC has, from its inception, been associated with research into education. WIC researchers have made substantial contributions to the study of individual education behaviour (e.g., enrolment) and characteristics (e.g., attainment or literacy), as well as their aggregate dynamics, at the population level, and thus as demographic events and characteristics.

⁶ Loichinger, E., & Prskawetz, A. (2017). Changes in economic activity: The role of age and education. *Demographic Research*, 36(40), 1185–1208. <https://doi.org/10.4054/DemRes.2017.36.40>

Indeed, the first step from “multi-state” to what the “Vienna School” terms “multi-dimensional” demographic analysis was the addition of education.

While WIC researchers have not neglected issues of education in high-income countries (e.g., education and fertility, as discussed below), their main contributions have been to development policy circles, where the suspicion that education was a drain on public investment (and hence a good basis for family planning policy) persisted long after the human capital model became ascendent in economics. Among the major contributions of WIC researchers has been to credibly argue that the so-called “demographic dividend” is really a dividend based on education, and not on age structure.⁷ Analysing economic growth and human capital (as measured by education) trends in 165 countries for the 1980-2015 period, they assessed the relative importance of changes in the age structure, and found that improvements in education have a clear statistical dominance over changes in the age structure, which implies that the demographic dividend is driven by human capital. Thus, they concluded that the causality path is not a simple linear one from exogenously declining youth dependency ratios to higher education, and hence to higher economic growth; but is instead a more complicated one in which education, by increasing human capital, contributes to both fertility decline and economic growth. WIC research on sustainable development has also argued that the effects of education are not limited to economic growth and material benefits, but extend to broader sustainable development concerns, such as human capabilities and resilience, both of which are essential in the context of global environmental change.

A long-standing problem has been the inability of traditional quantity-based education indicators (e.g., enrolment rates, attainment rates, mean years of schooling) to accurately measure the actual skill levels in the human capital stock. For example, the problem of skills depreciation – i.e., the loss of skills gained if they are not applied – is well established. WIC researchers have been among the first to take advantage

of the fact that an increasing number of countries have started to assess the literacy skills of their adult populations by age and sex directly. Drawing on these data and using back casting techniques, they found that, for the population aged 20-64 in 185 countries over the 1970-2015 period, the trends in actual adult literacy skills exhibit a widening global gap between low- and high-performing countries.⁸ This finding stands in strong contrast to the previous assumption that there has been a global convergence in mean years of schooling as enrolment rates have risen in low-income countries.

■ **Health.** Long before death, poor health can reduce the value of human capital. As population ageing advances, the theme of “healthy ageing” has moved to the centre of the policy stage, particularly in Europe. Why do some (groups of) people live longer and healthier lives than others? Will we see the “rectangularisation” of healthy life



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expectancy – i.e., populations living in good health up to the point of dying – or will added years of life expectancy be characterised by poor health and disability? WIC research on healthy ageing has concentrated on health differentials, new hypotheses to explain them, and innovative approaches to studying the link between health and longevity. For example, by decomposing years spent in poor health into a pure health effect and a pure longevity effect, WIC researchers demonstrated that women spend more years in poor health than men primarily

⁷ Lutz, W., Crespo Cuaresma, J., Kebede, E., Prskawetz, A., Sanderson, W. C., & Striessnig, E. (2019). Education rather than age structure brings demographic dividend. *Proceedings of the National Academy of Sciences*, 116(26), 12798–12803. <https://doi.org/10.1073/pnas.1820362116>

⁸ Lutz, W., Reiter, C., Özdemir, C., Yıldız, D., Guimaraes, R., & Goujon, A. (2021). Skills-adjusted human capital shows rising global gap. *Proceedings of the National Academy of Sciences*, 118(7), e2015826118. <https://doi.org/10.1073/pnas.2015826118>

Levels and Trends of Health Expectancy: Understanding its Measurement and Estimation Sensitivity

PI: Marc Luy

ERC-2016-COG-725187-LETHE

Time Frame: 01.09.2017 – 31.08.2023

Website: <https://delag.eu/Projects/>



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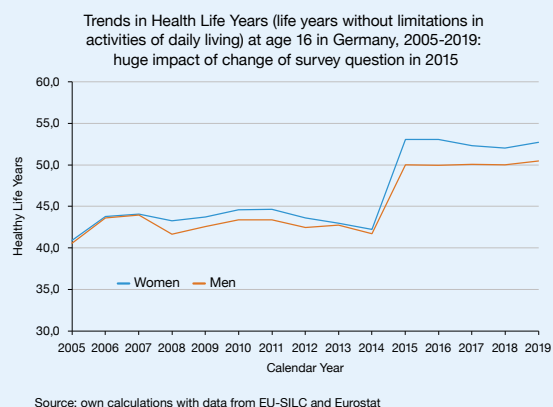
This project assesses the effects of the methodological features of "health expectancy" (HE). This indicator extends the average life expectancy (LE), and divides the total number of life years into two quality dimensions: life years spent in good health and life years spent in poor health. However, incorporating this additional dimension into the life table makes the indicator extremely sensitive to certain measurement and estimation issues. The project assesses the effects of these sensitivities through a direct empirical application of this indicator to the most important research questions. These questions are related to the expansion versus the compression of morbidity debate, as well as to the differences between socio-economic status groups, between women and men, and between eastern and western Europe.

In testing to what extent the choice of the underlying measure of longevity affects the HE results, we demonstrated that the estimated decrease in LE in almost all industrialised countries in 2015 is one example of how the choice of indicator matters. If life years are measured with cross-sectional average length of life (CAL) and similar approaches, LE did not decrease in this year. We applied these longevity measures to HE, and introduced the new indicator HCAL – i.e., HE based on CAL instead of LE – which showed that this conceptually more consistent variant of the HE indicator can indeed provide different results.

Of particular interest in this context were the effects of HE's technical sensitivities on gender differences and country-specific performance rankings in health throughout Europe. We found, for example, that it is not only the definition of health that is used that matters – i.e., the health indicator chosen for estimating HE – but also that focusing on the unhealthy or the healthy part of total LE can provide different results. We also showed that different reporting behaviours can affect differences in HE, such as differences between women and men or country rankings; and that changes in the wording of health questions can have a significant impact on the levels and the trends depicted by the HE indicators (see Figure).

Several analyses of self-rated health (SRH) measures showed that SRH is most influenced by chronic diseases and health conditions, and by the functional status of respondents, with substantial differences by age.

Most recently, we developed a new summary measure of population health: wellbeing adjusted health expectancy (WAHE). It combines health and mortality information into a single indicator with weights that quantify the reduction in wellbeing associated with decreased health. The advantage of WAHE over other summary measures of population (SMPH) health lies in its ability to differentiate between the consequences of health limitations at various levels of severity, and in its transparent, simple valuation function. Empirical tests revealed that WAHE estimates are most closely correlated with the other SMPHs, and are robust, regardless of whether health is defined across one or multiple simultaneous dimensions of health. These findings suggest that WAHE is a useful and reliable indicator of population health.



As well as providing strong recognition of our work, the presentation of our results and our exchanges with the scientific community confirmed our hypothesis that most users of the common health expectancy indicators are not aware of the indicators' sensitivities to various methodological and estimation issues, and the misleading conclusions they can produce. To increase the awareness of these sensitivities among scientists, policymakers and other stakeholders, the project results will be published in a book.

because women spend more years in old age – a finding that has broad implications for social and health policy.

Healthy Life Years (HLY) is a prominent summary indicator for evaluating and comparing the levels of population health status across Europe. However, variations in HLY do not

necessarily reflect underlying differences in health and mortality levels among countries, and the indicator is particularly sensitive when broken down by sub-populations. WIC authors have demonstrated how the education compositional effect shapes HLY levels by providing estimates for HLY by educational attainment and sex for 16 Eu-

The Male-Female Health-Mortality Paradox Project

PI: Marc Luy

ERC-2010-StG-262663-HEMOX

Time Frame: 01.04.2011 – 31.03.2016

Website: <https://delag.eu/Projects/>

and <https://www.cloisterstudy.eu/>



This project has deconstructed the long-accepted “gender and health paradox”: the idea that women live longer than men despite experiencing worse health. The team looked at the relationship between health and mortality among Catholic nuns and monks from Austria and Germany, and compared it to that of other subgroups of the general population with different levels of life ex-

pectancy. The central conclusion of the project was that the disadvantage of women in healthy life years is mostly a direct consequence of their advantage in longevity. After controlling for this “longevity effect”, the remaining disadvantage of women in healthy life years was eliminated when gender differences in health reporting were adjusted for. Based on these findings, we developed an explanation model for the “gender and health paradox” that also advances our general understanding of the mechanisms behind healthy ageing. The project’s outcomes are highly relevant for society, because they can influence corresponding public health measures.

ropean countries, and adjusting the country aggregates accordingly. The results showed that national differences can be driven, not by education-specific differences, but by the population composition in terms of education level.⁹ Moreover, related to the education-health nexus, WIC researchers demonstrated on the basis of survey data that the health-education gradient in the Philippines can be explained in large part by the educated population having more health knowledge and information, which allows them to make better health choices. Indeed, they found that this effect was twice as large as the effect of the more educated population having a higher income.¹⁰ Reinforcing these findings in a very different context, a model calibrated to the U.S. decomposed the longevity gap between the skilled and the unskilled, and found that the skills bias related to the effectiveness of health care use, once accessed, explains a large part of the increase in the longevity gap between the skilled and the unskilled populations.¹¹ The model also showed that both channels tend to be reinforced by medical progress, i.e., by the growing stock of tests and treatments.

WIC-affiliated researchers have contributed to the influential global burden of disease literature, with an emphasis on estimating economic costs through loss of human capital via death, sickness, and the diversion of productive resources into treatment and prevention. In the U.S., they found that non-communicable diseases (NCDs) – with the most significant being mental health conditions and cardiovascular diseases, followed by cancer, diabetes and chronic respiratory diseases – roughly correspond to a tax on aggregate income of 10.8%.¹² They also reported that in China, the world’s leading tobacco producer and consumer, the cost of tobacco-attributable NCDs in 2015-2030 is estimated to be 0.9% of aggregate income, 14% of which is due to second-hand smoke.¹³ The issue of road injuries is of particular and growing importance in global mortality research. Globally, and taking account that the incidence of road injuries is related to the education of those affected, it has been estimated that road injuries will cost the world economy 0.12% of GDP per year over the 2015-2030 period, with the burden being unequally distributed, but rising sharply as road transport in lower-income countries with poor road safety expands with development.¹⁴

⁹ Sauerberg, M. (2021). The impact of population’s educational composition on Healthy Life Years: An empirical illustration of 16 European countries. *SSM - Population Health*, 15, 100857. <https://doi.org/10.1016/j.ssmph.2021.100857>

¹⁰ Hoffmann, R., & Lutz, S. U. (2018). The health knowledge mechanism: Evidence on the link between education and health lifestyle in the Philippines. *The European Journal of Health Economics*, 20(1), 27–43. <https://doi.org/10.1007/s10198-017-0950-2>

¹¹ Frankovic, I., & Kuhn, M. (2019). Access to health care, medical progress and the emergence of the longevity gap: A general equilibrium analysis. *The Journal of the Economics of Ageing*, 14, 100188. <https://doi.org/10.1016/j.jeoa.2019.01.002>

¹² Chen, S., Kuhn, M., Prettnner, K., & Bloom, D. E. (2018). The macroeconomic burden of noncommunicable diseases in the United States: Estimates and projections. *PLOS ONE*, 13(11), e0206702. <https://doi.org/10.1371/journal.pone.0206702>

¹³ Chen, S., Kuhn, M., Prettnner, K., & Bloom, D. E. (2019). Noncommunicable diseases attributable to tobacco use in China: Macroeconomic burden and tobacco control policies. *Health Affairs*, 38(11), 1832–1839. <https://doi.org/10.1377/hlthaff.2019.00291>

¹⁴ Chen, S., Kuhn, M., Prettnner, K., & Bloom, D. E. (2019). The global macroeconomic burden of road injuries: Estimates and projections for 166 countries. *The Lancet Planetary Health*, 3(9), e390–e398. [https://doi.org/10.1016/S2542-5196\(19\)30170-6](https://doi.org/10.1016/S2542-5196(19)30170-6)



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Human Capital and the Demography of Sustainability

■ *Population, environment and resilience.* Through its expertise in human capital, and building on a foundation of population-environment case studies first implemented at IIASA in the 1990s, the WIC has carved out for itself a leading place in the sustainable development community. WIC researchers have credibly advocated for the central role of education in enabling sustainable development.¹⁵ They have concentrated on identifying complex feedback links between population dynamics, the environment and sustainable development, while consistently emphasising the close links between population composition, resilience and vulnerability. In the latter two cases, WIC researchers have highlighted the role of education as an adaptive strategy that is as important as infrastructure and income for reducing vulnerability and strengthening resilience. The demographic metabolism approach is particularly useful for explaining the rapid

shift in popular attitudes towards climate change and sustainability, as awareness has grown that younger cohorts will experience vastly greater climate-related challenges than older generations.¹⁶ On the importance of education in accelerating that metabolic change, WIC researchers have, for example, found that, in the Philippines, even one year of additional schooling is correlated with the probability of undertaking a wide range of pro-environment actions. They identified the main driver of this association as increasing awareness of the anthropogenic nature of climate change, rather than simply awareness of climate risks.¹⁷

The broadest and most recent – albeit still exploratory – area of WIC research seeks to provide the basis for a comprehen-

¹⁵ Bengtsson, S. E. L., Barakat, B., & Muttarak, R. (2018). *The Role of Education in Enabling the Sustainable Development Agenda*. Routledge. <https://doi.org/10.4324/9781315142708>

¹⁶ Thiery, W., Lange, S., Rogelj, J., et al (2021). Inter-generational inequities in exposure to climate extremes. *Science*, 374(6564), 158–160. <https://doi.org/10.1126/science.abi7339>

¹⁷ Hoffmann, R., & Muttarak, R. (2020). Greening through schooling: Understanding the link between education and pro-environmental behavior in the Philippines. *Environmental Research Letters*, 15(1), 014009. <https://doi.org/10.1088/1748-9326/ab5ea0>

The Demography of Sustainable Human Wellbeing

PI: Wolfgang Lutz

ERC-2016-AdG-741105-EmpoweredLifeYears

Time Frame: 01.11.2017 – 31.10.2023

Website: <https://cordis.europa.eu/project/id/741105>

This project applies two distinctly demographic concepts to address questions that go far beyond demography.

For the study of the determinants of sustainable human wellbeing, it focuses on comprehensive indicators of human wellbeing based on life table methods. The project also applies the recently operationalised concept of “demographic metabolism” – i.e., modelling social change through the replacement of generations – to get a quantitative analytical handle on the temporal dynamics of improvements in human wellbeing.

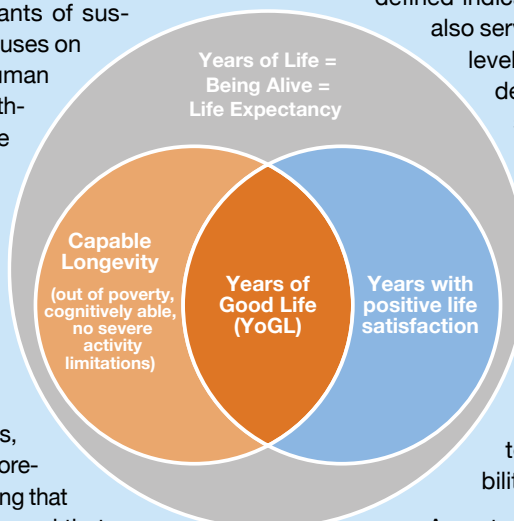
The project theoretically develops, empirically estimates, tests and forecasts indicators of human wellbeing that are based on life table methods, and that therefore reflect the basic – but often overlooked – fact that being alive is a necessary prerequisite for enjoying any quality of life. But since mere survival is not considered sufficient as an ultimate goal, the person years

lived at each age are only considered to be good years of life if an individual is above the minimal thresholds on both objective (being out of absolute poverty, being not physically or mentally disabled) and subjective (overall life satisfaction) indicators. The newly defined indicator “Years of Good Life” (YoGL)

also serves as the explanandum of global level econometric estimations of the determinants of wellbeing that consider human, manufactured and natural forms of capital, as well as knowledge and institutions.

The global level analysis is complemented by a set of strategically chosen in-depth case studies in South Africa, Nepal, Costa Rica and historical Finland. These case studies also include focus group discussions testing the inter-cultural acceptability of YoGL as an ultimate end.

A central aim of this innovative inter-disciplinary project is to contribute to the current discussions about operationalising the criteria of sustainable development, and about developing better human wellbeing-based metrics of progress.



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sive sustainability criterion in the form of an indicator (Years of Good Life – YoGL) based on life expectancy adjusted for poverty status, literacy, cognitive ability and subjective wellbeing; disaggregated by age, sex, residence and other relevant characteristics.¹⁸ This research raises the possibility of combining multi-dimensional population projection and the demographic metabolism approach to measure population wellbeing.

■ **Sustainable social protection systems.** Sustainability is not only an environmental concern, as it also refers to the sustainability of public finance systems. In the area of population economics, the WIC has established itself as a significant contributor to overlapping generations and economic life-cycle modelling for policy insights, es-

pecially through its contributions to the international National Transfer Accounts (NTA) project, with its focus on intergenerational equity. The changes in population structures as they relate to changes in age-based transfers and the role of pensions and health care has been analysed for the purposes of explaining and projecting trends in European public finances. The main thrust of the WIC's NTA work has been to demonstrate that, while current tax and public transfer policies are unsustainable given population ageing, a combination of delayed retirement, increased female labour force participation and increased education (with the latter boosting productivity and labour force participation) can substantially improve the outlook. However, the extrapolation of past or existing trends does not paint bright picture. Using data for 24 EU countries, focusing on the cohort born in 1950, and applying the age- and employment-specific transfer pattern observed in 2010, WIC researchers showed that in none of the analysed countries will the contributions of the 1950 cohort when young be sufficient

¹⁸ Lutz, W., Striessnig, E., Dimitrova, A., Ghislandi, S., Lijadi, A., Reiter, C., Spitzer, S., & Yildiz, D. (2021). Years of Good Life is a well-being indicator designed to serve research on sustainability. *Proceedings of the National Academy of Sciences*, 118(12), e1907351118. <https://doi.org/10.1073/pnas.1907351118>

Population Dynamics under Global Climate Change

PI: Raya Muttarak

ERC-2020-COG-101002973-POPCLIMA

Time Frame: 01.01.2022 – 31.12.2026

Website: <https://cordis.europa.eu/project/id/101002973>

The impacts of climate change on people's health, well-being and livelihoods are already being felt. Thus, it is reasonable to assume that climate change can influence demographic processes by influencing fertility, mortality and migration, the three key demographic outcomes driving population change. However, until now, global population projections have not considered the possible effects of climate change on population trends. The POPCLIMA project will comprehensively address this research gap by studying how climate change influences demographic outcomes; and by identifying the mechanisms, examining the differential effects on subgroups of populations, and forecasting future population dynamics

under climate change. The project's innovative methodological approach uses a combination of geo-referenced climate, population and socio-economic data from different sources, including surveys and social media at the individual, regional and country levels. The study will look at how the changing climate affects different population sectors, and it will seek to identify the ways in which mortality, fertility and migration patterns are influenced by these changes. The results will help the scientific community build more realistic scenarios about population trends as the pace of climate change accelerates.

While this ERC grant grew out of IIASA and was submitted through it, the PI later decided to move it to the University of Bologna, while continuing to closely collaborate with the WIC.



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Current ERC Grant

Forecasting Societies Adaptive Capacities to Climate Change

PI: Wolfgang Lutz

ERC-2008-AdG-230195-FUTURESOC

Time Frame: 01.03.2009 – 31.07.2014

Website: <https://cordis.europa.eu/project/id/230195>

This research project was driven by the highly unsatisfactory approach of many studies of the future impact of climate change that match the forecasted climatic conditions in a specific region with the demographic and socio-economic conditions (including the public health capabilities) of today. For these models to make sense, researchers need to also make assumptions about the future socio-economic conditions, including about how population dynamics and education will influence the ability of societies to adapt to climate change. This project

used multi-dimensional demographic models to develop scenarios of social and demographic trends over the 21st century. This information was collated into a resource to inform climate scenario models. The currently widely used and cited (for instance, in the most recent IPCC reports) Shared Socio-economic Pathways (SSPs), which seek to capture the future mitigative and adaptive capacities of societies, are based on this work. FUTURESOC's major printed output was a 1000-page volume summarising knowledge about the drivers of worldwide fertility, mortality, migration and education trends up to 2100. This report was the result of input from more than 500 researchers gathered through online surveys and expert meetings on five continents.



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Past ERC Grant

Demography-Based Market Forecasting Tools

PI: Wolfgang Lutz

ERC-2012-PoC-324617-FUTURE MARKETS

01.02.2013 – 31.01.2014

Website: <https://cordis.europa.eu/project/id/324617>

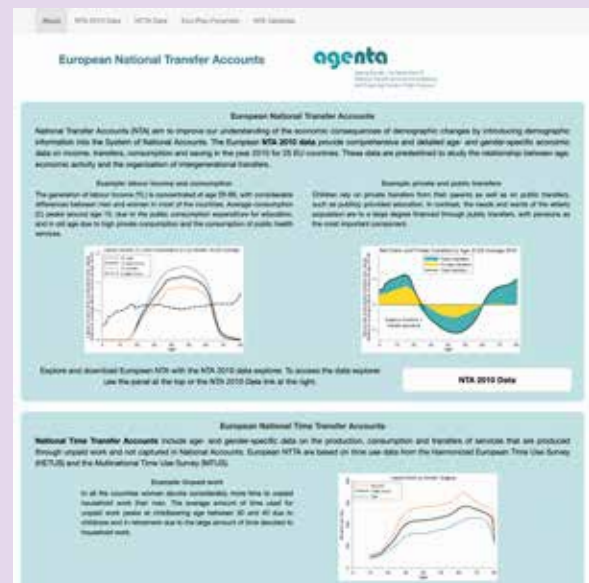
This project was a side product of the ERC FUTURESOC project. It demonstrated the capabilities of cohort analysis and the concept of demographic metabolism as tools for studying the dynamics of consumption patterns using

purchase incidence rates of aggregate panel data in four fast-moving consumer good categories (beer, wine, near water and organic food) over a time horizon of 17 years. The findings suggest that models that ignore cohort effects tend to underestimate variations in age group-specific forecasts, which might, in turn, result in misleading conclusions by managers. These results highlight the possible cohort effects in consumption behaviour, and hold promise for further applications in marketing research.

AGENTA Data Explorer

National Transfer Accounts (NTAs) provide data for analysing economic relationships between generations. The AGENTA data explorer allows users to examine and download European NTA data for the base year 2010. The European NTAs provide comprehensive and detailed age- and gender-specific economic data on income, transfers, consumption and savings for 25 European countries. Because the services produced by unpaid work are important intergenerational transfers, they are included in the data collection through the European National Time Transfer Accounts, which include time use-based estimates for the production, transfers and consumption of services produced by unpaid work for 17 EU countries.

Website: <http://dataexplorer.wittgensteincentre.org/nta/>



to finance their benefits in old age, even assuming optimistic employment scenarios.¹⁹

In a study using an overlapping generations approach, researchers examined the redistributive features of alternative pension systems when there are life expectancy and ability differences between high and low socio-economic groups.²⁰ Calibrated to the U.S. case, the resulting model found that the U.S. Social Security system reduces regressivity from longevity differences, but would require group-specific life tables to achieve progressivity and avoid regressive indirect second-order effects arising in the labour market.

Gender aspects of social protection play a prominent role in debates over sustainability, with frequent accusations of unfairness: some favouring women (greater longevity) and some favouring men (higher formal labour force participation, lower provision of unpaid work). Presenting a nuanced view, WIC researchers found that in all 15 European countries analysed, men contribute more than women to public transfers, and finance a larger proportion of the con-

sumption needs of children; while women provide most of the transfers of services produced by unpaid work, such as childcare and household work. Although yearly net public benefits in old age are considerably smaller for women than for men in most countries due to their lower formal labour force participation levels, the total public benefits over the whole retirement period are larger for women than for men due to their longer life expectancy.²¹ Sustainability also requires a reasonable distribution of income between young and old, which is closely related to the social protection system. In Europe, WIC researchers have shown through a decomposition analysis that the increase in pensions, especially for older women, together with higher employment among the older population, has contributed to a situation in which the income of the young has stagnated or declined since 2008, while the income of the older population has increased.²²

¹⁹ Hammer, B., Prskawetz, A., Gál, R. I., Vargha, L., & Istenič, T. (2018). Human capital investment and the sustainability of public transfer systems across Europe. *Journal of Population Ageing*, 12(4), 427–452. <https://doi.org/10.1007/s12062-018-9224-8>

²⁰ Sanchez-Romero, M., Lee, R. D., & Prskawetz, A. (2020). Redistributive effects of different pension systems when longevity varies by socioeconomic status. *The Journal of the Economics of Ageing*, 17, 100259. <https://doi.org/10.1016/j.jeoa.2020.100259>

²¹ Hammer, B., Spitzer, S., Vargha, L., & Istenič, T. (2020). The gender dimension of intergenerational transfers in Europe. *The Journal of the Economics of Ageing*, 15, 100234. <https://doi.org/10.1016/j.jeoa.2019.100234>

²² Hammer, B., Spitzer, S., & Prskawetz, A. (2021). Age-specific income trends in Europe: The role of employment, wages, and social transfers. *Social Indicators Research*. <https://doi.org/10.1007/s11205-021-02838-w>



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Fertility and Family

■ *Global trends.* WIC research has contributed significantly to our understanding of global fertility. Researchers have studied the determinants of family preferences and their realisation, the role of education differentials in shaping desired fertility and family behaviour, the effect of early fertility desires on later union formation outcomes, the role of human capital in reproductive decision-making, and the impact of family policies.

An important (if negative) finding emerged from an examination of countries in Europe, East Asia and North America that completed the transition to around-replacement fertility in the 1950s–1980s, and of countries with more recent fertility declines towards replacement level: namely, there is no obvious theoretical or empirical threshold around which period fertility tends to stabilise.²³ Period fertility rates usually continue falling once the threshold of replacement fertility is crossed, often to very low levels. However, due to the shift to late childbearing, period fertility typically remains unstable, while cohort fertility tends to stabilise. Un-

derscoring the observation that there is no universal pattern, another study found that the transition to sub-replacement fertility in some Latin American countries has been characterised by a bi-modal fertility pattern, whereby period rates remained high for very young women, declined for women in the middle years of their reproductive life span, and rose for women nearing the end of their reproductive life span.²⁴ This pattern suggests that the class and income distribution plays an important role in this transition.

Because it is of such importance for future global population trends, and in light of grave concerns about the socio-economic developments in Africa under conditions of climate change, the issue of African fertility is of special concern. WIC research has made a credible case that the stalling of the African fertility decline around 2000 was attributable not only to turmoil on the continent around that time, but also to earlier disruptions in the education of women who were of childbearing age at that time giving rise to both cohort and period effects, with more

²³ Sobotka, T. (2017). Post-transitional fertility: The role of childbearing postponement in fuelling the shift to low and unstable fertility levels. *Journal of Biosocial Science*, 49(S1), S20–S45. <https://doi.org/10.1017/S0021932017000323>

²⁴ Lima, E. E. C., Zeman, K., Sobotka, T., Nathan, M., & Castro, R. (2018). The emergence of bimodal fertility profiles in Latin America. *Population and Development Review*, 44(4), 723–743. <https://doi.org/10.1111/padr.12157>

Biological, Individual and Contextual Factors of Fertility Recovery

PI: Eva Beaujouan

ERC-2020-COG-101001410-BIC.LATE

Time Frame: 01.09.2021 – 31.08.2026

Website: <https://cordis.europa.eu/project/id/101001410>



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A few decades ago, most women had their children in their twenties. Today, across the high-income and low-fertility countries, the number of people who decide to have children after their 30th birthday is rising, but the factors affecting fertility at these ages are not well known. Whether individuals in their thirties are able to meet certain conditions has become key to their fertility decisions. Thus, whether women and men have or do not have children, and how many they have, are increasingly determined by their desire and ability to have children at later reproductive ages.

The objective of the BIC.LATE project is to study the biological, individual and contextual aspects of later reproduction. The project will assess the importance

of infertility and assisted reproduction for fertility recuperation; investigate new inequalities that could arise in that context; and seek to explain differences in fertility levels across the low-fertility countries. For this purpose, the BIC.LATE project will combine data on infertility and assisted reproduction with aggregate indicators of cohort fertility to gauge the effects of biological limits on fertility recuperation. The BIC.LATE project will also use contemporary data to identify the remaining individual demographic and socio-economic factors of later fertility, to examine the role of the structural and the cultural context of a country in fertility recuperation, and to assess how these factors are related to fertility recuperation.

Thus, the BIC.LATE project will challenge the assumption that fertility patterns are global, but are driven by different factors depending on age. It will also link the conditions at the time of fertility recuperation to today's and tomorrow's fertility levels. Finally, it will inform policymakers about the major drivers of future fertility across the low-fertility countries.

poorly educated women having children, and having them when exposed to unfavourable conditions.²⁵ By comparing actual trends with counterfactual trends based on the assumption of no education stalls, the researchers assessed the magnitude of the effect of educational discontinuity to be up to half a child per woman in 2010, and 13 million fewer live births over the 1995–2010 period.

²⁵ Kebede, E., Goujon, A., & Lutz, W. (2019). Stalls in Africa's fertility decline partly result from disruptions in female education. *Proceedings of the National Academy of Sciences*, 116(8), 2891–2896. <https://doi.org/10.1073/pnas.1717288116>

WIC research also confirmed the sensitivity of fertility to near-term shocks, whether in Europe due to the Great Recession²⁶, or in China when there were wide swings in marriage and birth policies in 1989 (tightening), 2002 (relaxation) and 2013 (abandonment).²⁷

²⁶ Matsiaki, A., Sobotka, T., & Vignoli, D. (2021). The Great Recession and fertility in Europe: A sub-national analysis. *European Journal of Population*, 37(1), 29–64. <https://doi.org/10.1007/s10680-020-09556-y>

²⁷ Zhang, C., & Sobotka, T. (2021). Drastic changes in fertility level and timing in response to marriage and fertility policies: Evidence from Shandong province, China. *China Population and Development Studies*, 5(3), 191–214. <https://doi.org/10.1007/s42379-021-00089-3>

Globalisation- and Technology-Driven Labour Market Change and Fertility

PI: Anna Matsiaki

ERC-2019-COG-866207-LABFER

Time Frame: 01.10.2020 – 30.09.2025

Website: <http://labfer.uw.edu.pl/>



European Research Council
Established by the European Commission

LABFER is the first project that comprehensively studies fertility decisions in the changing world of work. Technological changes and globalisation have led to an unprecedented transformation of the ways we live and work. New jobs and earnings opportunities are emerging that are enabling us to be more flexible in how, where and when we are working. At the same time, however, the demands on workers have increased with the intensification of global competition, and with the availability of smartphones and the internet, which have made it more and more difficult to disconnect from work.

These changes have had a tremendous impact on various aspects of our lives, such as on our time allocation, our economic and mental wellbeing, and our health. While they are also influencing our family life, including our childbearing decisions, this influence has not been fully studied or understood. The LABFER project studies the impact of these labour market changes on fertility, examines the individual mechanisms behind these effects, explores the role of the rise in inequality in fertility decisions, and investigates how family and employment policies can help to mitigate the effects of labour market changes on fertility.

While this ERC grant grew out of the VID and was submitted through it, the PI later decided to move it to the University of Warsaw.

WIC researchers have examined educational differentials in fertility rates across countries and over time, and have found that, with few exceptions, highly educated women continue to have the lowest fertility and the highest likelihood of childlessness. They also showed that these differentials persist across regions and over time. The education-fertility differential appears to reflect a wider gap between intended and realised fertility more than it does lower intended fertility, which suggests that there is still room for family policies and gender-sensitive reforms to close the educational fertility gap.

At the same time, there have been episodes in which the education-fertility relationship has been counter-intuitive. In Europe and the United States, women's educational attainment started to increase around the middle of the 20th century. This was expected to result in fertility decline and postponement; whereas in fact, the opposite occurred, in form of the Baby Boom. Analysing the completed fertility of the Baby Boom cohort in 15 countries, a team including WIC researchers found that, over the 1901–45 birth cohorts, the proportion of childless couples declined, and there was an increase in the progression from one to two children,

Birth Barometer: Monitoring of Fertility in Austria

The Birth Barometer features up-to-date data, graphs and analyses on fertility trends in Austria and in Vienna. It is available in English and German. Period fertility data and indicators are computed and analysed in both annual and monthly formats, which allows for a more detailed look at short-term fertility trends following policy changes, economic shocks and the recent COVID-19 pandemic. Six individual presentations provide in-depth coverage of period and cohort fertility, fertility timing, migrant fertility, male fertility and fertility in Vienna. The underlying data are available for download as a single data file.

Website: <https://www.birthbarometer.at/>

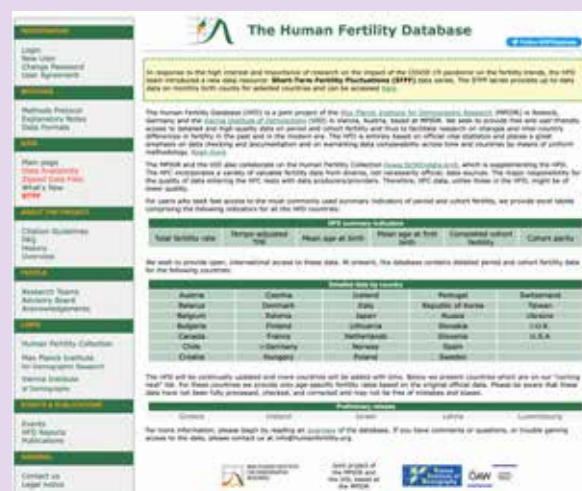


Human Fertility Database, Human Fertility Collection, and Short-Term Fertility Fluctuations

The Human Fertility Database (HFD) is a joint project of the Max Planck Institute for Demographic Research (MPIDR) in Germany and the Vienna Institute of Demography (VID) in Austria, based at the MPIDR. It provides free and user-friendly access to detailed and high-quality data on period and cohort fertility, and thus facilitates research on changes and inter-country differences in fertility in the past and in the modern era. The HFD is entirely based on official vital statistics, and places considerable emphasis on data checking and documentation, and on ensuring data comparability across time and countries by means of the application of a uniform methodology.

The Human Fertility Collection (HFC) has been designed to supplement the Human Fertility Database (HFD), and to incorporate a variety of international fertility data that are valuable for fertility research, but that do not meet all quality standards of the HFD.

In response to the COVID-19 pandemic, the HFD team established a new data resource: the Short-Term Fertility Fluctuations (STFF) data series. The STFF features



monthly data that are suitable for analysing the effects of the COVID-19 pandemic and other shocks on the trends in the number of births and fertility rates in high-income countries with good quality vital statistics data.

Website: <https://www.humanfertility.org>

Fertility, Reproduction and Population Change in 21st Century Europe

PI: Tomáš Sobotka

ERC-2011-StG-284238-EURREP

Time Frame: 01.02.2012 – 31.01.2017

Website: <https://www.eurrep.org/>



European Research Council
Established by the European Commission

This project analysed key issues related to fertility, reproduction and their implications for low-fertility societies. Particular attention was paid to the ways that cohort fertility rates, family size and fertility intentions are structured by level of education.

Many of the project's findings revealed long-term continuities in fertility and family behaviour, including the observation that broader regions across Europe have distinct trajectories of fertility and family changes that do not appear to be converging over time. As a result, diversity in fertility and family trends is likely to prevail across Europe and other highly developed regions in the coming decades, even as many countries are adjusting their policies and institutions to low fertility levels and the ongoing changes in families.

while the progression to a third child and beyond declined – a trend that resulted in the broadly perceived two-child norm, which is considered an intrinsic characteristic of low-fertility societies.²⁸

WIC research has demonstrated that it is not only girls' education, but also women's access to electricity and modern cooking fuels, that enhances women's ability to make reproductive choices, which is empirically expressed by falling birth rates.²⁹ Energy and education effects are complementary, and are strongest in regions with initially high fertility rates. Since expanded access to modern energy, as well as to education, appears to accelerate the demographic transition, thus reducing population growth, it has the potential to accelerate the transition to energy sustainability – which is a counter-intuitive conclusion. While improvements in health may also be expected to accelerate the demographic transition, in a growth model with differentiated improvements in male and female health, WIC researchers identified a dilemma.³⁰ Improvements in female health accelerate the demographic transition, boosting long-term growth. However, because of sex preferences, households prefer improvements in male health over improvements in female health. As male children are preferred to female children, improved male survival raises

fertility rates, delaying the demographic transition and the economic growth benefits it confers. Thus, the short-run interests of households are inconsistent with long-run development goals, and with the interests of their own children.

■ *Extreme fertility regimes – late and extremely late; low and extremely low.* Unsurprisingly in view of its location, a strong focus of WIC research has been on low-fertility countries in general, and a comparative European perspective in particular. Two phenomena of increasing



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importance are very low fertility and late (at ages 40+) fertility. Regarding the former, WIC researchers produced the first global analysis of the contribution of changing parity progression to fertility decline in 32 countries that eventually reached very low levels of completed cohort fertility.³¹ This analysis revealed that among women born

²⁸ Van Bavel, J., Klesment, M., Beaujouan, E., Brzozowska, Z., Puur, A., Reher, D., Requena, M., Sandström, G., Sobotka, T., & Zeman, K. (2018). Seeding the gender revolution: Women's education and cohort fertility among the baby boom generations. *Population Studies*, 72(3), 283–304. <https://doi.org/10.1080/00324728.2018.1498223>

²⁹ Belmin, C., Hoffmann, R., Pichler, P.-P., & Weisz, H. (2022). Fertility transition powered by women's access to electricity and modern cooking fuels. *Nature Sustainability*, 5(3), 245–253. <https://doi.org/10.1038/s41893-021-00830-3>

³⁰ Bloom, D. E., Kuhn, M., & Prettnner, K. (2020). The contribution of female health to economic development. *The Economic Journal*, 130(630), 1650–1677. <https://doi.org/10.1093/ej/ueaa061>

³¹ Zeman, K., Beaujouan, E., Brzozowska, Z., & Sobotka, T. (2018). Cohort fertility decline in low fertility countries: Decomposition using parity progression ratios. *Demographic Research*, 38(25), 651–690. <https://doi.org/10.4054/DemRes.2018.38.25>

Parenthood and Wellbeing

Bernhard Riederer

Against the background of low birth rates, problems with reconciling family and work, and the “regretting motherhood” debate, Bernhard Riederer investigates in this book the effects of parenthood on happiness and life satisfaction using data from 30 European countries. The empirical analysis shows that characteristics at the individual, couple and social level systematically influence the relationship between parenthood and subjective wellbeing. There are both positive and negative effects of having children that depend on factors like the par-

ents’ life stage, their partnership status, the processes between the partners, the availability of childcare and the socially dominant values. This book is available in German.



Riederer, B. (2018). *Elternschaft und Wohlbefinden: Kinder im individuellen, partnerschaftlichen und gesellschaftlichen Kontext*. Springer VS. <https://doi.org/10.1007/978-3-658-22561-2>

between 1940 and 1955, the fertility decline was mostly driven by reductions in third- and higher-order births. By contrast, among women born between 1955 and 1970, there were different routes to low and very low completed fertility: in some regions it was driven by falling second-birth rates; and in others it was driven by decreases in first-birth rates, i.e., increased childlessness. Between 1950 and the 1980s, fertility after age 40 fell sharply, but this trend reversed in the 1990s due to a steep rise in first births after 40. As researchers from the WIC have documented for developed countries, this reversal has been much more pronounced for women than for men.³² However, from the 1990s onwards, the prevalence of late first births increased rapidly, especially in countries where it was initially lowest. There has, moreover, been a growing phenomenon of “very late” first births after age 48, demonstrating that the biological limits of childbearing are being increasingly stretched.

■ *Realisation of fertility intentions.* Recent WIC research has focused on fertility intentions and gaps between intended and realised fertility. It has, for example, been shown that Eastern European (post-socialist) couples are three times more likely than couples in other parts of Europe to experience an unintended or sooner-than-intended birth.³³ Comparing 19 European countries and the U.S., WIC researchers found that when the

intended number of children of women aged 20–24 in the early 1970s was compared to their eventual completed fertility, women in all countries ultimately had, on average, fewer children than they had expected to have earlier in life, and remained childless more often than they had intended.³⁴ The aggregate intentions-fertility gap tends to be largest among highly educated women in most countries studied. In a paper covering 11 European countries that explored an entirely new issue, WIC researchers found that the realisation of fertility intentions was demonstrably lower in urban than in rural regions, largely because the postponement of childbearing was much more common in cities, perhaps in response to housing challenges.³⁵ Another study covering both Western and Eastern/Central Europe addressed the question of whether the higher fertility of religious individuals was associated with higher intended fertility or greater success in achieving intended fertility. The results showed that people’s religiosity had little effect on their likelihood of achieving their intended fertility, which implies that faith influences fertility intentions, rather than realised fertility.³⁶

³² Beaujouan, E. (2020). Latest-late fertility? Decline and resurgence of late parenthood across the low-fertility countries. *Population and Development Review*, 46(2), 219–247. <https://doi.org/10.1111/padr.12334>

³³ Brzozowska, Z., Buber-Ennsner, I., & Riederer, B. (2021). Didn’t plan one but got one: Unintended and sooner-than-intended parents in the east and the west of Europe. *European Journal of Population*, 37(3), 727–767. <https://doi.org/10.1007/s10680-021-09584-2>

³⁴ Beaujouan, E., & Berghammer, C. (2019). The gap between lifetime fertility intentions and completed fertility in Europe and the United States: A cohort approach. *Population Research and Policy Review*, 38(4), 507–535. <https://doi.org/10.1007/s11113-019-09516-3>

³⁵ Riederer, B., & Buber-Ennsner, I. (2019). Regional context and realization of fertility intentions: The role of the urban context. *Regional Studies*, 53(12), 1669–1679. <https://doi.org/10.1080/00343404.2019.1599843>

³⁶ Buber-Ennsner, I., & Berghammer, C. (2021). Religiosity and the realisation of fertility intentions: A comparative study of eight European countries. *Population, Space and Place*, 27(6), e2433. <https://doi.org/10.1002/psp.2433>



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Mortality, Longevity and Population Ageing

While the WIC has expertise in projecting all three components of population dynamics, fertility, mortality and migration; it has particularly deep expertise in the analysis and forecasting of population ageing. The WIC has made major contributions to the measurement of ageing, not only in chronological terms (whether backward- or forward-looking), but in the dimensions of health and cognitive ability. When the characteristics of the aged are added to their chronological age, the newly developed measures show not only that there will be less ageing in the future, but also that the faster the projected increase in life expectancy, the lower the projected speed of ageing.

WIC researchers have comprehensively studied international mortality trends, with an emphasis on differentials by sex and level of education. While most studies have explained life expectancy gains in developed countries by referring to improvements in

medical innovations and health behaviours, the role of changes in the education profiles of the population has not been investigated nearly as frequently. WIC researchers decomposed changes in population life expectancy at age 30 in Italy, Denmark and the U.S. between 1990 and 2010 into the effects of education-specific mortality changes and changes in the educational structure of the population.³⁷ While most of the increases in life expectancy were found to be due to the effect of changes in education level-specific mortality rates, the estimated contribution of the education compositional effect ranged from around 15% for men in the U.S. to approximately 40% for women in Denmark.

³⁷ Luy, M., Zannella, M., Wegner-Siegmundt, C., Minagawa, Y., Lutz, W., & Caselli, G. (2019). The impact of increasing education levels on rising life expectancy: A decomposition analysis for Italy, Denmark, and the USA. *Genus*, 75(1), 11. <https://doi.org/10.1186/s41118-019-0055-0>

Reassessing Ageing from a Population Perspective

PI: Sergei Scherbov

ERC-2012-AdG-323947-RE-AGEING

Time Frame: 01.04.2013 – 31.03.2019

Website: <https://cordis.europa.eu/project/id/323947>

This project developed new approaches to the study of age and ageing that are appropriate for 21st-century conditions. The project team developed a new paradigm in conceptualising population ageing: the Characteristics Approach to the measurement of population ageing. The hallmark of the approach is the consistent use of changing characteristic schedules together with changing age structures. The approach considers conventional measures of chronological age, but is far more general. The new approaches to measuring ageing based on people's characteristics that, for example, take into account increasing longevity were used to measure current and future ageing based on population

projections for almost all countries in the world up to 2100. Currently, these ground-breaking findings are being applied in the world's leading international source of data on population ageing: i.e., they are being incorporated into a UN official report on ageing. This milestone reflects a growing recognition that traditional measures no longer reflect the changing face of ageing around the world. We introduced a new and simple measure for human wellbeing across countries, called the Human Life Indicator (HLI), that expresses wellbeing in terms of years of life. This indicator is similar to life expectancy at birth, but takes inequality in life spans into account. By evaluating the wellbeing levels in selected countries over time, the researchers demonstrated that the behaviour of the HLI reflects the major political and economic events across the world in the last century.



Fair Pensions and Population Ageing

PI: Sergei Scherbov

ERC-2020-PoC-957509-PenAgeing

Time Frame: 01.01.2021 – 30.06.2022

Website: <https://cordis.europa.eu/project/id/957509>

With this project, Sergei Scherbov continued his research in the field of population ageing. The project worked on a detailed case study of intergenerationally equitable pension ages by providing policymakers with two kinds of tools that can facilitate structural adaptations in public policies. The project used new data and up-to-date measures on population ageing that were developed in the ERC RE-AGEING project, while taking into con-

sideration the changing characteristics of populations. Moreover, it applied an innovative methodology that produces scenarios of intergenerationally equitable normal pension ages based on the details of a specific pension system, and software that can be immediately updated every time the UN produces new data.

An important part of this project was the creation of a World Ageing Data Explorer, which enables researchers to evaluate most of the innovative measures of ageing, including intergenerationally equitable normal pension ages, for all countries of the world, and to easily present and compare the results of these evaluations.

Probably no contribution of WIC researchers to the study of mortality and ageing has been more influential than the introduction of the new mortality index of the age at which a person has a given number of years (typically five or 15) left to live. For example, when old-age dependency ratios are calculated on the basis of the proportion of the population with a remaining life expectancy of 15 or less years, rather than the proportion of the population above a fixed chronological age such as age 65, comparisons between countries and trends over time differ markedly.³⁸

For example, when researchers constructed prospective dependency ratios for 1950–2100, these new measures presented a very different view of ageing in Central and South America.³⁹ The pace and the scale of ageing were considerably slower and smaller than they were when standard, orthodox measures based on fixed chronological ages were applied, which suggests that population ageing is more manageable through institutional reforms than it is often perceived to be. Thus, these new metrics not only have implications for labour market and social protection policies, but they also, if properly disseminated, have the potential to fundamentally

³⁸ Sanderson, W. C., & Scherbov, S. (2020). Choosing between the UN's alternative views of population aging. *PLOS ONE*, 15(7), e0233602. <https://doi.org/10.1371/journal.pone.0233602>

³⁹ Gietel-Basten, S., Saucedo, S. E. G., & Scherbov, S. (2020). Prospective measures of aging for Central and South America. *PLOS ONE*, 15(7), e0236280. <https://doi.org/10.1371/journal.pone.0236280>

The Demography of Skills and Beliefs in Europe with a Focus on Cohort Change

PI: Vegard Skirbekk

ERC-2009-StG-241003-COHORT

Time Frame: 01.10.2009 – 31.03.2015

Website: <https://cordis.europa.eu/project/id/241003>

The unifying element in this project was a global cohort-based assessment, the aim of which was to improve our understanding of population dynamics; to enable us to build better projection models; and to improve our capacity to identify, and thus to develop, more targeted

policies that relate to demographically changing societies. The project focused on studying cognition and other functional measures associated with productivity, religion and beliefs, and their associated determinants, from a multidisciplinary perspective. It found that “soft factors”, such as values and religion, are becoming increasingly important in determining demographic behaviour, including when socio-economic factors are accounted for.



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Past ERC Grant

Prospective Longevity: A New Vision of Population Ageing

Warren C. Sanderson

Sergei Scherbov

In this pathbreaking book, Warren Sanderson and Sergei Scherbov provide a new way to measure individual and population ageing. In addition to counting how many years we have lived, we should also consider the number of years we expect to live. This combination of years will define our “prospective age”. Two people who share the same chronological age probably have different prospective ages, because one will outlive the other. By incorporating changing characteristics, such as longevity, physical and mental health, into the measurement of ageing, Sanderson and Scherbov show how better demographic estimates can be generated, which can, in turn, inform better policy responses. Measuring prospective age helps us make sense of observed patterns

of survival, reorients our understanding of health in old age, and clarifies the burden of old-age dependency. The metric also produces valuable data for debates about equitable intergenerational pensions.



Sanderson, W.C., & Scherbov, S. (2019). *Prospective Longevity: A New Vision of Population Aging*. Harvard University Press. <https://doi.org/10.4159/9780674243316>

change public perceptions of and attitudes towards population ageing – with ageing becoming much less alarming when viewed from the new perspective. In addition, WIC researchers have helped to alleviate fears of the negative impacts of population ageing, this time in Europe, by applying a microsimulation approach. They demonstrated that under conditions of demographic ageing, a broad-based approach that involves increasing the labour force participation rates of the general population, encouraging education-selective immigration, and accelerating the integration of immigrants can improve economic performance.⁴⁰

⁴⁰ Marois, G., Bélanger, A., & Lutz, W. (2020). Population aging, migration, and productivity in Europe. *Proceedings of the National Academy of Sciences*, 117(14), 7690–7695. <https://doi.org/10.1073/pnas.1918988117>



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Migration

Recognising that migration is a major determinant of human capital accumulation (via immigration) and loss (via emigration), WIC researchers made path-breaking contributions to this area of research by estimating the first complete matrix of bi-lateral global migration streams by education level, especially in the context of population ageing in Europe and population growth in potential sending countries.

Most early WIC work on migration was undertaken in collaboration with the European Commission Joint Research Centre, specifically the IIASA/JRC Centre of Expertise for Population and Migration (CEPAM). Through this partnership, the WIC conducted studies to inform the migration policies of the EU Member States, and of the Commission itself. Following the push-and-pull approach, European demand for immigrants was estimated on the basis of population projections not only by age and sex, but by age-, sex- and education-specific labour force status. Scenarios for out-migration from countries of origin were constructed on the basis of alternative demographic scenarios combined with statistical analyses of past migration drivers and

climate change scenarios. Moreover, in collaboration with CEPAM, WIC researchers employed micro-simulation models that included many more demographic variables – such as place of birth, duration of stay in the country and language use, among others – to assess the integration challenges associated with alternative future immigration scenarios.

As the effects of climate change have become more evident, their impact on migration is of growing concern. Indeed, even decades ago, fears about the effects of climate change were giving rise to doomsday scenarios of waves of “environmental refugees”. WIC researchers have conducted studies that have added nuance to the environmental refugee model, and have contributed to knowledge that can be used to identify potential migration hotspots. They were the first to provide a comprehensive meta-analysis of qualitative and quantitative evidence on the environmental drivers of migration in Africa. Taken together, the results of these analyses suggest that the influence of environmental change on migration is indirect, operating through impacts on other drivers of migration, includ-

ing socio-demographic, economic and political factors.⁴¹ Since migration-environment relationships are contingent on the nature and the duration of the environmental pressure, the livelihoods of the populations, the role of kinship ties and demographic differentials, and other contextual factors, it is impossible to derive a simple prediction of whether environmental change will increase or suppress migration in Africa.

Another meta-analysis, synthesising the worldwide evidence from 30 country-level studies on how environmental change affects migration, found that these effects are more likely to cause internal or intra-regional, not inter-continental, migration; and are conditional on the presence or the absence of conflict.⁴² In another study based on

⁴¹ Borderon, M., Sakdapolrak, P., Muttarak, R., Kebede, E., Pagogna, R., & Sporer, E. (2019). Migration influenced by environmental change in Africa: A systematic review of empirical evidence. *Demographic Research*, 41(18), 491–544. <https://doi.org/10.4054/DemRes.2019.41.18>

⁴² Hoffmann, R., Dimitrova, A., Muttarak, R., Crespo Cuaresma, J., & Peisker, J. (2020). A meta-analysis of country-level studies on environmental change and migration. *Nature Climate Change*, 10(10), 904–912. <https://doi.org/10.1038/s41558-020-0898-6>

IIASA-JRC Centre of Expertise on Population and Migration (CEPAM)

PI: Wolfgang Lutz and Alain Bélanger
IIASA, JRC

Time Frame: 20.06.2016 – 31.12.2020

Website: <https://iiasa.ac.at/projects/cepam>

Like many national governments, the European Commission was taken by surprise by the wave of refugees that entered Europe in 2015. While the Commission's in-house research service (JRC) employed more than 2000 scientists addressing a range of economic, environmental and technical issues, it had little expertise in the social sciences, and none in demography and migration. Thus, IIASA, under the leadership of Wolfgang Lutz and Alain Bélanger, was invited to join forces with the JRC to study the scientific basis and the drivers of migration, and to prepare alternative future scenarios to inform migration-related policymaking in Europe.

Demographic and human capital scenarios for the 21st century

In October 2018, IIASA and the JRC published a book that examined potential future scenarios of population trends across the world, while taking into account migration, fertility, mortality, education and labour force participation. The book looked at the population outcomes for 201 different countries, based on three different migration scenarios in addition to different fertility, mortality and education scenarios. The “medium” scenario assumes that migration rates will remain similar to the average level observed for each country from 1960 to 2015. The “double migration” scenario assumes twice the average level of in- and out- migration rates. The “zero migration” scenario assumes no migration. These scenarios can serve as first benchmarks to understand how migration affects population size and structures. This book was followed by more specific studies on EU member states that also used micro-simulation approaches.



Lutz, W., Goujon, A., KC, S., Stonawski, M., Stilianakis, N. (Eds.) (2018). *Demographic and Human Capital Scenarios for the 21st Century: 2018 Assessment for 201 Countries*. Publications Office of the European Union. <https://doi.org/10.2760/835878>

Demographic scenarios for the EU: Migration, population and education

A flagship report from IIASA and the JRC was published in 2019. It examined the key factors that will shape European demographics over the coming decades. By examining the contributions not only of migration, fertility and mortality, but also of education levels and labour force participation rates, a more comprehensive view of possible futures was outlined than the conventional demographic projections allowed for. The first five sections of this report focused on demographic challenges inside the EU, such as population ageing, a shrinking labour force, more non-working people being dependent on working people, and the impact of high levels of emigration in some EU member states. With these challenges in mind and with a view towards 2060, the report built scenarios to illustrate the long-term effects of changes in key trends, and to assess whether the undesirable consequences can be limited or counteracted. As the EU and its demographics do not exist in isolation, the following sections explore the relevant trends for world demographics and for migration flows.



Lutz, W. (Ed.) (2019). *Demographic Scenarios for the EU - Migration, Population and Education*. Publications Office of the European Union. <https://doi.org/10.2760/590301>

two meta-analyses, the authors systematically reviewed the quantitative empirical literature on climate-related migration from a methodological perspective.⁴³ In total, information from 127 original micro- and macro-level studies was analysed to assess how different concepts, research designs and analytical methods shape our understanding of climate migration. The authors identified five key challenges: the i) measurement of migration and ii) climatic events, iii) the integration and

aggregation of data, iv) the identification of causal relationships, and v) the exploration of contextual influences and mechanisms.

The WIC's contribution to the migration aspect of the Shared Socioeconomic Pathways (SSP) narratives of future development used for climate change research has been especially significant.⁴⁴ The SSPs' population projections embody explicit, pathway-specific inter-

national migration assumptions that are only implicit in the projections of other variables. Quantifying the effects of international migration on income levels and income inequality across and within countries by comparing the original SSP projections to scenarios of zero migration, WIC researchers found that, on average, migration tends to make the world richer in all SSP narratives, decreasing income inequality across countries and within most destination countries, but not affecting within-country inequality in origin countries.

⁴³ Hoffmann, R., Šedová, B., & Vinke, K. (2021). Improving the evidence base: A methodological review of the quantitative climate migration literature. *Global Environmental Change*, 71(4), 102367. <https://doi.org/10.1016/j.gloenvcha.2021.102367>

⁴⁴ Benveniste, H., Crespo Cuaresma, J., Gidden, M., & Mutarak, R. (2021). Tracing international migration in projections of income and inequality across the Shared Socioeconomic Pathways. *Climatic Change*, 166(3), 39. <https://doi.org/10.1007/s10584-021-03133-w>



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Demography in Time of Crisis: The WIC Response to COVID-19 and the 2015 Asylum-Seeker/Refugee Wave

■ **COVID-19.** The COVID-19 pandemic, which began early 2020, but is still taking a toll today and will likely continue to do so into the future, is the demographic event of a generation, if not a half century. WIC researchers have made significant contributions to the policy response. In a series of papers, advanced mathematical optimisation techniques were applied to analyse a question that policymakers across the world continue to grapple with: How should lockdowns, with all of the economic and social costs that they involve, be used in response to COVID-19 outbreaks? In one paper that applied a simple optimal control model, researchers found that very different strategies – one trying essentially to eradicate the virus, and another attempting merely to flatten the curve so fewer people urgently need healthcare when hospitals

are already filled to capacity – can perform similarly well in terms of the trade-offs between health and economic costs.⁴⁵ Another paper applying a more elaborate model found that an on-off-on approach – first locking down to choke off infections, then re-opening, then locking down again – can be optimal.⁴⁶ From the policymakers' point of view, the message is that an on-off-on again sequence, even if it arouses the public's

⁴⁵ Caulkins, J., Grass, D., Feichtinger, G., Hartl, R., Kort, P. M., Prskawetz, A., Seidl, A., & Wrzaczek, S. (2020). How long should the COVID-19 lockdown continue? *PLOS ONE*, 15(12), e0243413. <https://doi.org/10.1371/journal.pone.0243413>

⁴⁶ Caulkins, J. P., Grass, D., Feichtinger, G., Hartl, R. F., Kort, P. M., Prskawetz, A., Seidl, A., & Wrzaczek, S. (2021). The optimal lockdown intensity for COVID-19. *Journal of Mathematical Economics*, 93, 102489. <https://doi.org/10.1016/j.jmateco.2021.102489>

fury, is not an admission of failure, but an optimal strategy. On the other hand, the same paper demonstrated that optimal strategies are extremely sensitive to the relative valuation of health and economic damages; that different strategies sometimes perform equally well (or badly); and that the emergence of complex dynamics can result in extreme paths of state variables, such as the unemployment rate, including politically unacceptable ones. Taken as a whole, this body of research suggests that a degree of humility is needed that is far from evident in the shrill policy debate. At a deeper level, it suggests that even people who share a common understanding of the economics and the epidemiology of the COVID-19 pandemic can prefer dramatically different policies – or, to put it another way, the fact that people favour very different policies is not evidence that there are fundamental disagreements.

An immediate challenge facing public health authorities during the pandemic was how to estimate the prevalence of COVID-19 without conducting a massive, expensive and time-consuming set of seroprevalence studies. WIC researchers proposed a complementary estimation approach combining infection-fatality rates with reported case-fatality rates in order to indirectly estimate the fraction of people ever infected (from the total population) and detected (from the ever-infected).⁴⁷ Applying the technique to 20 U.S. states, the authors estimated, for example, that roughly one year into the pandemic, it was very likely that fewer than half of ever-infected persons had been detected.

WIC researchers were among the first to estimate the impacts of the pandemic on mortality and fertility. A microsimulation model calibrated on Chinese data was applied to four broad regions: North America and Europe, Latin America and the Caribbean, South-eastern Asia, and sub-Saharan African.⁴⁸ The results indicated that in regions with relatively high life expectancy, the COVID-19 pandemic would break the secular trend of increasing life expectancy if

the infection prevalence threshold exceeded 1 or 2%. At a 10% prevalence rate, the loss of life expectancy at birth would likely be more than one year in the high life expectancy regions (North America and Europe, Latin America and the Caribbean); while in the medium and low life expectancy regions (South-eastern Asia, sub-Saharan Africa), an infection prevalence of about 15% and 25%, respectively, would likely result in the loss of one year of life expectancy. To put it differently, the impact of COVID-19 on mortality is muted by competing hazards in high-mortality settings. In the area of fertility, WIC researchers working with monthly data from the Human Fertility Database identified the initial signs of the expected COVID-19 “birth recession”.⁴⁹ Initial evidence on pandemic birth trends in late 2020 and early 2021 showed a fall in the number of births associated with the pandemic, which, in combination with elevated mortality, pushed natural increase to record low levels. However, a more recent study, also based on monthly birth data through 2022, found that overall, the coronavirus pandemic did not result in a lasting “baby bust” in most of the in 37 developed countries analysed.⁵⁰ However, this summary picture hides distinct short-term downturns and upturns during the pandemic, illustrating the importance of real-time monitoring.

■ *The 2015 asylum-seeker / refugee wave.* WIC research has dealt with both the causes of the crisis and its impacts. Using a gravity model estimated with bilateral data on asylum-seeking applications for 157 countries over the 2006–2015 period, WIC researchers found that by affecting drought severity and the likelihood of armed conflict, climate conditions played a significant role in asylum-seeking in the latter years of the period studied.⁵¹ Particularly striking was the finding that the effect of climate on conflict occurrence was particularly relevant for countries in Western Asia, which suggests

⁴⁷ Sánchez-Romero, M., di Lego, V., Prskawetz, A., & Queiroz, B. L. (2021). An indirect method to monitor the fraction of people ever infected with COVID-19: An application to the United States. *PLOS ONE*, 16(1), e0245845. <https://doi.org/10.1371/journal.pone.0245845>

⁴⁸ Marois, G., Muttarak, R., & Scherbov, S. (2020). Assessing the potential impact of COVID-19 on life expectancy. *PLOS ONE*, 15(9), e0238678. <https://doi.org/10.1371/journal.pone.0238678>

⁴⁹ Sobotka, T., Jasilioniene, A., Galarza, A. A., Zeman, K., Nemeth, L., & Jdanov, D. (2021). Baby bust in the wake of the COVID-19 pandemic? First results from the new STFF data series. *SocArXiv*. <https://doi.org/10.31235/osf.io/mvvy62>

⁵⁰ Sobotka, T., Jasilioniene, A., Zeman, K., Winkler-Dworak, M., Brzozowska, Z., Galarza, A. A., Nemeth, L., & Jdanov, D. (2022). From bust to boom? Birth and fertility responses to the COVID-19 pandemic. *SocArXiv*. <https://doi.org/10.31235/osf.io/87acb>

⁵¹ Abel, G. J., Brottrager, M., Crespo Cuarema, J., & Muttarak, R. (2019). Climate, conflict and forced migration. *Global Environmental Change*, 54, 239–249. <https://doi.org/10.1016/j.gloenvcha.2018.12.003>

that climate conditions, as well as political factors, may have contributed to the events that led to the surge in asylum-seekers and refugees.

In response to the 2015 surge of asylum-seekers entering Austria, the WIC designed and implemented the pioneering Displaced Persons in Austria Survey (Di-

in significantly better health outcomes.⁵⁴

Finally, WIC researchers have come to grips with one of the most divisive issues in Europe: the impact of immigration on the religion composition of the population.⁵⁵ Focusing on Austria, they presented estimates of the religious composition for 2016 and projections until 2046 based on

Social Inclusion of Refugee Women

Judith Kohlenberger
Sophia Heyne
Bernhard Rengs
Isabella Buber-Ennsner

This book provides insights into the lives of female refugees in Austria, who are growing in number, but remain largely invisible in the public discourse. Drawing on data from a mixed-methods survey, the authors analyse refugees' social contacts, education and educational aspirations, participation in the labour market, and experiences of discrimination. They also look at the role of the family and family work in successful integration.

Highly detailed figures, data and facts are presented, and are contrasted with personal accounts. This book serves as a guide to countering prejudices and fostering peaceful coexistence in our modern migration society. This book is available in German.



Kohlenberger, J., Heyne, S., Rengs, B., & Buber-Ennsner, I. (2022). *Soziale Inklusion geflüchteter Frauen: Zur Rolle der Familie und Familienarbeit*. Nomos.

<https://doi.org/10.5771/9783748931331>

PAS), the first such survey implemented in post-crisis Europe, with a particular focus on human capital (educational attainment and professional qualifications), as well as attitudes and values.⁵² The respondents' educational levels were found to be higher, on average, than the levels of the population in the country of origin. The vast majority of the asylum-seekers were Muslim, with most being in the middle range of religiosity. The men interviewed tended to have more progressive gender attitudes than their compatriots at home. WIC survey research on self-assessed health and experiences with the Austrian health system generated practical public health policy recommendations.⁵³ A study comparing self-reported health for asylum-seekers in Germany and Austria concluded that unrestricted access to the health system on arrival in Austria resulted

several scenarios related to the three major forces affecting the religious composition: migration (including asylum-seekers), differential fertility and secularisation. The results suggested, first, that the dominant Catholic majority is bound to lose demographic ground to other, predominantly (but not only) Muslim populations; and, perhaps more important, that the Catholic majority will be significantly older than the religious minority population due to immigration and fertility differentials. The disparity between the older majority and the younger minority religious groups will further increase the cultural generation gap, which could have widespread social implications. At the same time, as immigrants age, the religious diversity of the elderly population will increase.

⁵² <https://www.oeaw.ac.at/vid/research/research-projects/dipas>

⁵³ Kohlenberger, J., Buber-Ennsner, I., Rengs, B., Leitner, S., & Landesmann, M. (2019). Barriers to health care access and service utilization of refugees in Austria: Evidence from a cross-sectional survey. *Health Policy*, 123(9), 833–839. <https://doi.org/10.1016/j.healthpol.2019.01.014>

⁵⁴ Georges, D., Buber-Ennsner, I., Rengs, B., Kohlenberger, J., & Doblhammer, G. (2021). Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees. *PLOS ONE*, 16(4), e0250821. <https://doi.org/10.1371/journal.pone.0250821>

⁵⁵ Potančoková, M., Jurasszovich, S., & Goujon, A. (2018). Consequences of international migration on the size and composition of religious groups in Austria. *Journal of International Migration and Integration*, 19(4), 905–924. <https://doi.org/10.1007/s12134-018-0575-z>

Closing Thought: The “Vienna School”

It was not too many years ago that the future of the human population was considered in simple high-low-medium growth scenarios, and was analysed as an exogenous variable in social and economic projections. The WIC and the associated “Vienna School” have, through the combination of demographic metabolism with its implications for evolving population composition, an emphasis on human capital and its link to resilience and sustainability in the face of global change, and multi-dimensional projection approaches, broadened our perspective on the role of population as both an agent and a subject of human development. In so doing, the WIC has established itself as the principal actor in the area of population and sustainable development. Underlying and informing this research is basic, policy-relevant work on fertility, mortality and migration; and on their implications for population structure and composition.

It is not just population, but the field of demography itself that has a metabolism. The foundation of the new Department of Demography at the University of Vienna, one of the three WIC pillars, now promises to train the new generation of global demographers at the post-graduate level. This department will provide a new generation of graduate students, post-docs and junior faculty with the opportunity to launch their teaching careers.

This appreciation started by proposing a new term, the “Vienna School”, to describe the demographic research that has emerged from the Austrian capital. Looking back over the last century, the emergence of various major schools of post-World War II demography can be traced. The American School, which was originally associated with the Office of Population Research at Princeton, and was concerned at its inception with global population trends, eventually expanded to the University of Pennsylvania, the University of California at Berkeley, the University of Chicago, and other major American universities; and it embraced a broader range of interests. The British School was largely associated with the London School of Economics, and was, in its early days, associated with methods of indirect estimation in a world characterised by data shortages. The French School, which was largely sociological, was supported by the state, and was based at

INED. In its early years, it concentrated on the demography of France and its former colonies, and it had a major influence on the United Nations Population Division when it was a French concession. The German



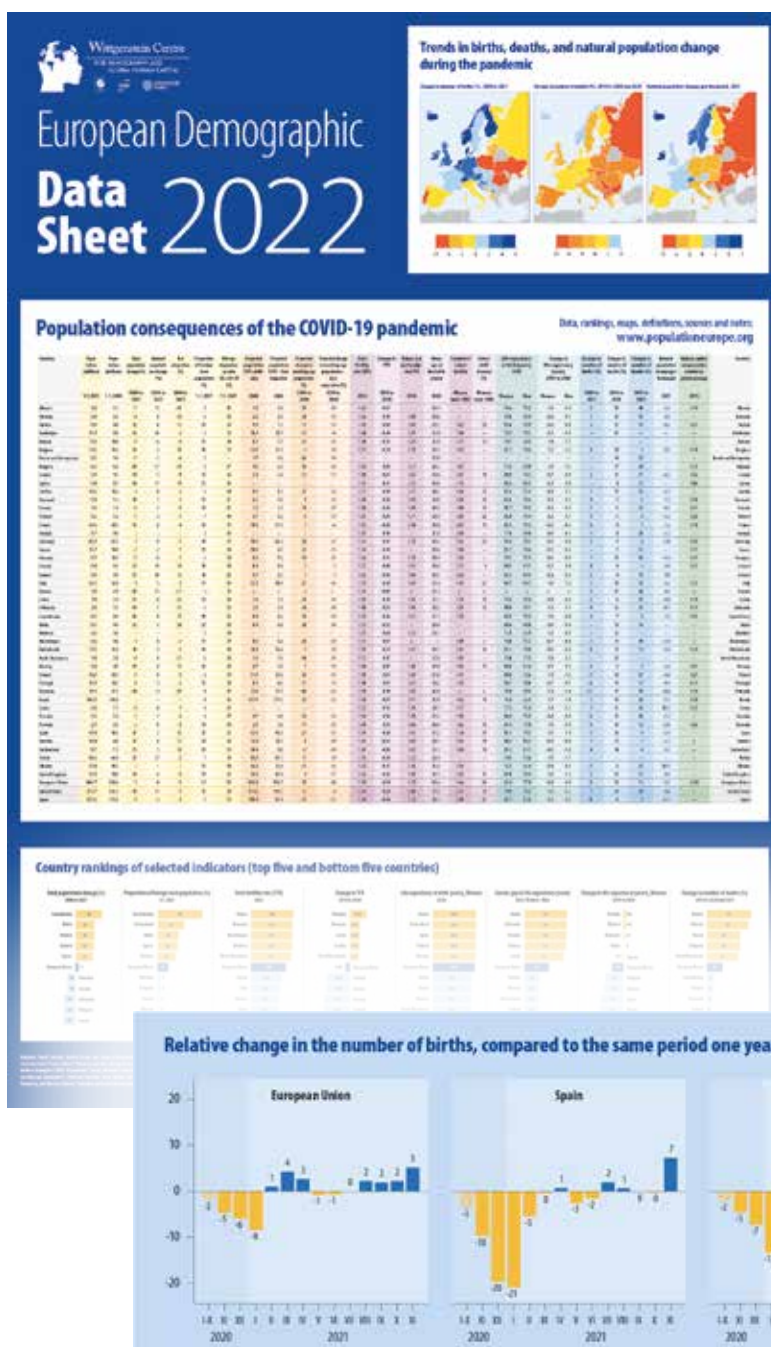
© Greg Reese/Pixabay

School was largely statistical and social, but was tragically derailed from a promising path by the National Socialist aberration in the 1930s. It is only in recent decades that it has re-emerged in the form of the Max Planck Institute in Rostock, with its emphasis on formal demographic approaches.

Demography has had other centres of research, of course, by no means all in the global North and West, but it would be an exaggeration to apply the term “school” to them. A school requires not only a geographical indicator, but an identifiable approach at its inception, and, as is implicit in the term, the capacity to generate new scholars grounded in its tradition. The “Vienna School”, with its combination of human capital, demographic metabolism and multi-dimensional population projection; with its intense focus on policy-relevant research that can help to promote resilience and sustainability in the face of global change; and, now, with its capacity to contribute to producing the next generation of demographers; satisfies all the criteria.

Demographic Data Sheets

European Demographic Data Sheets



The European Demographic Data Sheet reviews, explores and visualises recent population trends in 45 European countries. The Data Sheet is published every two years, and also provides a snapshot of the recent research by scientists at the Wittgenstein Centre and by collaborating researchers. The 2018 issue looks at changes in the educational composition of the population and the labour force, and new measures of economic dependency and healthy life years. The 2020 issue focuses on measuring and assessing education, wellbeing and internal migration; and on examining recent trends in fertility and mortality.

The most recent issue was published in June 2022. As well as presenting key demographic data and projections of population trends until 2050, it focuses on the demographic consequences of the COVID-19 pandemic.

The online version of the Data Sheet provides an expanded selection of maps, ranking tables, as well as theme-focused texts and figures. The latest European Demographic Data Sheet, together with archived versions (online and pdf) of all the past Data Sheets (2006-2020), are available at: <https://www.populationeurope.org/en/>.

Aging Demographic Data Sheet 2020



International Institute for
Applied Systems Analysis
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Wittgenstein Centre
FOR EDUCATION AND
GLOBAL HEALTH CARE



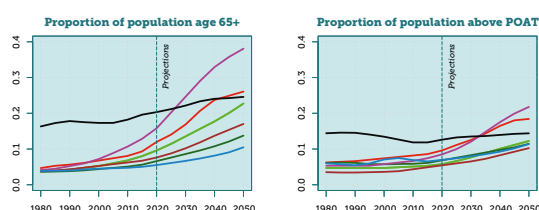
ATHLOS



Data Sheet on Population Ageing 2020

This updated issue of the Ageing Demographic Data Sheet 2018 presents comprehensive information on traditional and new measures of ageing developed at the Wittgenstein Centre for all countries in the world and for world regions, including projections for 2050. The 2020 Data Sheet shows population ageing trends and projections with a focus on traditional and alternative indicators of population ageing for current and future population changes across the world. Available at: <https://pure.iiasa.ac.at/16279>.

Selected countries



US Aging Data Sheet 2019

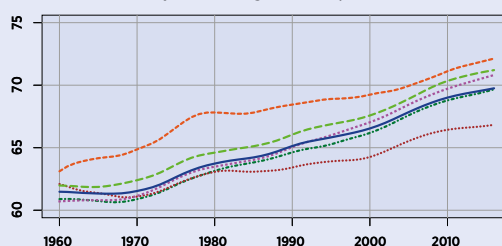


A large table of data from the US Aging Data Sheet 2019. The table has many columns and rows, displaying various indicators for different states and populations. The data is organized into sections, with the first section showing data for the United States as a whole, and subsequent sections showing data for individual states. The table includes a wide range of demographic and health-related indicators.

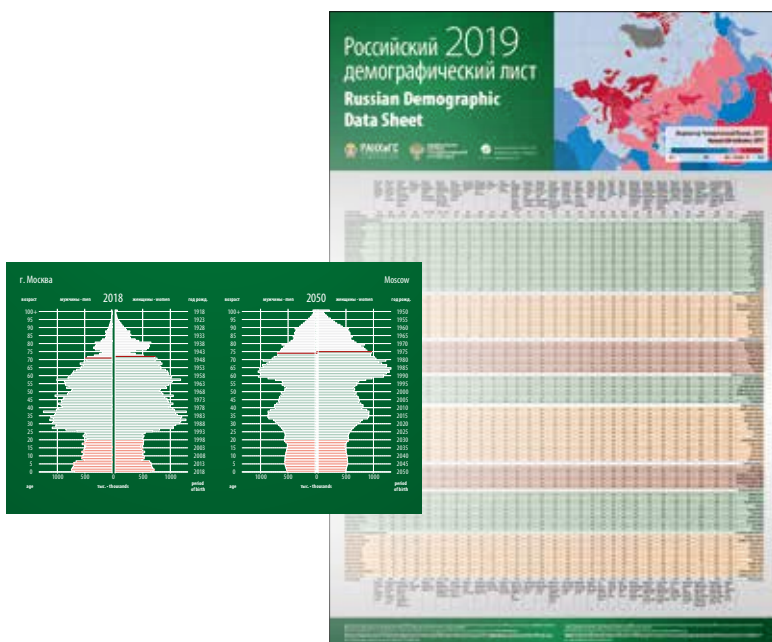
United States Ageing Data Sheet 2019

The first US Ageing Data Sheet presents comprehensive information on traditional and new measures of ageing, developed at IIASA, for all U.S. states. This Data Sheet uses the United States Mortality DataBase to analyse ageing across the U.S. states by: (1) contrasting conventional measures of ageing with new ones based on the Characteristics Approach to the Measurement of Population Ageing; and (2) providing new measures that are particularly appropriate for the current U.S. context. The Data Sheet provides new policy-relevant measures with respect to pension policies as well as policies to combat the opioid epidemic. Available at: <https://pure.iiasa.ac.at/16039>.

Prospective old-age threshold, males



Russian Demographic Data Sheet 2019



The Russian Demographic Data Sheet 2019 provides a comprehensive look at key demographic indicators and main population trends for all Subjects of the Russian Federation, including population projections to 2050. The Data Sheet combines national-level data with data for all regions and districts. It also features maps, population pyramids, rankings, graphs and a glossary. The Data Sheet pays special attention to the importance of using alternative indicators of population ageing in assessing the current and future population changes across Russia. All information is provided in Russian and English. The project is a collaboration between IIASA, the Russian Presidential Academy of National Economy and Public Administration (RANEPA) and the Russian Federal State Statistics Service (Rosstat). The 2022 update of the Russian Demographic Data Sheet is currently in the final stages of preparation. Available at: <https://pure.iiasa.ac.at/15652>.

Asian Demographic and Human Capital Data Sheet 2018



The Asian Data Sheet provides a window on indicators related to demographic changes and education processes in the countries of the region. It also includes data on labour force participation and urbanisation. For each indicator, the Data Sheet allows for a comparison of three data points: 2000, 2015 and 2030 according to a medium scenario projection. The 2018 issue focuses on an essential component of the education target of the United Nations' Sustainable Development Goals, 2030: namely, ensuring that all boys and girls complete secondary education. The Asian Data Sheet 2018 was prepared in collaboration with the Asian Demographic Research Institute (ADRI) in Shanghai. Available at: <https://pure.iiasa.ac.at/15367>.



All data sheets and more data can be accessed online:
<https://wittgensteincentre.org/en/data.htm>

Reports

Green Family: Generational Fairness in Climate Change

Anthropogenic climate change has not been caused by all of humanity equally, and its consequences will not to be experienced by all people equally. Large differences in the level of exposure to the effects of climate change exist between and within societies, as well as across generations. This report tries to address the question of how inter-generational equity and social justice considerations can be integrated into climate change mitigation and adaptation strategies. Green Family, which was created in cooperation with Population Europe, and is fund-

ed by the German Federal Ministry for Family Affairs, Senior Citizens, Women and Youth, has identified families as potential key actors in the struggle to reduce global warming, and to soften its impacts.

Striessnig, E., Mair, N., & Riepl, T. (2022). *Green Family: Generationengerechtigkeit im Klimawandel. Discussion Paper No. 14*. Max Planck Society/Population Europe. https://population-europe.eu/files/documents/pb34_green-family_de.pdf



Education: The Key to Global Sustainable Development

This report authored by Wolfgang Lutz and Claudia Reiter discusses evidence showing that education is at the centre of human life, and is the key to building a better world. The research findings, collated over the past 70 years, indicate that education is an “essential prerequisite” for humanity’s most important aspirations, including ending poverty and hunger, improving institutions and participation in society, promoting technological innovation and economic growth, and even enhancing humanity’s capacity to

adapt to the unavoidable effects of climate change.

Lutz, W., & Reiter, C. (2021). *Education: The Key to Global Sustainable Development. Yidan Prize Foundation Report*. Yidan Prize. <https://bit.ly/3rDEd3M>

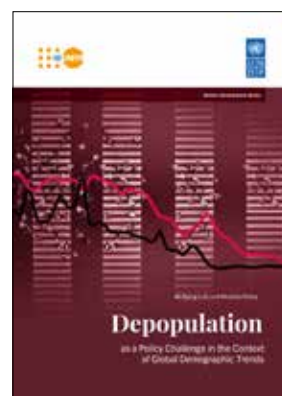


Depopulation as a Policy Challenge

Depopulation is a recurring theme in human history, but its contemporary causes tell a new story. Declining populations – which are now the by-product of the development process and of individual lifestyle choices – do not necessarily define the economic or geopolitical future of countries. This report from the United Nations Development Programme (UNDP) written by Wolfgang Lutz and Nicholas Gailey investigates depopulation from a multi-dimensional demographic perspective by looking not only at changes in population size and age structure, but

also at changes in educational attainment and labour force participation.

Lutz, W., & Gailey, N. (2020). *Depopulation As A Policy Challenge in the Context of Global Demographic Trends*. UNFPA, UNDP Serbia. <https://eeeca.unfpa.org/en/node/53482>



Labour Force Participation and Employment Integration of Immigrants in the EU

The report presents scenarios for the economic integration of immigrants from third countries. It looks at two dimensions of the economic integration of immigrants: labour force participation and employment. Using a microsimulation population projection model, it evaluates the impact of improved, continued or worsened levels of economic integration of immigrants in the EU and in individual member states. The results illustrate that integration policies should not focus solely on addressing barriers to employment for job seekers with a migrant background.

Marois, G., & Potančoková, M. (2020). *Scenarios of Labour Force Participation and Employment Integration of Immigrants in the EU: Demographic Perspective*. JRC Technical Report. Publications Office of the European Union. <https://doi.org/10.2760/021884>



Measuring Labour Mobility and Migration

Dilek Yildiz and Guy Abel are among the authors of this report, which evaluates the data on the movement of people and workers across the EU, with a special focus on new data sources that can be used to complement traditional sources of EU mobility statistics. The report takes stock of the advantages and disadvantages of new and traditional data sources, and looks at what is known about new methodologies using social media data. It then describes the data that have been collected, the pro-

posed models for estimating and nowcasting stocks and flows, and the results of applications of these models using real-world data. In addition, the report offers direction for the European Commission to potentially use this approach in the policy process.

Gendronneau, C., Wiśniowski, A., Yildiz, D., et al. (2019). *Measuring Labour Mobility and Migration Using Big Data*. Publications Office of the European Union. <https://doi.org/10.2767/474282>



The Digital Revolution and Sustainable Development

This report describes how digitalisation can transform the world, and how societies can plan for these changes as they move towards 2030 and beyond. More than 45 authors and contributors from 20 institutions, including Anne Goujon and Michael Kuhn, examined the major opportunities and challenges that digital technologies present in efforts to achieve the SDGs. They outline nine key considerations on the linkages between the digital and the sustainability revolutions – both positive and negative – and the critical issues that need to be addressed to maximise the opportunities and to minimise the risks of digitalisation

in efforts to secure a sustainable future for all. The report was released by IIASA, the United Nations University Institute for Environment and Human Security (UNU-EHS), and partners.

TWI2050. (2019). *The Digital Revolution and Sustainable Development: Opportunities and Challenges*. Report prepared by the World in 2050 initiative. IIASA. <https://doi.org/10.22022/TNT/05-2019.15913>



The Future is Now

In 2019, the United Nations published the first in a series of quadrennial Global Sustainable Development Reports to assess that progress that has been made in achieving the Sustainable Development Goals. This report of 15 independent scientists, among them Wolfgang Lutz, who were directly appointed by former UN Secretary-General Ban Ki-moon, strengthens the science-policy interface as an evidence-based instrument to support policymakers and other stakeholders in the implementation of the 2030 Agenda for Sustainable Development across the social, economic and environmental dimensions of sustainable development. It highlights state-of-the-art knowledge for moving societies towards sustainable development, and it identifies

concrete areas in which rapid, transformational change is possible. The report was received in person by the current Secretary-General, António Guterres, on 10 September 2019. The main lessons learned were discussed at a meeting on 11 September, and were ultimately presented at a high-level political forum, the SDG Summit, which took place on 24 September 2019 in New York.

Independent Group of Scientists appointed by the Secretary-General. (2019). *Global Sustainable Development Report 2019: The Future is Now – Science for Achieving Sustainable Development*. United Nations. <https://doi.org/10.18356/5d04ad97-en>



Health, Demography and Climate Change

The impact of climate change can be classified as an increasing threat to health in Austria. There are, however, many options for taking action to mitigate the health effects of climate change, and to reduce the vulnerability of the population to these effects. To initiate a transformation at the intersection of climate and health policy requires the cooperation of climate and health policymakers, as well as a scientific understanding of the current and the future distribution and composition of the population who will be vulnerable to the health effects of climate change. This APCC special report is a comprehensive inquiry, summary and assessment of the current scientific research on the complex relationship between health, demography and climate change. As

an evaluation report, the SR18 is the first special report after the publication of the Austrian Assessment Report 2014, which focused on the impact of climate change as a whole, with a special focus on population dynamics. Raya Muttarak was a co-chair of this project, while Erich Striessnig was a coordinating lead author and Thomas Fent and Roman Hoffmann were among the lead authors of the report.

APCC. (2018). *Österreichischer Special Report Gesundheit, Demographie und Klimawandel (ASR18)*. Austrian Panel on Climate Change (APCC), Verlag der OeAW. <https://sr18.ccca.ac.at/downloads/>



Other Research Reports

Wiedemann, A., Bowen, C.E., Di Giulio, P., Krivanek, D., Marcher, A., Sauerberg, M., Wegner-Siegmundt, C., & Luy, M. (2022). *Der Gesundheits-Survey der Klosterstudie. Daten- und Methodenbericht zu Welle II und Welle III*. VID Forschungsbericht 41. OeAW. <https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Publications/Forschungsberichte/FB41.pdf>

Buber-Ennsner, I., Berghammer, C., Fent, T., Gisser, R., Riederer, B., Sobotka, T., & Zeman, K. (2021). *Demografische Entwicklung und derzeitiger Stand der Familienformen*. In: 6. Österreichischer Familienbericht 2009 – 2019: Neue Perspektiven – Familien als Fundament für ein lebenswertes Österreich. Bundeskanzleramt. https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Publications/diverse_Publications/Familienbericht-6_Beitraege_2_6_13_Langfassung.pdf

Kohlenberger, J., Heyne, S., Rengs, B., & Buber-Ennsner, I. (2021). *Women's Integration Survey (WIN): Inklusion, Teilhabe und Enablement geflüchteter Frauen in Österreich*. WU Wien. https://www.ams-forschungsnetzwerk.at/downloadpub/2021_Forschungsbericht_WIS_August_2021_Kohlenberger_et_al.pdf

Kohlenberger, J., Weigl, M., Gaiswinkler, S., Buber-Ennsner, I., & Rengs, B. (2021). *COVID-19 und Migrationshintergrund. Erreichbarkeit, Umgang mit Maßnahmen und sozioökonomische Herausforderungen von Migrant/inn/en und Geflüchteten*. Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz. <https://bach.wu.ac.at/d/research/results/100114/>

Luy, M. (2021). *The Male Female Health Mortality Paradox: Research Report of the ERC Project HEMOX*. VID Forschungsbericht 40. OeAW. <https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Publications/Forschungsberichte/FB40.pdf>

Riederer, B. (2020). *Ausbildung, Job, Karenz? Die Erwerbskarrieren der Wienerinnen im innerösterreichischen Vergleich*. VID Forschungsbericht 39. OeAW. <https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Publications/Forschungsberichte/FB39.pdf>

Riederer, B. (2020). *Weibliche Erwerbskarrieren: Erwerbstätigkeit und Erwerbsunterbrechungen in Wien im innerösterreichischen Vergleich*. OeAW. https://www.oeaw.ac.at/fileadmin/subsites/Institute/VID/PDF/Projects/Wiefert/Riederer-2020-Weibliche_Erwerbskarrieren.pdf

Fent, T., Fürnkranz-Prskawetz, A., Hammer, B., & Danhel, G. (2019). *Demographischer Wandel – geänderte Rahmenbedingungen für den Sozialstaat? Research Report*. Bundesministerium Arbeit, Soziales, Gesundheit und Konsumentenschutz. <https://hdl.handle.net/20.500.12708/39858>

Sobotka, T., Matysiak, A., & Brzozowska, Z. (2019). *Policy Responses to Low Fertility: How Effective are They? Working Paper No. 1*. UNFPA. <https://www.unfpa.org/publications/policy-responses-low-fertility-how-effective-are-they>

UNIDO (2019). *Creating Opportunities through Vocational Training. Results of a Baseline Survey among Commercial Vehicle Drivers in Addis Ababa, Ethiopia*. UNIDO. https://open.unido.org/api/documents/14158583/download/Creating%20Opportunities%20Through%20Vocational%20Training_Misale%20Baseline%20Report.pdf

Vienna Yearbook of Population Research

Editor-in-Chief: Tomáš Sobotka

Editors: Paola Di Giulio, Vanessa di Lego, Miguel Sánchez-Romero, Sonja Spitzer

Managing Editor: Maria Winkler-Dworak

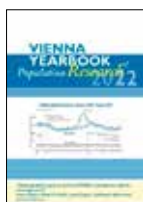
The Vienna Yearbook of Population Research (VYPR) is an open-access journal addressing population trends as well as a broad range of theoretical and methodological issues in population research. In addition to publishing *Research Articles* and *Review Articles*, the journal features *Data & Trends contributions*, which are shorter analytical or descriptive articles that focus primarily on empirical analyses; and *Perspectives* articles, which focus on ideas, concepts or theories. The journal also publishes *Debates* articles, which are



invited short contributions and reflections on selected questions and issues.

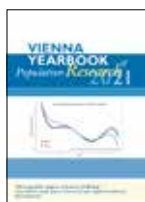
The journal has been published since 2003 by the Austrian Academy of Sciences Press, and is hosted by the Vienna Institute of Demography of the Austrian Academy of Sciences. While it is based in Austria, it aims to provide global coverage of population issues, and to attract high-quality contributions from authors from different regions and backgrounds. Since 2008, individual volumes have focused on selected themes.

All issues are available at: <https://viennayearbook.org>



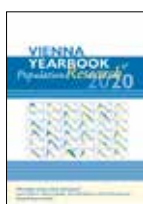
Demographic Aspects of the COVID-19 Pandemic and its Consequences – Vienna Yearbook of Population Research 2022, Volume 20 [doi:10.1553/populationyearbook2022]

Guest Editors: Paola Di Giulio, Anne Goujon, Guillaume Marois and Joshua Goldstein. The contributions in the 2022 issue address the demographic, economic and social consequences of COVID-19, and the lessons learned in terms of data needs and methods of analysis. Policy priorities for the future are also discussed.



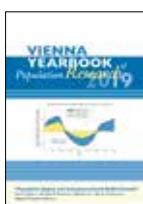
Demographic Aspects of Human Wellbeing – Vienna Yearbook of Population Research 2021, Volume 19 [doi:10.1553/populationyearbook2021]

Guest Editors: Sonja Spitzer, Vanessa di Lego, Angela Greulich, Raya Muttarak. The Vienna Yearbook 2021 explores demographic perspectives on the study of human wellbeing, while also bringing in different approaches and evidence from other scientific disciplines. It provides a deep dive into the concepts and measurements of human wellbeing.



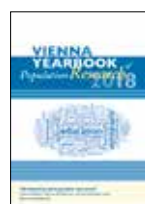
Fertility across Time and Space – Vienna Yearbook of Population Research 2020, Volume 18
[doi:10.1553/populationyearbook2020]

Guest Editors: Tomáš Sobotka, Aiva Jasilioniene, Kryštof Zeman and Diego Ramiro Fariñas. This 2020 issue of the Vienna Yearbook brings together many perspectives on the past, present and future of fertility. It also includes invited contributions that discuss the key drivers of future fertility.



Population Ageing and Intergenerational Redistribution. Vienna Yearbook of Population Research 2019, Volume 17
[doi:10.1553/populationyearbook2019]

Guest Editors: Bernhard Hammer, Ronald Lee, Alexia Prskawetz, Miguel Sánchez-Romero. This 2019 issue of the Vienna Yearbook shows the wide range of applications using National (Time) Transfer Accounts that were conducted in the EU-funded AGENTA project. This issue contains studies about population ageing, the welfare state, gender and intergenerational inequality, the division of labour, unpaid work, and informal care for different population subgroups.



Broadening Demographic Horizons Vienna Yearbook of Population Research 2018, Volume 16
[doi:10.1553/populationyearbook2018]

Guest Editors: Alexia Prskawetz, Sergei Scherbov und Warren C. Sanderson. This volume of the Yearbook presents papers that in one way or another challenge conventional ideas about how demographic studies are conceived and carried out. These papers cover concepts and developments related to multiregional, multistate and probabilistic population forecasts; population projections by education and labour force status; and causal models of migration.

POPNET – Population Network Newsletter

Since 1982, the World Population Program at IIASA (since 2021, the Population and Just Societies Program) has distributed the POPNET newsletter to an extensive network of researchers and institutes working in the fields of population and sustainable development. Moreover, since 2011, POPNET has also served as the newsletter of the Wittgenstein Centre. On a regular basis, POPNET provides collaborators and interested individuals with details on developments at the Centre and its pillars, includ-



ing on its current research and latest publications, and information on upcoming meetings and conferences. POPNET has been a fully online newsletter since July 2022.

Available at:

<https://iiasa.ac.at/popnet>

Demografische Forschung aus erster Hand

DFaEH is co-published by the Max Planck Institute for Demographic Research in Rostock, in cooperation with the Institute of Sociology and Demography at the University of Rostock, the Rostocker Zentrum zur Erforschung des Demografischen Wandels, the Federal Institute for Population Research in Wiesbaden, as well as the Vienna Institute of Demography and the Wittgenstein Centre in Vienna.

Since 2004, the open-access newsletter has been published four times a year, and has been available in both electronic and print versions. The aim of the editors, including Wolfgang Lutz, is to use the newsletter to strengthen the dialogue between researchers and the public. The newsletter is primarily addressed to journalists, politicians and interested parties in neighbouring fields of research. The newsletter presents relevant studies for Germany and/or Austria.

All issues are available at: <https://www.demografische-forschung.org/>





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Training & Education

On 1 October 2019, the University of Vienna opened a new Department of Demography (DoD) in the Faculty of Social Sciences. Headed by Wolfgang Lutz, this department is a strong university-based pillar of the Wittgenstein Centre. As of October 2022, Erich Striessnig serves as head of the department. The DoD offers an English-language master's programme in Global Demography and a specialisation in Demography within the Vienna Doctoral School of Social Sciences (ViDSS).

Master's Programme in Global Demography

The two-year master's programme in Global Demography at the University of Vienna welcomed its first cohort of students in October 2021, and its second cohort in October 2022, enrolling around 30 new students each year. The principal aim of the programme is to give students a strong scientific grounding in the analysis and forecasting of demographic developments across the globe, and particularly in fertility, mortality and migration trends. Guided by leading experts in the field, students are given the opportunity to explore the multidimensional ramifications and implications of demographic change for economic, social, and environmental issues.

Students enrolled in the Global Demography master's programme explore the international demographic literature, learn how to

use important methodological tools, and acquire an array of skills that are transferable beyond academia. Thus, a graduate of the Global Demography programme will be able to deal with large volumes of complex scientific data, to evaluate their practical meaning, and to apply the findings to advance research and influence regional and global policymaking.

Alumni will be well-prepared for a wide variety of careers in academia, international organisations, NGOs, think tanks and research centres, national planning and statistical agencies, government bodies and consultancies.

Website: <https://studieren.univie.ac.at/en/degree-programmes/master-programmes/global-demography-master/>

Vienna Doctoral School of Social Sciences (ViDSS)

The Vienna Doctoral School of Social Sciences promotes innovative, excellent, problem-oriented research that aspires to contribute to societal debates, and to address key global challenges. Demography is one of the official fields of specialisation within the ViDSS.

The cohorts trained and supported by the ViDSS are part of a vibrant research environment and an international network. The ViDSS provides and fosters connections between a broad range of disciplinary, interdisciplinary and transdisciplinary perspectives. The ViDSS embraces the entire spectrum of epistemological, methodological and theoretical approaches that are employed at the Faculty of Social Sciences. Doctoral candidates receive research training that will enable them to write a doctoral thesis in a

wide range of fields, including communication, demography, development studies, nursing science, political science, science and technology studies, social and cultural anthropology and sociology. The ViDSS seeks to achieve the highest standards in doctoral training, and provides close supervision to ensure that students acquire a mastery of social scientific debates and relevant theories and methods. Thus, ViDSS graduates are highly employable both within and outside academia.

The inaugural cohort of doctoral students specialising in demography consists of 12 young demographers from around the world.

Website: <https://vds-sosci.univie.ac.at/>



© Fernando Martins

IIASA Young Scientists Summer Program (YSSP)

IIASA offers an annual summer program for PhD students seeking to undertake a scientific project on a topic related to the IIASA research agenda. Between 2018 and 2022, 22 junior researchers from around the world worked under the direct mentorship of experienced IIASA demographers in a unique interdisciplinary and international research environment. In the framework of

the Wittgenstein Centre, the YSSP participants benefit from an extended network of researchers who provide them with guidance and exchanges in the form of co-supervision, additional presentation opportunities and discussions.

Website: <https://iiasa.ac.at/yssp>

Selected WIC Events 2018–2022

Wittgenstein Centre Conferences

WIC Conference 2021: The Causes and Consequences of Depopulation

29 November - 1 December 2021,
via Zoom

While the overall global population has been growing, the number of countries and regions that are seeing a decline in their population size has been increasing; a process that has likely been accelerated by the COVID-19 pandemic. This conference addressed a wide range of challenges related to depopulation from economic, social, political and strategic perspectives. As well as exploring the oft-cited downsides of shrinking populations, the contributions highlighted the potential opportunities associated with this trend.

WIC Conference 2020: Demographic Aspects of the COVID-19 Pandemic and its Consequences

30 November - 1 December 2020,
via Zoom

Many of the most serious health, social and economic challenges associated with the COVID-19 pandemic were directly related to demographic factors. The contributions at this conference were centred around the significant demography-related consequences of the pandemic, including its effects on the labour market and migration, family-related behaviour (including possible effects on fertility), mortality, social and health care policies, and the distribution of the economic burden across the population.

WIC Conference 2019: Demographic Aspects of Human Wellbeing

11-12 November 2019, Vienna, Austria

This conference brought together researchers from around the world who were working on different aspects of human wellbeing from a specifically demographic perspective, including the heterogeneity in wellbeing, and



WIC 2019 © Barbara Simunics/VID

wellbeing over the life course. The aim was to position demography more prominently as a discipline that has much to contribute to the scientific study of human wellbeing, including in terms of the measurement of wellbeing and the analysis of its determinants.



WIC 2018 © Barbara Simunics/VID

WIC Conference 2018: Fertility across Time and Space: Data and Research Advances

5-7 December 2018, Vienna, Austria

Period fertility indicators are often unstable, undergoing unexpected downturns, up-swings and reversals. To account for these developments, new theories, methods and measures have been proposed. Moreover, the emergence of new datasets allows for in-depth comparisons of period and cohort fertility between countries (e.g., the Human Fertility Database (HFD) and the Human Fertility Collection (HFC)). This conference built on the expansion of data availability, and contributed to methodological and empirical advances in fertility research.

Information on the WIC Conferences, as well as presentations, posters and videos, are available at: <https://www.oeaw.ac.at/vid/events/conferences>

Measuring Population Ageing: Bridging Research and Policy

25-26 February 2019, Bangkok, Thailand

Recognising the diverse stages and characteristics of ageing in various regions of the world, as well as the developments and innovations in its measurement in the

tional Institute for Applied System Analysis (IIASA) and Chulalongkorn University, in collaboration with the Social Development Division of the Economic Commission for Asia and the Pacific (ESCAP), organised an international expert group meeting on “Measuring Population Ageing: Bridging Research and Policy”.

This expert meeting sought to take stock of different concepts and methodologies, and to assess their scope and limitations for supporting policy design, implementation and monitoring at the national, regional and global levels, including for monitoring and reviewing ageing-related Sustainable Development Goals. Experts from governmental and international organisations, research institutions and civil society organisations were invited to discuss the applicability of various measures of ageing in different contexts.



Measuring Population Ageing 2019 © Chulalongkorn University

framework of the ERC-funded RE-AGEING project, the Population Division of the Department of Economic and Social Affairs (DESA) of the United Nations, the Interna-

All presentations are available at: <https://www.un.org/development/desa/pd/events/expert-group-meeting-measuring-population-ageing-bridging-research-and-policy>

Wittgenstein Centre Colloquium

The WIC Colloquium is a series of demography-related talks at the WIC that originated at the VID. Since 2014, more than 90 demographers and researchers in adjacent fields from around the world have presented and discussed their latest research developments at this event. The

WIC Colloquium is organised by Claudia Reiter and Patrick Lazarevič.

More information, as well as documentation, are available at: <https://www.oeaw.ac.at/vid/events/wic-colloquium>

WIC
COLLOQUIUM

Other Selected Events (2018–2022)

■ **Demography Beyond Age and Sex: How Multidimensional Demography can Contribute to a Better Human Future on our Planet:** Inaugural lecture by Wolfgang Lutz, University of Vienna, 4 May 2022.

■ **The Demography of Sustainable Human Wellbeing:** Cyberseminar organised by IIASA, the Population-Environment Research Network (PERN) and The Center for International Earth Science Information Network (CIESIN) of Columbia University, 14-21 March 2022.

■ **Dateninfrastruktur für die empirische sozialwissenschaftliche Forschung:** OeAW – Statistik Austria Workshop, 19 October 2021.

■ **Demographic Consequences of COVID-19:** Online symposium hosted by IIASA and the Russian Presidential Academy of National Economy and Public Administration, 29 June 2020.

■ **Heterogeneous Dynamic Models of Economic and Population Systems:** Viennese Vintage Workshop 2019 hosted by the TU Wien and the VID, 5-6 December 2019.

■ **Demographic Analysis with Applications to Aging and Health:** High-level international research workshop organised by IIASA and the College of Population Studies, Chulalongkorn University, 4-22 November 2019.

■ **German-Austrian-Swiss Demographer's Meeting (DACH 19)** hosted by the VID, 23-25 October 2019.

■ **Is Europe Facing a Population Crisis?** Panel discussion organised by UNFPA, VID, IIASA and the Institute for Human Sciences (IWM), 18 October 2018.

■ **Statistische Woche 2018:** Conference co-organised by the VID, 11-14 September 2018.

■ **14th Viennese Workshop on Optimal Control and Dynamic Games:** Co-organised by Miguel Sánchez-Romero, 3-6 July 2018.

■ **Future of Health Care Systems: Annual Meeting & 100th Anniversary of the Austrian Economic Association (NOeG)** hosted by the TU Wien and the VID, 11-12 May 2018.

Selected Awards & Honours 2018–2022

2022



Eva Beaujouan, Nico van Nimwegen and Tomáš Sobotka at the EPC 2022 © VID

■ Eva Beaujouan received the Jan M. Hoern Award and Tomáš Sobotka received the Dirk J. van de Kaa Award from the European Association for Population Studies.

■ Sonja Spitzer received a Dr. Maria Schau-mayer Foundation Award for her doctoral dissertation.

■ Marc Luy was appointed as Honorary Professor at the University of Vienna.

■ Leora Courtney-Wolfman was awarded a GO.INVESTIGATIO Fellowship by the OeAW.

■ Claudia Reiter won a Best Presentation Awards at the 13th Young Demographers Conference 2022.

■ Alexia Fürnkranz-Prskawetz was elected as a member of Academia Europaea in the Economics, Business and Management Sciences section.



Sonja Spitzer at the award ceremony 2022 © Dr. Maria Schaumayer Stiftung

■ Caroline Berghammer received the Käthe-Leichter-Preis für Frauenforschung, Geschlechterforschung und Gleichstellung in der Arbeitswelt endowed by the Austrian Federal Ministry of Labour, Family and Youth.

■ Klaus Prettnner was ranked among the top 100 researchers under 40 years old in the Handelsblatt Ranking of Economists, 2021.

2021

■ Dalkhat Ediev received a Medal “For Irreproachable Work and Excellence”, III class, by the Russian Ministry for Science and Higher Education.

■ Ingrid Setz received the FIW Award for Women in Economic Research 2020 for her master thesis.

■ Sonja Spitzer received an Emerging Scholar Award at the Aging & Social Change Eleventh Interdisciplinary Conference.

2020

■ Sonja Spitzer received an honourable mention at the AK Science Award 2020 on challenges in public healthcare and long-term care.

■ Eva Beaujouan received a WU Best Paper Award 2020.

■ A WU Award for Outstanding Research Achievements 2020 was granted to the following WIC researchers: Eva Beaujouan, Zuzanna Brzozowska, Jesús Crespo Cuaresma, Anne Goujon, Endale Birhanu Kebede, Judith Kohlenberger, Wolfgang Lutz, Orawan Prasitsiriphon, Sonja Spitzer, Daniela Weber.

■ Wolfgang Lutz received an Honorary Doctoral Degree in Liberal Arts from Chulalongkorn University.

■ Raya Muttarak received a Best Alumni Award from Chiang Mai University.

■ Daniela Weber received the OeAW APART-GSK Fellowship 2019.

■ Jesús Crespo Cuaresma received the Vladas Jurgutis Award from the Bank of Lithuania.

2019

■ Judith Kohlenberger, Isabella Buber-Ennsner and Bernhard Rengs received the Kurt-Rothschild-Award 2019.

■ Moradkhaj, Wolfgang Lutz, Nandita Saikia, Erich Striessnig and Samir KC received a Best Paper Award at the Second Asian Population Forum.

■ Valeria Bordone and colleagues received a Poster Award at the WIC Conference 2019.

■ Sergei Scherbov received an Honorary Doctoral Degree in Liberal Arts from Chulalongkorn University.

■ Sonja Spitzer received a Poster Award at the Population Association of America Annual Meeting 2019.

■ Jesús Crespo Cuaresma and colleagues received the Scottish Journal of Political Economy Best Paper of the Year Prize 2018.



Isabella Buber-Ennsner, Judith Kohlenberger and Bernhard Rengs at the Kurt-Rothschild-Award 2019 © Astrid Knie/Renner Institut

■ Wolfgang Lutz was elected as a member of the pan-European Academy of Humanities, Letters, Law, and Sciences.

2018

■ Wolfgang Lutz as well as Jesús Crespo Cuaresma and colleagues received WU Best Paper Awards 2018.

■ Gustav Feichtinger received the Wissenschaftspreis der Österreichischen Forschungsgemeinschaft.

■ Judith Kohlenberger, Wolfgang Lutz and Maria Rita Testa received a WU Reward for Outstanding Achievements in Research.

Wittgenstein Centre Team Members

As per August 2022

Scientific Team Members

Guy Abel (IIASA)	Nicholas Gailey (University of Vienna, IIASA)	Klaus Prettnner (VID)
Saroja Adhikari (IIASA)	Simone Ghislandi (IIASA)	Claudia Reiter (University of Vienna, IIASA)
Arda Aktas (IIASA)	Richard Gisser (VID)	Bernhard Rengs (VID)
Ross Barker (VID)	Miguel González-Leonardo (IIASA)	Bernhard Riederer (VID)
Eva Beaujouan (University of Vienna)	Anne Goujon (IIASA)	Patrick Sabourin (IIASA)
Caroline Berghammer (University of Vienna, VID)	Raquel Guimaraes (IIASA)	Patrick Sakdapolrak (University of Vienna, IIASA)
Bernhard Binder-Hammer (VID)	Roman Hoffmann (IIASA, VID)	Miguel Sánchez-Romero (VID, IIASA)
Valeria Bordone (University of Vienna, IIASA)	Aayushma KC (IIASA)	Warren C. Sanderson (IIASA)
Zuzanna Brzozowska (VID)	Samir KC (IIASA)	Sergei Scherbov (IIASA)
Isabella Buber-Ennsner (VID)	Endale Birhanu Kebede (University of Vienna)	Ingrid Setz (VID)
Brian Buh (VID)	Michael Kuhn (IIASA)	Martina Siskova (VID)
Côme Cheritel (IIASA)	Patrick Lazarevič (VID)	Tomáš Sobotka (VID)
Marie-Caroline Compans (University of Vienna)	Ester Lazzari (University of Vienna)	Sonja Spitzer (University of Vienna)
Leora Courtney-Wolfman (VID)	Misun Lee (VID)	Nadia Steiber (University of Vienna, IIASA)
Jesús Crespo Cuaresma (IIASA, VID)	Wolfgang Lutz (IIASA, VID, University of Vienna)	Erich Striessnig (University of Vienna)
Paola Di Giulio (VID)	Marc Luy (VID, University of Vienna)	Andrea Tamburini (VID)
Vanessa di Lego (VID)	Landis MacKellar (IIASA)	Olena Tarasiuk (IIASA)
Afua Durowaa-Boateng (VID)	Marija Mamolo (IIASA, VID)	Daniela Weber (IIASA)
Dalkhat Ediev (IIASA)	Guillaume Marois (IIASA)	Maria Winkler-Dworak (VID)
Gustav Feichtinger (VID)	Moradhvaj (VID)	Stefan Wrzaczek (IIASA)
Thomas Fent (VID)	Magdalena Muszynska-Spielauer (VID)	Dilek Yildiz (IIASA, VID)
Michael Freiberger (IIASA)	Raya Muttarak (IIASA)	Kryštof Zeman (VID)
Alexia Fűrnrkranz-Prskawetz (VID, IIASA)	Orlando Olaya Bucaro (IIASA)	Ekaterina Zhelenkova (University of Vienna)
	Dimitar Philipov (IIASA)	
	Michaela Potančoková (IIASA)	

Statistics on WIC scientific employees as of August 2022

Total number of scientific employees	71
Male/female	39/32
Number of nationalities	24
Full-time equivalent in PY, core funding 2021	28
Full-time equivalent in PY, external funding 2021	18

Administrative Team Members

Heike Barakat (University of Vienna)	Binita KC (VID)	Gladys Shamirian (IIASA)
Inga Freund (VID)	Ani Minassian (VID)	Petra Schmutz (VID)
Lisa Janisch (VID)	Katja Scherbov (IIASA)	Barbara Simunics (VID)

WIC Fact Sheets

Climate Change and Demography

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_climatechangedemography.pdf



FACT SHEET

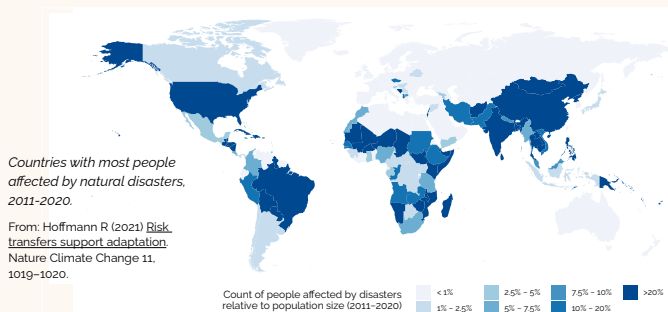
Climate Change and Demography

Humans and climate change

Human populations are at the center of climate change research. On the one hand, human activities contribute to climate change. On the other hand, changes in the climate system affect human wellbeing and livelihoods. Both the contribution to and the impact of global warming is not distributed equally across the planet. Rather, different people in different places contribute and suffer to different degrees, depending on their characteristics and their level of affluence. Climate risks are the outcome of differential exposure and vulnerability to hazards. Understanding the reciprocal relationships between human populations and climate change and how they will evolve in the future, thus, is crucial for policy design and planning, both in the area of mitigation and adaptation.

Vulnerability and adaptation

Wittgenstein Centre research comprises two key elements. First, we assess the direction and the extent to which climate change affects human populations with a focus on demographically differentiated vulnerability. Using advanced statistical methods, we produce the empirical evidence on how climate variability and extremes affect subgroups of populations depending on their sociodemographic characteristics, as well as location-specific aspects that affect their livelihoods. Different demographic outcomes are considered, including impacts on migration, health and well-being, and union formation and



fertility. Second, we apply demographic techniques, in particular, multidimensional cohort-component population projections to predict future vulnerability and adaptive capacity given changes in population composition and distribution under different scenarios. Such predictions of future vulnerability are of high societal relevance because they allow for more specific interventions to tackle foreseeable future threats.

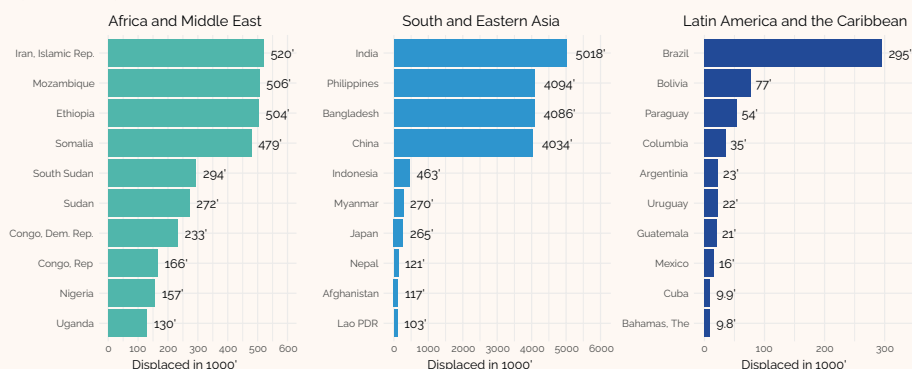
Regional differences

The impact of climate change is already being felt in all regions of the world. However, the impact is not distributed evenly. The areas where the population is already vulnerable, e.g. because of civil strife, high levels of poverty, and poor services and infrastructure will have lower capacity to respond to, cope with and adapt to

climate change. Rural areas that depend heavily on rain-fed agriculture will be vulnerable to food insecurity, while urban areas are vulnerable to heat extremes. Even in a high-income country like Austria, certain subgroups of the population, particularly the elderly, but also children, minorities and marginalized groups can be more vulnerable to climate risks than others due to their higher susceptibility to certain climatic hazards and lower adaptive capacity.

This includes also Austria, where population aging and increasing social vulnerability coincides with levels of warming exceeding the global average.

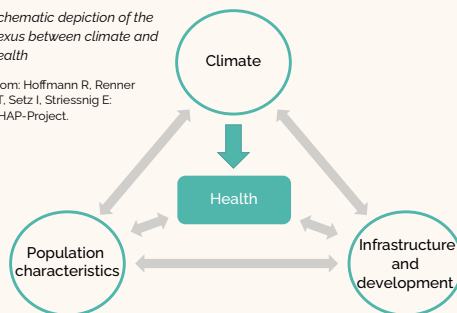
Disaster displacement in Africa and the Middle East, South and Eastern Asia, and Latin America and the Caribbean, 2019



Source: Internal Displacement Monitoring Centre (2020). From: Hoffmann R & Muttarak R (2021) *Environment, migration, and urbanisation: challenges and solutions for low- and middle-income countries*. T20 Task force on migration.

Schematic depiction of the nexus between climate and health

From: Hoffmann R, Renner AT, Setz I, Striessnig E: CHAP-Project.



Our research on the relationship between past temperature extremes and hospitalizations shows that elderly people are at a particular risk of becoming victims of heatwaves. As the Austrian population is aging rapidly and global warming leads to rising numbers of heat days every year, the health system will have to be prepared for carrying the additional burden of dealing with increasing numbers of patients, particularly during the hot summer months. While in the past, death was more concentrated in the cold season of the year, under future climates excess mortality is increasingly going to shift to the summer.

Also, preliminary statistical analyses show that climate change can hamper the global progress in eradicating gender-based violence and harmful practices. This points towards the need to better protect women and girls. As temperatures increase and crop failures become more prevalent, family resources are often put under severe strain in many parts of the global South, putting more and more women at risk of becoming victims of abuse.

The role of education

The climate-related research carried out at Wittgenstein Centre over the past couple of years has consistently shown that formal education matters for both climate change mitigation and adaptation. In particular, we show that providing at least secondary level of education universally can substantially reduce disaster vulnerability. At the same time, education enhances adaptive capacity through changing risk perception, increasing awareness, and improving socioeconomic resources necessary to implement adaptation and responses to change.

Further investments into both climate mitigation and adaptation are needed. In particular, a focus should be placed on those population groups that are characterized by a high vulnerability, making them more susceptible to the consequences of climate change. Together with demographic factors, social inequality and poverty are important vulnerability drivers. Policy can provide effective support by strengthening adaptive capacities and by building resilience, among others through increased education.

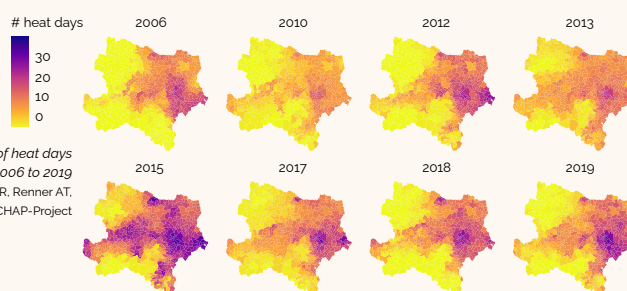
Uncertain future

Up until now, we have analyzed the impact of climate variability and extremes that occurred in a 1.2°C world (global mean near-surface temperature 1.2°C warmer than the pre-industrial level). Even under these comparably moderate levels of warming, we have already observed the effects on human health, wellbeing and livelihoods. For instance, there is evidence that migration increases in response to adverse climatic conditions. However, these effects are highly contextual and in some contexts, migration has also been shown to decline, as climate change deprives people of the resources necessary to afford to migrate.

Nonetheless, there are many things that we still do not know about the future, when much more extreme changes are likely. Given the current trends in greenhouse gas emissions, the global

average temperature is on the course of rising by 3°C compared to pre-industrial levels by the end of the century.

Projections of future climate impact typically consider only biophysical changes but neglect future societal changes. The key contribution of our work is to point out that the climate of the future will not match the societies of today i.e. emphasizing that future societal and demographic changes need to be accounted for when predicting future societies' vulnerability to climate change. We provide critical information for policy makers to improve decision-making related to tackling the impacts of future socioeconomic and demographic trajectories. We help identify specific population subgroups, as well as geographical vulnerability hotspots where interventions are most urgent given existing resource constraints.



Annual number of heat days in Vienna and Lower Austria, 2006 to 2019
Source: INCA, ZAMG. From: Hoffmann R, Renner AT, Setz I, Striessnig E: CHAP-Project

KONTAKT

Erich Striessnig
University of Vienna
erich.striessnig@univie.ac.at

Roman Hoffmann
OeAW and IIASA
roman.hoffmann@oeaw.ac.at

Raya Muttarak
IIASA and University of Bologna
muttarak@iiasa.ac.at

Web: www.wittgensteincentre.org
E-mail: press@wittgensteincentre.info
Twitter: [@WiCVienna](https://twitter.com/WiCVienna) (English) | [@demografie_wien](https://twitter.com/demografie_wien) (Deutsch)

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PUBLICATIONS

- Hoffmann R, et al. (2020) A meta-analysis of country-level studies on environmental change and migration. *Nature Climate Change* 10, 904–912.
- Hoffmann R, et al. (2022) Climate change experiences activate environmental concerns and promote green voting. *Nature Climate Change* 12, 148–155.
- Lutz W & Muttarak R (2017) Forecasting societies' adaptive capacities through a demographic meta-bolism model. *Nature Climate Change* 7, 177–184.
- Muttarak R (2021) Demographic perspectives in research on global environmental change. *Population Studies* 75, 77–104.
- Striessnig E, et al. (2019) Empirically based spatial projections of US population age structure consistent with the shared socioeconomic pathways. *Environmental Research Letters* 14, 114038.

RESEARCH PROJECTS

- APCC Special Report: Health, Demography and Climate Change, <https://sr18.ccca.ac.at/>
- Climate, Health and Population - Climate Change and Differential Vulnerabilities in the Metropolitan Area of Vienna (CHAP), <https://www.oeaw.ac.at/vid/research/research-projects/chap>
- Forecasting Societies Adaptive Capacities to Climate Change (FutureSoc), <https://iiasa.ac.at/pop/futuresoc>
- Just Transitions to net zero carbon emission for all (JustTrans4ALL), <https://iiasa.ac.at/web/si.html>
- Population Dynamics under Global Climate Change (POPCLIMA), <https://cordis.europa.eu/project/id/101002973>
- Warum auf Wissen nicht immer Taten folgen: Eine experimentelle Studie zu Barrieren klimafreundlichen Verhaltens im Labor und im Feld (StartClim), <https://startclim.at/projektliste>

Migration

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_migration_en.pdf



FACT SHEET Migration

Who migrates why?

The public discourse on migration is usually simplified and limited to the potentially large migration flows that are triggered by armed conflicts and wars, and economic deprivation. However, migration is a highly complex social phenomenon, and migration decisions depend on a variety of social, political and economic factors. Mobility includes flight, voluntary migration, systematic resettlement, and immobility. For a social and political debate, it is necessary to understand the reasons for migration, to know the socio-demographic characteristics of the population groups that migrate, and to analyze the consequences of migration flows on the societies in the country of origin and destination.

Migration in the EU

From a demographic perspective, is there a need for migration in the EU? Today, the EU member states have to deal with the long-term consequences of a changing population structure, above all aging societies and the resulting decline in the working population. Without immigration from third countries, the population in the EU would decline to 466 million by 2060 due to low birth rates, i.e. to the level of the 1980s. Migration can affect the size of the total population and the labor force, but it has only a limited effect on the age structure in the EU. This is partly due to the fact that migrants settle permanently in the destination country and thus, age just like the local population. Even if a high level of immigration increases the overall size of the working

population, this does not automatically result in a more balanced ratio between the working and non-working population. To achieve that, the effective economic integration of migrants is crucial.

Migrants in Austria

At the beginning of 2022, 1.8 million people were living in Austria who had been born abroad. The largest group of people with a country of birth other than Austria comes from Germany (2.8 %). Bosnia-Herzegovina (1.9 %), Turkey (1.8 %), Serbia (1.6 %), Romania (1.5 %), Hungary (1.0 %) and Poland (0.9 %) are also relatively frequent countries of origin. People born in Afghanistan and Syria currently represent 0.5 % and 0.7 %, respectively, of the population living in Austria. At the beginning of 2022, there were almost 16,500 people living in Austria who were born in Ukraine – most of them in Vienna (57 %).

Refugees in Austria

Who are the people seeking refuge in Austria? In a scientific survey conducted by the Wittgenstein Centre at the end of 2015, refugees who had recently come to Austria were interviewed. This was the first social survey in Europe in the context of the much-cited "refugee crisis" of 2015. Rather than merely "counting heads", the aim was to reveal what is in those people's minds, what education they bring with them, what their values and attitudes are, and what their health status is. The responses resulted in a differentiated picture of migrants.

- Refugees from Syria and Afghanistan are far better educated than the average population in their country of origin.
- While nine out of ten refugees in Austria rated their health as good or very good, in Germany it was only around seven out of ten. Overall, refugees recorded a high level of satisfaction with the Austrian health system and low barriers to health care access.
- Women, the elderly and people from Afghanistan are particularly vulnerable groups with poorer health on average.

What is the situation of refugee women in Austria?

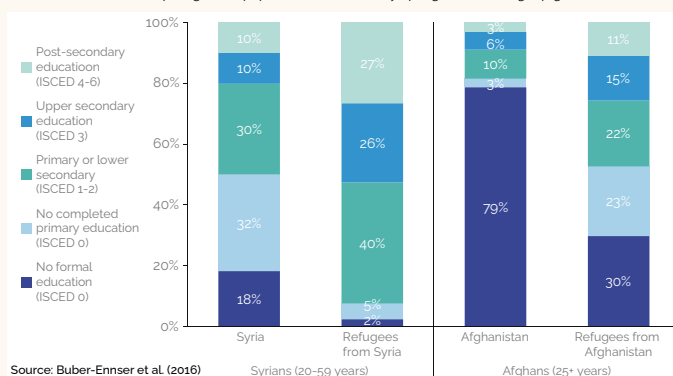
The studies conducted by the Wittgenstein Centre generate a comprehensive picture of the perceptions, realities and challenges of female refugees who came to Austria from Syria and Afghanistan in the context of the refugee movement in 2015/16.

- Refugees – especially women – rate their health worse than the Austrian population of the same age. As a result, not only health inequalities remain, but there are also considerable follow-up costs in the area of secondary and tertiary care.
- Many women who fled to Austria in 2015/16 gave birth to a child soon after their arrival. Very high birth rates among refugees shortly after their arrival that gradually decline again, were also reported in other countries and have been labelled with the term "arrival effect". This was also evident from 1992 onwards among refugees from Bosnia.
- Caring for (small) children while lacking social and family networks constitutes a major challenge for refugee women.
- Many refugee women view their lives in Austria as an extension of their personal options for action, their educational and professional opportunities, both for themselves and for their children.

Consequently, some important conclusions can be drawn for political decisions that are also relevant for other migration groups and movements:

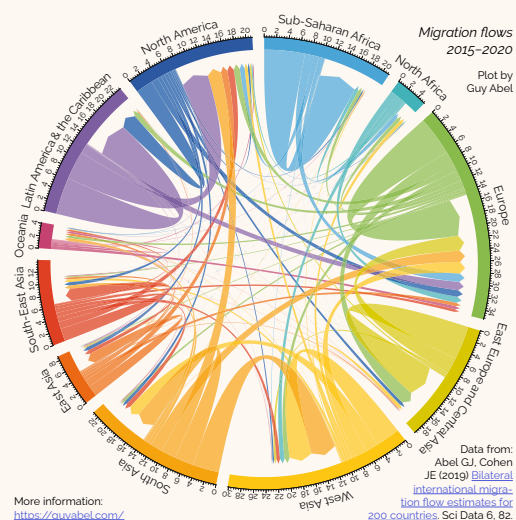
- Physical and mental health are key for a successful inclusion into society and the labor market. Hence, target-group-specific care and prevention are needed for female refugees.
- Unrestricted access to health care – as is the case in Austria – is crucial for the health of refugees.
- Participation in informal, low-threshold integration activities offered by civil society associations and organizations, such as language cafés, neighborhood meetings and training opportunities, are particularly conducive to the social integration of women.

Educational attainment of the general population in the country of origin and among refugees



Some facts and numbers

- A 2017 estimate by the International Fund for Agricultural Development states that one in nine people worldwide relies on remittances from international migrants to secure their livelihood.
- Despite the Covid-pandemic, the financial transfers of migrants to their countries of origin have barely collapsed and are many times higher (about a factor of 3.8) than the official development assistance.
- There is ample evidence of the importance of migration as adaptation: 40% of the studies included in a review by Burnham et al. (2015) on the adaptation of smallholder farmers to climate change in Asia, Africa and South America mentioned migration as a risk mitigation strategy. In a meta-analysis of adaptation in sub-Saharan African arid regions by Wiederkehr et al. (2018), which analyzed 63 studies with more than 6,700 rural households, it was reported that a quarter of rural households rely on migration as an adaptation strategy.
- In a study on the resilience of households in Thailand, we have shown that the potential for migration as an adaptation is unevenly distributed between different socio-economic groups: households with a better socio-economic situation benefit more from migration than poorly off households.
- In recent decades, there have been strong population shifts within the EU, especially towards the west. The EU as a whole benefits economically from this mobility. However, many Eastern European member states have experienced a sharp decline in population due to considerable emigration (Bulgaria and the Baltic States, for example, between 16% and 26% respectively), which is exacerbated by low birth rates. This deepens structural challenges, such as in the areas of infrastructure, education and aging.



Environment and migration

Research at the Wittgenstein Centre takes a differentiated look at the relationship between environment and migration. Therefore, the focus is on both the question of how environmental and climate change affect migration decisions and flows, and how migration can contribute to improved adaptation to climate change. Studies have shown that environmental hazards affect migration, albeit with contextual differences. Migration in the context of environmental and climate change is socially differentiated and takes place mainly within a country or towards low- and middle-income countries. International migration is the exception.

Migration as adaptation

Can migration contribute to the adaptation to climate change? On the one hand, migration in the context of environmental and climate

change can be a sign of a failure of adaptation if households' risk reduction strategies fail or the livelihood collapses. If the last resort that households can fall back on is (the then involuntary) migration, this often leads to a reduction of livelihood security and well-being. On the other hand, migration in the context of environmental and climate change can also be a form of successful adaptation: households can take advantage of migration to diversify risks and maintain well-being during a crisis. In the event of a drought, for example, individual household members may temporarily go to urban areas for work to compensate for the loss of agricultural income through remittances.

The mechanisms for the success of migration as adaptation and the question of the circumstances under which migration as an adaptation has reached its limits have not yet been well studied. However, existing studies allow some conclusions. On the one hand, the goal of development and adaptation policy must be to reduce vulner-

ability to climate change and thus, to increase the freedom of choice to migrate or not to migrate. On the other hand, the living and working conditions of migrants should be improved – not only in migration destinations such as Austria, but especially when migrants move within their country. The living and working conditions of migrants also have an impact on the potential of migration as an adaptation – and thus, on the need for further migration – as this influences, for example, the ability of migrants to support their households of origin with remittances.

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CONTACT

Isabella Buber-Ennsner
OeAW
isabella.buber@oeaw.ac.at

Patrick Sakdapolrak
IIASA and University of Vienna
patrick.sakdapolrak@univie.ac.at

Web: www.wittgensteincentre.org
Email: press@wittgensteincentre.info
Twitter: [@WICVienna](https://twitter.com/WICVienna) (English) | [@demografie_wien](https://twitter.com/ademografie_wien) (German)

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- Displaced Persons in Austria Survey (DIPAS): <https://www.oeaw.ac.at/vid/research/research-projects/dipas>
- Future Migration Scenarios for Europe (FUME): <https://futuremigration.eu/>
- Linking Climate Change, Habitability and Social Tipping Points: Scenarios for Climate Migration (HABITABLE): <https://habitableproject.org/>
- Population Dynamics under Global Climate Change (POPCLIMA): <https://cordis.europa.eu/project/id/101002973>
- Quantifying Migration Scenarios for Better Policy (QuantMig): <http://quantmig.eu/>
- Refugee Health and Integration Survey: Mental Health and Health Access of Refugees in Austria (ReHIS): <https://www.oeaw.ac.at/vid/research/research-projects/dipas/rehis-project>
- Women's Integration Survey: Inclusion, Participation and Enablement of Refugee Women in Austria (WIN): <https://www.oeaw.ac.at/vid/research/research-projects/dipas/win-project>

Longevity, Health, Well-being

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_life_expectancy.pdf



FACT SHEET

Longevity, Health, Well-being

Health: the greatest asset

Demographic developments in Europe today are characterized by aging populations. Fewer children are being born and at the same time people are living longer. However, this demographic change does not necessarily mean more problems. The consequences of this process depend strongly on people's health status. According to the World Health Organization, health is central to the happiness and well-being of people and crucial for economic progress – since healthy populations live longer and are more productive. Improving the health of a population is therefore one of the most important and effective ways to cope with the challenges of aging societies.

Average life expectancy

Life expectancy – at birth or at a given age – is usually understood as indicator for the health status of a population. However, the complexity of the indicator is often underestimated. Ultimately, it describes a purely hypothetical lifespan under the assumption, that the age-specific probabilities of dying of a given year remain constant forever. However, these reflect not only the current health status of people but are also

affected by other factors such as the population composition, e.g. according to the level of education or the proportion of active or ex-smokers in different age groups. Hence, average life expectancy is applicable to people who are born or alive today only to a limited extent, what can lead to misleading conclusions.

International differences

In an international comparison according to UN data, Austria is currently in 25th place (for both sexes 2015/20: 81.35) in respect to life expectancy. The difference to the leader Japan is -3.08 (84.48) and to the last place Central African Republic +28.68 (52.67) years. In 1950/55, Austria was still 20th place, but the international differences were much greater at that time: Austria had a difference of -6.26 (66.54) to number one Norway (72.80) and +38.58 to Mali (26.96) at the bottom.

Trends in life expectancy

In almost all industrialized countries, life expectancy has been increasing almost continuously for over 100 years. Whether this development will continue in the future is a subject of controversial debate among scientists. The "optimists" expect a continuously strong, nearly linear increase. The "pessimists" do not assume a life expectancy decline, but they expect the increase to slow down and the trend to flatten. As a matter of fact, the pace of increase has somewhat declined over the last 20-30 years. Ultimately, the future trends in life expectancy will depend primarily on whether a biological limit of

the human lifespan exists. While pessimists are convinced of such a limit, optimists assume that there is no limit for the human lifespan.

Impact factors

Research suggests that around 25% of today's differentials in life expectancy, mortality and health are caused by genetic factors, 25% by the environment (economic, social and cultural factors), and 50% can be attributed to lifestyle. Health behavior, especially smoking, but also the consumption of alcohol and other drugs, diet, physical activity, utilization of medical care and services, general risk-taking (e.g. road traffic), (social) stress and health risks at work play a role here.

Gender paradox

Even though women have a higher remaining life expectancy than men at any age, they spend a larger proportion of their total life in poor health – a phenomenon that has been labelled the "gender paradox". However, these opposite differences between women and men in health and mortality are not as conclusive as the term might imply. In the ERC project HEMOX we found, that gender differences in healthy life years vary considerably across age groups, social contexts and most notably the used health indicator. In addition, men rate their health problems in surveys less severe than women. This difference in health reporting behavior also contributes to the statistics on gender differences in healthy life years.

Gender differences in life expectancy

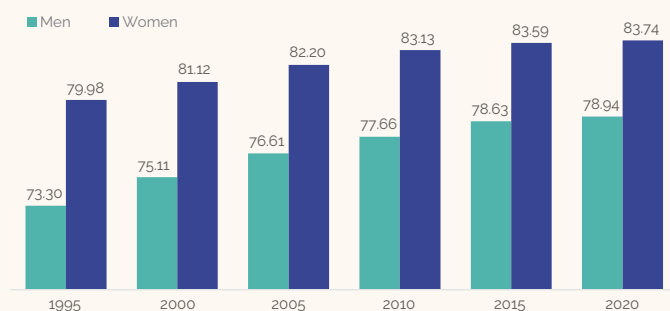
The cloister study uses the life data recorded in archives of religious communities and a health survey carried out among Catholic order members with the aim of finding the key for the so-called "successful aging", i.e. for a long life spent in good health. This study provided important contributions to the understanding of the causes of gender differences in life expectancy. Today, women in Austria have an advantage in life expectancy of almost 5 years compared to men. The cloister study has shown that only 1 of these 5 years is determined by biological factors, such as genetic and hormonal differences between the sexes. The remaining 4 years are caused by non-biological factors, most notably smoking.

More information: [Cloister Study](#) and [HEMOX Project](#)

Because of increased mortality due to COVID-19, life expectancy in Austria decreased by around -0.5 years in 2020 compared to 2019. In 2021 it remained unchanged at this level.

Life expectancy (years) in Austria 1995-2020

Source: Statistik Austria



The role of education

In addition to improved hygiene, medical innovations and advances in health-related behaviors, also structural changes in the populations have contributed to almost continuous gains in life expectancy, particularly increases in the average educational level. A study on several industrialized countries has shown that changes in the population composition by educational attainment alone accounted for between 15 and 40 percent of the increase in life expectancy between 1990 and 2010. This suggests, that education policies can also be seen as indirect health policies.

Healthy life expectancy

Today, "healthy life expectancy" has replaced average life expectancy as key indicator of a population's health status. It reflects the number of healthy life years that a person will live based on current health and mortality conditions in the population. However, adding the health dimension to life expectancy increases the complexity of the indicator significantly. Healthy life expectancy varies considerably more due to its high methodological sensitivity, including, among others, the definition of health, the choice of data sources, and specific technical aspects.

Compression and expansion of morbidity

For many people, the most important question is probably whether the life years gained through increasing life expectancy are primarily spent in good or poor health. In this context, two opposing theoretical models have been proposed:

1. A longer life results in more years spent primarily in poor health, the so called "expansion of morbidity", and

2. Additional life years go hand in hand with a postponement of health issues to later ages, the so called "compression of morbidity".

The empirical evidence to date supports both hypotheses, depending on which health indicators are considered. While in Austria the trends in life years spent in good general health follow the compression-scenario, trends in chronic health problems show an expansion of morbidity. In the case of limitations due to health problems, both, the years spent in poor health as well as those spent in good health increase approximatively to the same extent as the total life expectancy, hence, neither compression nor expansion is indicated.

Longer life, longer working life?

With the aging of populations and an increase in life years, the question of the effective retirement age becomes even more important. Many European governments have already raised official retirement ages, and the labor force participation of people aged 50+ has strongly increased, especially among women. But is the health potential to work longer also increasing with the years of life? Research shows that there are significant differences between subpopulations. The health potential (expected number of years in good health) varies significantly between persons with different levels of education and by gender, which should be taken into account.

New measures of aging

While life expectancy is increasing around the world and people are staying healthy longer, the traditional measure for aging has remained unchanged: People are usually classified as "old" at age 60 or 65. This has significant consequences on social security systems and labor markets. We have developed "The Characteristics Approach to the Measurement of Population Aging" which – for the first time in measuring aging – considers not only people's chronological age but also their health, physical and cognitive abilities, and other characteristics. The "prospective old-age threshold" is a good example of application of this approach. It defines people as being old not at a fixed age but at the age when remaining life expectancy is 15 years or less. From this perspective, if the life expectancy increases also the old-age threshold increases, and thus, people are considered old at more advanced ages. More information: [Re-Aging Project](#).

An indicator to measure quality of life

A good life is more than mere survival. Therefore, the "Years of Good Life indicator (YoGL)" accounts also for the quality of life-years lived, i.e. whether individuals are simultaneously not living in absolute poverty, free from cognitive and physical limitations, and report to be generally satisfied with their lives. Unlike many other indicators, YoGL can be assessed for flexibly-defined sub-populations and over long-time horizons, allowing for intergroup comparisons over time. Most importantly, though, YoGL can serve as a criterion for assessing the sustainability of policy interventions.

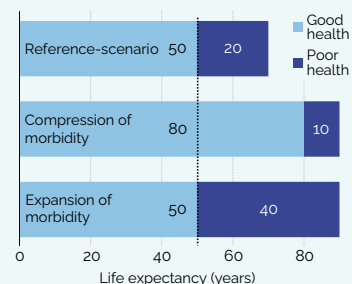
More information: [EmpoweredLifeYears Project](#).

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Hypothetical example of compression and expansion of morbidity

Suppose that the total life expectancy today is 70 years, of which 50 years are spent in good health and 20 years in poor health. If life expectancy increases to 90 years, in the optimistic "compression" scenario, all life years gained are spent in good health and the number of years spent in poor health are reduced ("compressed") to 10 years. By contrast, in the pessimistic "expansion" scenario, the number of life years spent in good health do not increase and all life years gained are spent exclusively in poor health.



RESEARCH PROJECTS

- Determinants of Longevity and Ageing in Good Health (DELAGE) <https://delage.eu/>
- German-Austrian Cloister Study, and The male-female health-mortality paradox (HE-MOX): cloisterstudy.eu
- Reassessing Aging from a Population Perspective (Re-Aging): <https://iiasa.ac.at/projects/reassessing-aging-from-population-perspective-re-ageing>
- The Demography of Sustainable Human Wellbeing (EmpoweredLifeYears) <https://iiasa.ac.at/projects/demography-of-sustainable-human-wellbeing>

CONTACT

Marc Luy
OeAW
marc.luy@oeaw.ac.at

Web: www.wittgensteincentre.org
E-mail: press@wittgensteincentre.info
Twitter: [@WiCvienna](https://twitter.com/WiCvienna) (English) | [@demografie_wien](https://twitter.com/demografie_wien) (German)

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Economic Demography

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_economic-demography.pdf



FACT SHEET

Economic Demography

Population and economy

Population structure and dynamics are directly interlinked with economic development. Declining birth rates and the resulting long-term drop in the labor force, ageing populations and the associated increase in welfare spending, an outflow of the working-age population, migration and refugee movements, to name only a few, all impact the economy. The links are often complex and many changes in the population and age structure create uncertainties and new challenges for the economic system. A closer look at the economic consequences of the demographic changes shows however, that general pessimism about the future is not justified, because knowledge about these changes will provide new options for adaptation and opportunities.

Income trends in Europe

How have age-specific income trends in Europe changed in recent years? What is the role of employment, wages, and social transfers such as family and retirement benefits in explaining these trends? A study of 9 European countries has shown that between 2008 and 2017 the GDP has dropped in only 2 out of 9 countries, while the average per capita income has dropped in 5 countries. Furthermore, not only the level of income, but also its structure has changed: Taxes as well as transfer income have increased in all countries analyzed (relative to the primary income). There are large differences in age-specific income trends. In most countries, the mean income in the population at age 20–39 stagnat-

ed or declined, while income increased for the elderly population aged 60+. The main drivers of these differences are a decline in employment rates and wages of the younger population, and an increase in employment rates and wages in the older population.

This trend is expected to continue. The retirement of the baby boomers, for example, and the resulting increase in social welfare contributions, but also the consequences of the COVID-19 pandemic will burden young Europeans. To be able to find better responses to economic crises, it is therefore important to closely monitor age-specific income trends.

Depopulation

Is population decline cause for pessimism? In the past years, some countries have already experienced a drop in population, and for many other countries this will be the new reality in the 21st century. As a result, some economists and policy makers fear negative economic consequences, including a collapse of social security and retirement systems, a decline in (particularly rural) infrastructure and innovation, and a brain drain caused by emigration. New research shows, however, that higher investments in education and health can considerably counteract these negative developments.

This raises the question if shrinking regions will face a shortage of productive and well-educated workers. Some aspects contradict this assumption. With falling birth rates the labor force participation rate of women increases, which, over a certain period, leads to a rise in the number of workers relative to the total population

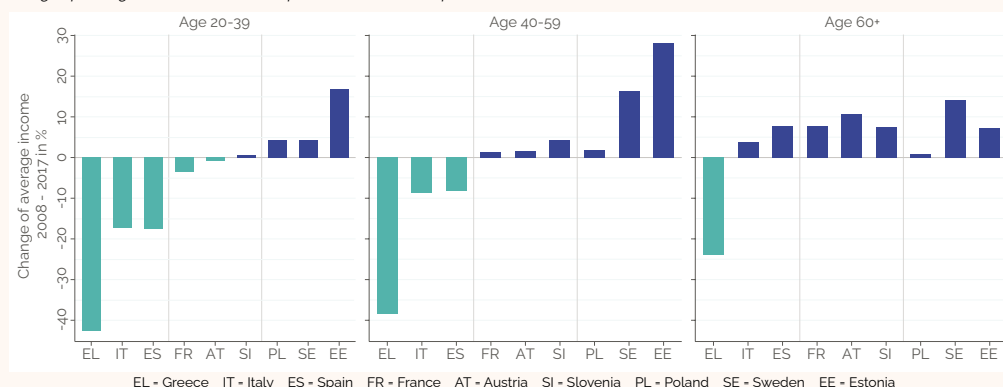
Aggregate measures such as the GDP mask the fact that the situation of young adults has worsened – with far-reaching consequences. For example, the countries that face the highest loss of income also have the lowest birth rates.

– even if the total population declines. Furthermore, falling birth rates result in an increase in private and public educational investments per child. These children, in turn, will be better educated and more productive in later life. Over one generation, this effect could compensate for about 10% of depopulation. Additionally, economic policies can make a big difference. With sufficient investments in health, people will live longer and stay healthier at old age, and can therefore participate in the labor market longer and more productively. Hence, flexible retirement models are desirable that enable those people who are healthy and want to work longer, to do so.

Does depopulation hinder technical and economic progress? New studies indicate the contrary. A declining labor force implies a stronger incentive to invest in the adoption of automation. In countries with declining or lower population growth, the number of industrial robots in relation to the total workforce is comparatively high. The cross-country average shows that a 1 percent reduction in population growth is associated with a 1.5 to 2 percent growth rate of robot density. Thus, advances in automation can help overcome negative economic effects of declining populations.

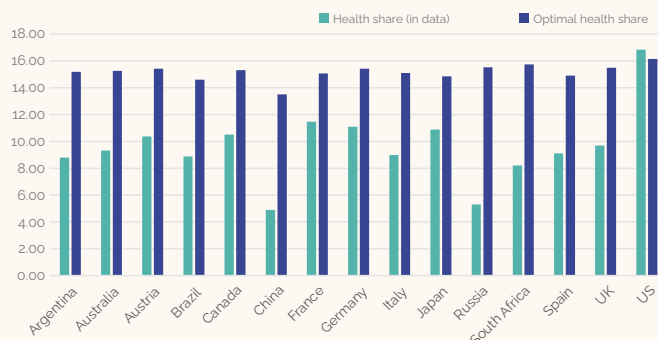
Change of average income 2008–2017 in percent, selected European countries

Source: Own calculations based on EU-SILC



Optimal vs. observed health share in 2015

Source: Own calculations based on World Bank data



Health systems

Should health expenditures be reduced to increase the efficiency of the healthcare sector? For a long time, in the public discourse concerns were expressed about whether the health systems in western economies are too big and expensive, and would therefore be an obstacle to economic growth. Recent studies show that, while there is potential for cost reduction in many areas of health care, this does not imply that also fewer resources should be spent on health at the macroeconomic level.

The size of a country's health system can be measured by the health expenditures as a share of GDP. The optimal share of public spending on health is derived from a comparison of the welfare gains that would result from an increase in life expectancy made possible by additional health expenditures, with the welfare gains that would result if the additional health expenditures were used for consumption instead. For most countries, the optimal health expenditure share would be above 15 percent, a value that, with the exception of the USA, is more or less clearly above the actual realized shares of health expenditures in GDP. In most high-income economies high health expenditures are justified because the benefit of additional consumption in

"saturated" societies is on average considerably lower than the benefit of additional years of life, particularly, if they are spent in relative wealth. This welfare economics perspective shows, that in most countries there is still considerable potential for growth in the health sector.

The costs of COVID-19

How expensive is the COVID-19 pandemic for Austria? When estimating the economic costs of COVID-19, it is important to know that a country's spending on relief efforts does not correspond to the overall economic cost to that country. This is because public support payments represent a redistributive measure that flows back into the economic cycle. Thus, from an economic point of view, these support payments are not "lost". In contrast, macroeconomic costs are actual production or income losses of companies, households and the state, which would not have occurred without the pandemic. In order to es-

Against a measure of welfare that includes not only consumption but also life expectancy, health systems in most developed economies are too small.

Are current pension systems still appropriate?

In theory, the pension system serves as a social equalizer: the working population pays contributions in and people who no longer work receive a pension. But with demographic changes the population structure has become more complex. Today, people overall live longer, but the life expectancy of individuals is associated with their socio-economic status. A higher level of affluence, that is also associated with a higher level of education and income, mostly results in a longer life, and therefore a collection of pension payments over a longer time – a trend that will continue in the future. As a consequence, pension systems that have been conceptualized as progressive, will become regressive, i.e. a redistribution from the poor to the rich population segments takes place. Pension reforms are necessary, but they must take into account, that different population groups benefit from the pension system in very different ways.

estimate these losses for Austria in the short run, the first approximation is to compare the current GDP with the corresponding forecasts from before the outbreak of the pandemic. For Austria, this resulted in a difference of around 33 billion Euro by the first quarter of 2021. Since then, a high level of consumption growth has fueled the economy, while another lockdown in Nov/Dec 2021 has led to a short-term slump.

Compared to these short-term economic consequences the question arises, what is the long-run economic burden of the COVID-19 pandemic? To estimate the macroeconomic costs under a herd immunity approach (absence of behavioral or policy responses) in the USA, we have developed a detailed macroeconomic model that factors in reduced labor supply due to COVID-19, and production losses caused by a pandemic-related decline in investments. Depending on the assumptions made regarding the impairments due to Long Covid and how the suffering of those affected is quantified, the economic burden in the USA under the herd immunity approach could be up to 94 trillion US\$ over the 10-year time span 2020–2030.

CONTACT

Michael Kuhn
IIASA
kuhn@iiasa.ac.at

Klaus Prettnner
OeAW and WU Vienna
klaus.prettnner@wu.ac.at

Alexia Fürnkranz-Prskawetz
IIASA, OeAW and TU Vienna
alexia.fuernkranz@oeaw.ac.at

Web: www.wittgensteincentre.org
Email: press@wittgensteincentre.info
Twitter: [@WiCvienna](https://twitter.com/WiCvienna) (English) | [@demografie_wien](https://twitter.com/demografie_wien) (German)

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- Siskova M, et al. (2022) Does human capital compensate for depopulation? VID WP 02/2022. Wien: OAW.

RESEARCH PROJECTS

- Ageing Europe: An application of National Transfer Accounts (NTA) for explaining and projecting trends in public finances <http://www.agenta-project.eu/en/index.htm>. NTA Daten für Europäische Länder finden sich auf www.wittgensteincentre.org/ntadata
- National Transfer Accounts – Understanding the generational economy www.ntaccounts.org

Fertility and Family

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_fertilityfamily.pdf



FACT SHEET

Fertility and Family

Why study fertility?

Both from the perspective of individuals as well as from the viewpoints of societies, fertility and reproduction matter. For individuals, the questions of whether to reproduce and when, how many children to have, with whom, in what family configuration, are among the most important questions people ponder over in their lives. Our research helps identifying the obstacles people face when planning to have children and studying the factors, circumstances and living arrangements that influence whether they succeed or not in realising these plans. At the level of populations, towns, regions, and countries, fertility is a major force that alters their population size and age structure, and which influences, among other things, future size of the labour force, social security needs, or the demand for health care. Our research particularly focuses on education, which plays a key role in the ongoing fertility and family changes. Education empowers men and especially women to plan their lives and to take a better control over their reproduction. But education also shifts priorities in life, leading to delayed partnerships and family formation.

Fertility in Europe

Do Austrians have more or fewer children than people in other European countries? Is there a trend to late parenthood? In a European comparison, Austria's period Total Fertility Rate of 1.44 children per woman (2020) is moderately low and close to the EU average of 1.5. In Austria and other highly developed countries the family formation has been shifting to ever later ages (Fig. 1) and women's mean age at first birth is now close to 30, up from age 24 in the early 1980s. In

Historical foothold of out-of-wedlock births in Austria. In 2020, 50% of first children were born outside of marriage – with a surprising regional distribution: The highest number was observed in Carinthia (61%) and the lowest number in Vienna (42%). This pattern is reflective of historical developments: In the 19th century, the share of non-marital births in Austria was among the highest in Europe. It was particularly high in the mountainous areas of Carinthia and Styria. The relatively low non-marital fertility in Vienna is linked to the high share of foreign-born mothers, for whom child-bearing outside wedlock is less common.

comparison, lower fertility rates are concentrated in the South of Europe – especially in Spain, Italy, Greece, Malta, and Cyprus – where women have their first child at a higher age (around 31 years) than in other parts of Europe. With many people postponing childbearing past age 35, women and men alike experience a decrease in the realisation of their intention to have a child with age, despite advancing use of assisted reproductive technologies.

Is fertility stable over the long term in Austria? Fertility rates in Austria are best characterised by their stability in the past three decades: the period Total Fertility Rate (TFR) in 2020, at 1.44 children per woman, is almost identical to its level in the mid-1980s. This stability is quite remarkable given changes in family policies, women's growing education and labour force participation, changing partnership and marriage behaviours and also the fact that Austria has become a more diverse and multicultural society due to immigration. Women born in the late 1970s, who are now approaching the end of their reproductive lives, have 1.65 children on average—the same value as the mean family size among women in the whole EU.

Family trends

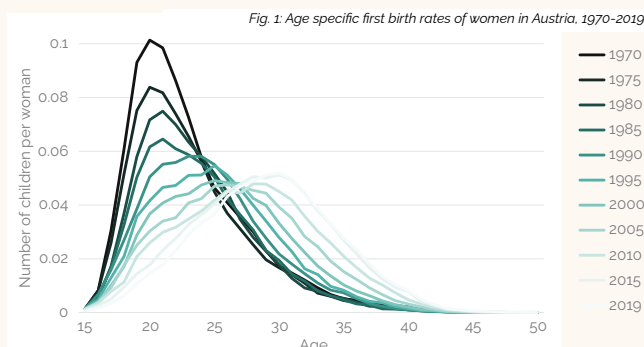
Which couples have many children? Who remains childless? As in the other European countries, the share of large families declined in Austria over the past decades. Families with three or more children are common among couples who have a lower level of education, in rural areas, among people with a high level of religiosity, and among migrants from particular countries. Only around 15% of women that were born around 1980 had three or more children – while around 20% remained childless – and childlessness is still on the rise. Only few EU countries report higher levels of childlessness, mostly in Southern Europe, but also in Germany and Switzerland. Childlessness is most prevalent among highly educated women – around 30% – reflecting their difficulties in combining a career with childrearing.

The share of women wishing a child at age 40-42 has increased from around 1% in 1986 to 12% in 2016 in Austria. Among childless women, the share rose from around 4% to 30%.

Is reproduction becoming disconnected from marriage? Marriage and childbearing have become increasingly disconnected around Europe: in Austria 41% of all children were born outside of marriage in 2019, which is close to the EU average. Higher values were observed in the Nordic countries and some Central and Eastern European countries, e.g., Bulgaria and Slovenia. France has the highest value in the EU with 61% of children born to cohabiting couples and single mothers.

Fertility during COVID-19

Was there a baby boom or a baby bust during the COVID-19 pandemic in Austria? Surprisingly, the coronavirus pandemic has had rather small impact on fertility intentions and birth trends. This is arguably in part due to relatively generous welfare and family policies, including job protection and continuing financial support to families. At the start of the pandemic, the uncertainty and the initial lockdowns in mid-March 2020 contributed to a decline in the number of births 8-9 months later (-5% births in December 2020). The end of lockdowns and restrictions led to a mini-baby boom some 9 months later (births jumped by 8% in February 2021). Births did not change compared with 2020 between April and August 2021, but then they jumped by around 6% in September – November 2021, nine months after the third lockdown, suggesting that the experience of the pandemic was no longer discouraging couples from realising their reproductive plans.



Migration and fertility

Do migrant women differ in their fertility behaviour from "native-born" women? Although women born abroad have on average higher fertility rates than women born in Austria, wide differences prevail in fertility rates of migrant women coming from different countries. For instance, women born in Germany and Hungary have almost identical fertility rates as Austrian-born women. Women born in South-eastern Europe and Turkey have higher fertility rates than Austrian women, with their total fertility rate reaching around 2 births per woman. Yet higher fertility rates are found among women born in Syria and Afghanistan. Migration and childbearing are often interconnected: many migrant women have a child soon after their arrival to Austria as they had postponed childbearing until they could settle.

The future of fertility

How low will fertility fall in the future? A combination of declining family size and fertility postponement has squeezed period fertility rates in many countries to extreme low levels, with East Asia and Southern Europe becoming global hotspots of "ultra-low" fertility and high childlessness. It is likely that more countries will follow and experience protracted periods of period total fertility rates at around or below 1 in the future.

How do economic factors, policies and gender inequality affect fertility decisions?

Across many highly developed countries women and men broadly adhere to a two-child family ideal (Fig. 2). Many societies show continuing stark gender inequalities in labour force participation and the division of childcare and housework within couples. Especially highly educated women have to make difficult choices between their career and family lives. In addition, because of the instability of the labour market and of demanding parenting norms, medium educated increasingly struggle to realise their reproductive goals. Societies that do not adapt their policies, norms and institutions to the new reality are likely to experience very low fertility in the decades to come.

Will fertility ideals and intentions fall well below two kids on average? The widespread idea that declining fertility rates are likely to eventually reverse and recover some "lost ground" critically hinges on expecting that women and men retain reproductive intentions at around or above two births on average. But this is far from being guaranteed. Current uncertainties and anxieties among young adults, including worries about climate change and political polarisation, but also less positive attitudes towards kids, may translate into falling fertility desires and a rise of voluntarily childfree lifestyle in the future.

Will age cease being a barrier to reproduction? Advances in assisted reproduction help eroding the initially solid limits to late reproduction that were "dictated" by the onset of infertility and menopause among women. If the use of assisted reproduction, including egg harvesting and freezing, become much more widespread in the future, reproduction among women in their 40s, and even 50s and 60s may become common, vastly expanding the reproductive span people have for realising their reproductive plans.

Will male-factor infertility reach alarming levels? Some research during the past three decades suggests that male reproduction is threatened by the ubiquitous spread of endocrine disruptors—chemicals that cause declining sperm counts, concentrations and sperm quality. Despite many compelling arguments and analyses, the evidence that men face a global trend of increasing difficulties to reproduce still seems to be speculative.

Policy recommendations

Policies need to respect the diversity of people as well as their family preferences and reproductive rights. There is no single "one-size-fits-all" policy that can address low fertility. Rather, what's needed is a comprehensive package of policies that address different needs and preferences of individuals, give them enough flexibility, and also help them improve their work-life balance.

RESEARCH PROJECTS

- Arbeitsteilung in Paaren in der Corona-Krise (CoWork). <https://cowork.univie.ac.at/>
- Auswirkungen der COVID-19 Pandemie auf die Kinderwünsche in Wien (COVKIWU). <https://www.oew.ac.at/en/vid/research/research-projects/covkiwu>
- Fertility and family change – Late fertility in Europe. <https://fertilitychange.wordpress.com/>

OPEN-ACCESS DATABASES

- European Demographic Data Sheet: <https://www.populationeurope.org/en>
- Birth Barometer Austria: <https://www.birthbarometer.at/en>
- Human Fertility Database: <https://www.humanfertility.org>
- Short-term fertility fluctuations data series: <https://www.humanfertility.org/cgi-bin/stff.php>
- Human Fertility Collection: <https://www.fertilitydata.org>
- Cohort Fertility and Education database: <https://www.cfe-database.org/database/>

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CONTACT

Eva Beaujouan
University of Vienna
eva.beaujouan@univie.ac.at

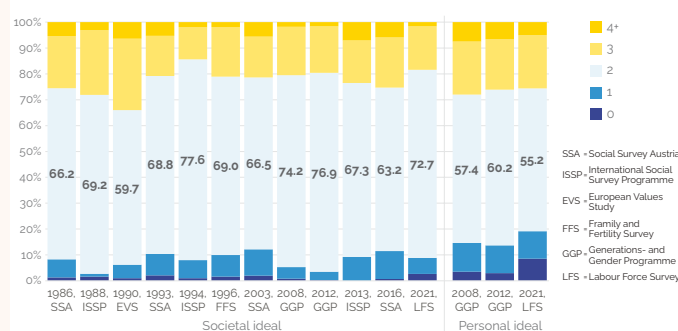
Caroline Berghammer
OeAW und University of Vienna
caroline.berghammer@univie.ac.at

Tomas Sobotka
OeAW
tomas.sobotka@oeaw.ac.at

Web: www.wittgensteincentre.org
E-mail: press@wittgensteincentre.info
Twitter: @WICVienna (English) | @demografie_wien (German)

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Fig. 2: Ideal number of children of women aged between 20-45 years in Austria



Source and single data sources: Buber-Ennsner I, Riederer B. und Setz, I. (2021) *Changes of fertility plans in Austria due to the COVID-19 pandemic*, COVKIWU Projekt.

Demographic Aspects of COVID-19

https://www.wittgensteincentre.org/Jacomo/upload/wic_factsheet_covid-19_en.pdf



FACT SHEET

Demographic Aspects of COVID-19

Challenges and uncertainty

The COVID-19 pandemic has brought about many societal challenges. People's health, family dynamics, economies and migration were all deeply affected. One of the key challenges of the COVID-19 pandemic is the uncertainty in measurement and estimates, that are in turn needed to understand the effectiveness of policies and show which population groups are most affected. Accurate case- and death-reporting rely on consistent testing policies and the ability of governments in detecting cases. Studies can provide different ways to more accurately estimate the number of people ever infected and to raise awareness towards the sensitivity of widely used indicators. A better understanding about people's behavior, such as adherence to COVID-19 rules and the impact of the pandemic on family behavior, can help to find better ways to tackle and adapt to the new challenges and find adequate policy responses.

Assessing the number of infected

In the beginning of the pandemic and previous to widespread vaccination, seroprevalence studies were regarded as the gold-standard to retrospectively assess the number of infections. However, because these studies are expensive and time-intensive, their availability was very restricted across populations. Wittgenstein Centre

researchers developed a complementary approach to indirectly estimate the fraction of people ever infected (from the total population) and detected (from the ever infected). Applied in the case of Austria, it was found that less than 7% of the total population had been infected in the pre-vaccination period, which implied that relying on herd immunity as a policy was not advisable. The approach can be a valuable tool for future new virus outbreaks, as it provides a reliable estimate of the total number of infections amidst uncertainty.

The importance of testing

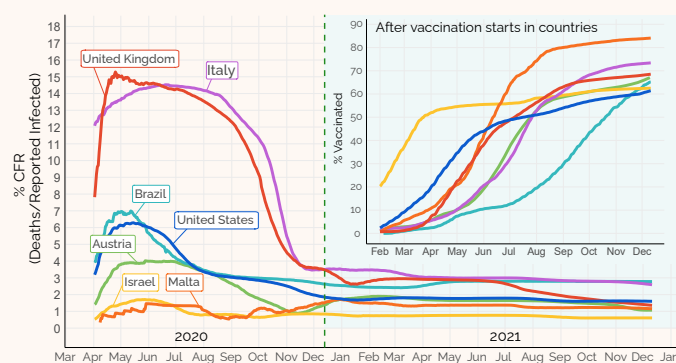
As vaccines were shown to be effective in reducing hospitalizations and preventing deaths, testing has been often dismissed by individuals and governments. Studies have shown that it is nonetheless still crucial to detect cases among both vaccinated and unvaccinated persons for assessing immunity duration, booster shot requirements, and emergence of more contagious variants. The case-fatality rate (CFR), an indicator frequently used to monitor the pandemic, is sensitive to how breakthrough cases are being accurately detected. By the end of December 2021, a little over 90% of persons aged 84 and over were fully vaccinated in Austria while at the same time the CFR remained stable across the whole year of 2021. However, this does not imply that vaccines were not effective in preventing

deaths. In the absence of information on infections among both the vaccinated and the unvaccinated, the CFR may be misleading, especially when used to assess the effectiveness of vaccines in reducing deaths or virus transmission. As a consequence, the CFR needs to be used with caution. Hence, widespread testing is still a key policy strategy to detect asymptomatic or mild infections among both the vaccinated and unvaccinated populations.

Optimal lockdown policies

To prevent the spread of the COVID-19 virus, governments implemented many non-pharmaceutical interventions before vaccines were widely available, first and foremost the introduction of lockdowns. However, the intensity and duration of the lockdowns have greatly varied across countries. Wittgenstein Centre studies show that different strategies can perform similarly well when the impact of COVID-19 on work and life are simultaneously taken into account. Moreover, the developed economic and epidemiological models show that the optimal lockdown intensity varies over time, depending on the evolution of the pandemic, the importance of economic outcomes and life losses.

Case-fatality rate (CFR) during observed time period

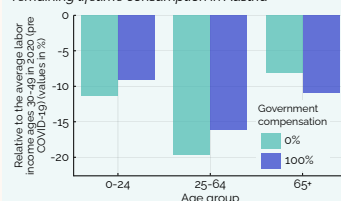


Source: di Lego V, Sanchez-Romero M, Prskawetz A (2022)

Refugees and migrants amidst COVID-19

Reliable data on infections and deaths in connection with COVID-19 in the migrant population are currently not available for Austria. Although single COVID-19 clusters were reported in connection with returnees in the media in the summer of 2020, valid and sufficient data are required to determine any differences in infections or analyze associated deaths. To improve data on refugees and migrants amidst COVID-19 pandemic, a research project on COVID-19 and migration background investigated the impact among migrants and refugees, how they deal with the COVID measures, and their socio-economic challenges during the pandemic. The study identified target group-specific barriers to accessing and complying with health information (such as language barriers and homeschooling), as well as provided concrete solutions to strengthen the accessibility and thus the resilience of the migrant population (such as close cooperation with community associations and expansion of target group-specific information dissemination about vaccinations and regulations).

Impact of the COVID-19 pandemic on the remaining lifetime consumption in Austria



Source: Sánchez-Romero (2022)

The impact of COVID-19 on the economic situation of different cohorts

How did the pandemic impact different generations economically? An economic model built for assessing the generational impact of COVID-19 takes into consideration that individuals of different ages are tightly linked through private (family) and public transfers. The results show that COVID-19 is affecting the financial situations of people aged 25 to 64 and their children more than those of older people. As the figure shows, by compensating workers for their in-

come losses, the economic impact of COVID-19 has been more evenly distributed across cohorts, reducing the burden on people aged zero to 64, and increasing the burden on people aged 65 and older. Moreover, the simulation results show that a 1% decline in labor income leads to an average increase in the debt-to-total labor income ratio of between 1.2% (without fiscal policy) and 1.6% (when the government fully compensates for the labor income loss).

Adherence to COVID-19 rules

Does health perception play a role in explaining health behavior during the pandemic? Health beliefs are important for the adoption of preventive health behaviors. Research shows that older adults who perceive themselves as being less healthy than they actually are show more adaptive behavior related to mobility reductions (e.g. they are more likely to stay at home, shop less, and go for walks less often), while those who perceive themselves as being more healthy than they actually are show no difference compared to those who estimate their health correctly. Protective behavior in public spaces and adopting hygiene measures also does not vary systematically between health perception groups. Future health literacy campaigns should consider differences in health perception among people, its effect on health behavior, and how to tackle biased beliefs in one's own health, to form better public messaging in health crisis. While adaptive behavior helps to contain the virus, exaggerated mobility reduction in those who underestimate their health might be contributing to the already high social isolation and loneliness of older adults during the pandemic.

Fertility fluctuations

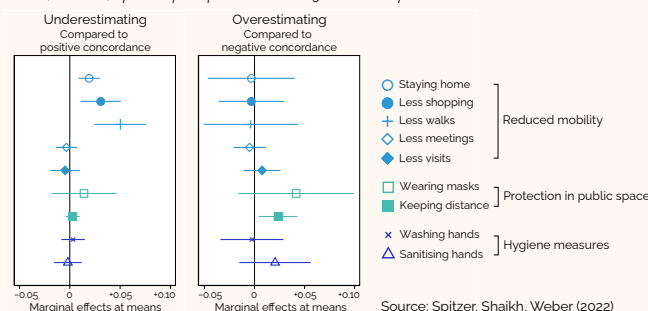
How did birth trends shift during the course of the pandemic? The Short-Term Fertility Fluctuations Data Series – covering 41 countries and territories – has shown, that with a few exceptions, the first wave of the pandemic was associated with a downturn in the number

of births in December 2020 and January 2021. These declines were especially sharp in Southern Europe, but also in Central-Eastern and South-Eastern Europe. Austria experienced an annual drop in the number of births by 3% as measured in January 2021. Subsequently, birth rates in most countries increased in March 2021. This recovery was closely linked with the end of the first wave of the pandemic in late Spring and early Summer 2022. Thereafter, the trends became diverse across countries, often displaying slight rises between July and November 2021.

The impact on partnerships

Did people change their family plans due to the pandemic? A study on women and men aged 20-45 years in Austria and France showed that partnership dissolution was less frequent during 2020/21 than in the two preceding years. Compared to their peers with children, couples without children below age 18 in the household consistently had a higher dissolution risk, but it declined more strongly during the pandemic. A precarious economic situation was also related to a higher dissolution risk. The observed convergence in the dissolution risk between couples with and without children suggests that families with children faced higher strain and more conflicts during the pandemic. In addition, the pandemic had almost no effect on the (long-term) family plans of women and men in Austria: Only 4.3% stated to have changed their family plans due to the pandemic, 1.5% want less children or no children any longer, and 2.1% wanted an (additional) child later than previously planned.

Effects (at means) of health perception on COVID-19-related adaptive behavior



Source: Spitzer, Shaikh, Weber (2022)

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- di Lego V, Sanchez-Romero M, Prskawetz A (2022) *The impact of COVID-19 vaccines on the Case Fatality Rate: The importance of monitoring breakthrough infections*. International Journal of Infectious Diseases 119: 178-183.
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DATA BASES

- COVID-19 Tracker: <https://zozlak.org/covid19/>.
- European Demographic Data Sheet: <https://www.populationeurope.org/en>
- The Demography of COVID-19 Deaths. <https://dc-covid.site.ined.fr/en/>
- The Short-Term Fertility Fluctuations Data Series (STFF): <https://www.humanfertility.org/cgi-bin/stff.php>

CONTACT

Vanessa Di Lego
OeAW
vanessa.dilego@oeaw.ac.at

Miguel Sánchez-Romero
OeAW
miguel.sanchez@oeaw.ac.at

Web: www.wittgensteincentre.org
Email: press@wittgensteincentre.info
Twitter: @WiCVienna (English) | @demografie_wien (German)

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EU-funded Projects at the WIC

Quantifying Migration Scenarios for Better Policy

IIASA Project Leader: Michaela Potančoková
H2020-SC6-MIGRATION-2019-870299-
QuantMig

Time Frame: 01.02.2020 – 31.01.2023

Website: <https://www.quantmig.eu/>

QuantMig aims to produce comprehensive, multi-perspective and robust quantitative migration scenarios to support various areas of European migration policy, based on the cutting-edge developments in conceptualising, explaining, estimating and forecasting migration. The project focuses on understanding the mobility of third-country nationals and the decision-making of migrants, thereby illuminating the trade-offs between different policy options. QuantMig is being undertaken by a consortium of seven top European migration research institutions, led by the University of Southampton. The IIASA team integrates cutting-edge past mi-

gration estimates of bilateral flows between European countries and world regions into a unique microsimulation model that simulates future populations in 31 European countries. We implement advanced tools for scenario building into migration assumptions in order to address the complexity and the uncertainty of migration patterns. Directly applicable to the interests of European policymakers is our focus on scenarios of high-impact migration events originating from different sending regions. The simulations then quantify the long-term impacts of these scenarios on population dynamics and labour supply. To encourage the use of the data and the models for migration policy and planning, the project develops various directly applicable policy support tools. An interactive online scenario explorer will visualise the simulations in an accessible way for less knowledgeable users, as well as for experts.

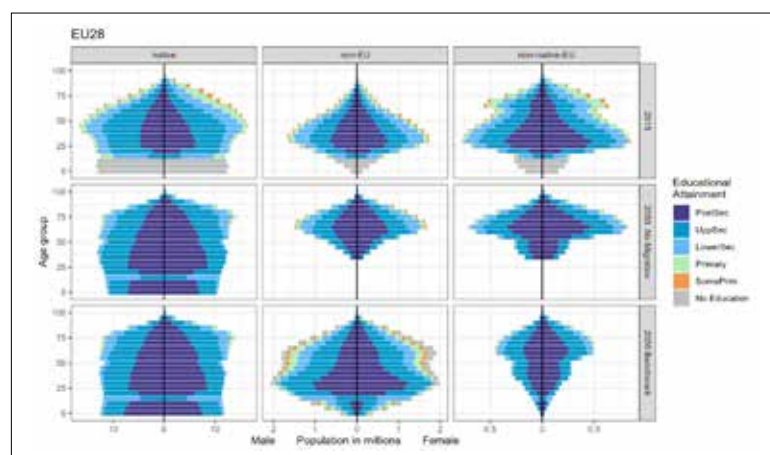
Future Migration Scenarios for Europe

IIASA Project Leader: Dilek Yildiz
H2020-SC6-MIGRATION-2019-870649-
FUME

Time Frame: 01.02.2020 – 31.01.2023

Website: <https://futuremigration.eu/>

This project focuses on improving our understanding of the patterns, motivations and modalities of migration at multiple geographical scales, from the international to the regional to the local level; and on imagining possible futures. It proposes a new method for migration scenario building that focuses on quantifying the key drivers of migration prior to combining them into different scenarios. Moreover, the project connects global flows of migrants to the local circumstances at both the origin and the destination of the migration process. While the former provides input for the migrations scenarios, the latter helps us understand how migrants shape the places that they move to.



Distribution of the population in EU28 by age, sex, and educational attainment by broad region of birth in 2015 and 2050 for two scenarios (no migration and benchmark migration); Note: The colours under 15 years represent mother's education; Source: KC S., Kluge L., Olaya Bucaro O., Schewe J. Deliverable 4.3: National level population and migration projections

IIASA's two main contributions are to create the migration scenario narratives and to develop population projections. The FUME population projection methodology de-

viates from the WIC methodology in two ways. First, in addition to the size of the native population, the size of the migrant population in each EU member country is projected by the country of origin of the migrant. Second, instead of a constant or a zero migration scenario a dynamic migration model is used within the population projection model. Additionally, IIASA researchers are collaborating with University of Manchester to develop a model to “now-cast” migrant stocks and migration flows by combining traditional and social

media data. By using the FUME migration scenarios, European policymakers will be better able to assess and prepare for the different ways in which migration to the region will unfold in the future.

The project is coordinated by Aalborg University Copenhagen (AAU), in conjunction with nine partners from eight European countries. It also draws on the input of experts from multi-disciplinary fields such as demography, geography, geoinformatics, economics and statistics.

Ageing Trajectories of Health: Longitudinal Opportunities and Synergies

PI: (WP 4) Sergei Scherbov and Warren C. Sanderson, (WP 5) Guillaume Marois
H2020-PHC-2014-635316-ATHLOS
Time frame: 01.05.2015 – 30.04.2020
Website: <https://cordis.europa.eu/project/id/635316>

The aim of this project was to achieve a better understanding of ageing by identifying patterns of healthy ageing pathways or trajectories and their determinants, and the critical points in time when changes in trajectories are produced; and to propose timely clinical and public health interventions. Sergei Scherbov and Warren Sanderson were among the IIASA partners in this project. Their research on new definitions of ageing based on many characteristics, rather

than just on the classical chronological definition of age, that have been developed in recent years was used for calculating projections in each specific population, and for guiding policy recommendations. In the second contribution by IIASA under the leadership of Guillaume Marois, IIASA researchers translated the ATHLOS findings from micro-simulation exercises to provide evidence-informed policy recommendations. This five-year project was coordinated by the Parc Sanitari Sant Joan de Déu (PSSJD) in conjunction with 14 partners from 11 European countries, and drew on input from experts from the areas of demography, sociology, clinical medicine, epidemiology and public health, health statistics, economics, data management and policy.



StockSnap © Pixabay

Ageing Europe: An Application of National Transfer Accounts (NTA) for Explaining and Projecting Trends in Public Finances

PI & Coordinator: Alexia Fürnkranz-Prskawetz | FP7-SSH-2013-613247-AGENTA | 01.01.2014 – 31.12.2017

Website: <https://cordis.europa.eu/project/id/613247>

The aim of the AGENTA project was to explain the past and to forecast the future of taxes and public transfers and services in light of demographic change in the European Union. The project was conducted together with eight research partners in Europe.

Changing Families and Sustainable Societies: Policy Contexts and Diversity over the Life Course and Across Generations

Leader of WP 10: Dimiter Philipov & Thomas Fent (02/2013-01/2016, Bernhard Riederer (02/2016-01/2017) | FP7-SSH-2012-320116-FamiliesAndSocieties | 01.02.2013 – 31.01.2017

Website: <https://cordis.europa.eu/project/id/320116>

This project investigated the diversity of family forms, relationships and life courses in Europe; assessed the compatibility of existing policies with these changes; and contributed to evidence-based policy-making. Work package 10 analysed the impact that family-related policies have over the long run on wellbeing and on the satisfaction of family needs. The consortium involved 25 research partners and three transnational civil society actor partners.

Couples and Childbearing: New Approaches to the Study of Fertility Outcomes and Family Formation Across Europe

PI: Natalie Nitsche | FP7-PEOPLE-2013-IIF-627543-COUPFER | 18.08.2014 – 17.08.2016

Website: <https://cordis.europa.eu/project/id/627543>

This project examined the relative education levels of European couples in terms of numbers of children per couple. The study also investigated gender values as a predictor of housework participation.

Welfare, Wealth and Work for Europe – Europe Moving Towards a new Path of Economic Growth and Social Development

Co-PI: Jesús Crespo Cuaresma | FP7-SSH-2011-290647-WWWFOREUROPE | 01.04.2012 – 31.03.2016

Website: <https://cordis.europa.eu/project/id/290647>

The project explored science-based policies aimed at increasing Europe's contributions to world growth, ensuring the maximum wellbeing of European populations and reducing Europe's energy and material inputs to promote social and ecological sustainability. The research group found an empirical relationship between changes in education inequality and economic growth.

Forward Looking Analysis of Grand Societal Challenges and Innovative Policies

PI at VID: Dimiter Philipov, Anne Goujon | FP7-SSH-2012-320330-FLAGSHIP | 01.01.2013 – 31.12.2015

Website: <https://cordis.europa.eu/project/id/320330>

The aim of the FLAGSHIP project was to drive policy change, and to support the shift away from adapting to changes through short-term policy responses, and towards anticipating, welcoming and managing changes more effectively.

Long-run Economic Perspectives of an Ageing Society

Co-Investigator & Leader of VID WP: Alexia Fürnkranz-Prskawetz | FP7-SSH-2007-217275-LEPAS | 01.04.2009 – 31.03.2012

Website: <https://cordis.europa.eu/project/id/217275>

As partners in this collaborative EU FP7 project, we have developed and analysed economic life-cycle models to study individual incentives to invest in health.

Other Research Projects at the WIC 2018–2022

Balancing Human and Natural Resource Use in a Circular Bioeconomy (BALANCE)

PI at IIASA: Raya Muttarak | Research Council of Norway | 12/2021 – 06/2025
Website: <https://iiasa.ac.at/projects/balance>

BALANCE develops a strategic tool for decision-making that enables policy-makers to evaluate alternative strategies for a circular bioeconomy based on the goals of value creation and employment, greenhouse gas emission reductions and resource efficiency.

Long-Term Spillover Impacts of Financial Markets on the Environment (PVARGLOBIOM)

PI: Michael Kuhn | Jubilee Fund of the OeNB, 210056 | 12/2022 – 12/2024

The aim of this project is to capture the medium- to long-term spillover effects of financial markets, and of related stakeholders such as regulatory institutions, on climate-relevant emissions from land use and from changes in the land use pattern.

Reducing Inequality Within and Across Generations (RIWAG)

PI: Miguel Sánchez-Romero | Jubilee Fund of the OeNB, 18744 | 03/2022 – 08/2024
Website: <https://www.oeaw.ac.at/vid/research/research-projects/riwag>

The aim of this project is to provide a unified framework for studying and mitigating the economic and demographic consequences of increasing inequality in European countries.

Just Transitions to Net-Zero Carbon Emissions for All (JustTrans4ALL)

PI at POPJUS: Roman Hoffmann | IIASA | 09/2021 – 08/2024
Website: <https://iiasa.ac.at/projects/justtrans4all>

This project will contribute to novel analyses of transition pathways that are socially and environmentally just, and inform policy design, with the aim of achieving high levels of human wellbeing

Realisation of Fertility Intentions in Vienna

PI: Isabella Buber-Ennsner | City of Vienna, MA 7 – Kultur und Wissenschaft | 04/2021 – 12/2023
Website: <https://www.oeaw.ac.at/vid/research/research-projects/realisierung-von-kinderwuenschen>

This project investigates the question of how many women and men in Vienna realise their family plans, and whether certain groups of people are more successful than others.

Later Fertility in Europe: How Far Can Childbearing be Postponed Without Being Forgone? (LATEFERT)

PI: Eva Beaujouan | FWF, P31171-G29 | 01/2019 – 06/2023
Website: <https://fertilitychange.wordpress.com/>

Using advanced demographic methods and microsimulation techniques, this project investigates later childbearing at the individual and the aggregate level. In particular, it explores the differences between men and women, as well as the mechanisms through which people postpone childbearing and potentially recover fertility at later ages.

Births and other Life Goals: Complementarity or Competition? (BIRTHLIFE)

PI: Maria Rita Testa (03/2019 – 09/2020), Isabella Buber-Ennsner (since 10/2020) | FWF, P31357-G29 | 03/2019 – 02/2023
Website: <https://www.oeaw.ac.at/vid/research/research-projects/birthlife>

This project investigates the transition path from birth intentions to birth outcomes at the intersection of life course domains intimately related to the family formation process.

Human Mobility in the Context of Climate Change (ClimMob)

PI: Roman Hoffmann | GIZ, 81269341 | 07/2021 – 10/2022

This project will help improve the database on human mobility-associated climate change-related slow-onset events and environmental changes in the Horn of Africa.

Impact of the COVID-19 Pandemic on Fertility Plans in Vienna (COVKIWU)

PI: Isabella Buber-Ennsner | City of Vienna, MA 7 – Kultur, Wissenschafts- und Forschungsförderung | 10/2021 – 09/2022
Website: <https://www.oeaw.ac.at/vid/research/research-projects/covkiwu>

The COVKIWU project investigated the effects of the COVID-19 pandemic on family plans in Vienna, and compared them with the situation in Austria as a whole.

Impact of Climate Change on the Transformative Results Estimates

PI: Erich Striessnig | UNFPA, FA645003 | 06/2021 – 07/2022

This project looked at the potential impacts of climate change on progress with respect to UNFPA's "Transformative Results" in the areas of maternal health, unmet family planning needs, as well as gender-based violence and other harmful practices.

Short- and Long-Term Consequences of COVID-19 for Population Dynamics in Russia and its Regions (RUSCOV)

PI: Sergei Scherbov | IIASA and RANEPa | 03/2021 – 03/2022

The project developed probabilistic projections for 85 administrative regions of Russia while considering urban and rural populations. The projections are based on long-term scenarios for fertility, mortality and migration until 2050.

Green Family – Generationen-fairness im Klimawandel

PI at the University of Vienna: Erich Striessnig | UNFPA, FA645004 | 09/2021 – 02/2022

In collaboration with Population Europe, this project looked into families as potential agents of change in the area of climate change mitigation and adaptation.

Bayesian Reconstruction of Populations and Vital Rates by Educational Attainment (BayesEdu)

PI: Dilek Yildiz | Innovation Fund, IF_2019_29 | 05/2020 – 12/2021
Website: <https://www.oeaw.ac.at/vid/research/research-projects/bayesedu>

The aim of the project was to combine the available demographic data to provide true estimates of population sizes, and vital rates by educational attainment with uncertainty around them.

Climate, Health and Population - Climate Change and Differential Vulnerabilities in the Metropolitan Area of Vienna (CHAP)

PI: Roman Hoffmann, Erich Striessnig, Raya Muttarak | Jubilee Fund of the City of Vienna for the OeAW, JF_2019-19 | 01/2020 – 12/2021
Website: <https://www.oeaw.ac.at/vid/research/research-projects/chap/>

This project studied the impact of changing environmental conditions on population health in the metropolitan area of Vienna.

Warum auf Wissen nicht immer Taten folgen: Eine experimentelle Studie zu Barrieren klimafreundlichen Verhaltens im Labor und im Feld (Start-Clim2020.B)

PI at OeAW: Roman Hoffmann, Marcel Seifert | University of Natural Resources and Life Sciences (BOKU) | 08/2020 – 08/2021
Website: <https://startclim.at/>

This project investigated three behavioural barriers that are characteristic of many forms of environmental behaviour.

Life-Cycle Behaviour in the Face of Large Shocks to Health (LIFE SHOCKS)

PI: Stefan Wrzaczek | FWF, P30665-G27 | 01/2018 – 04/2021
Website: <https://www.oeaw.ac.at/vid/research/research-projects/life-shocks>

This project studied the implications of large health shocks for individuals over the life course by comparing different types of anticipation, while taking into account the effects of health and disability insurance, as well as longevity insurance through the annuity market.

Age-Specific Wellbeing and Transfer Accounts: Evaluating Intergenerational Support (AgeWellAccounts - AWA)

PI: Alexia Fürnkranz-Prskawetz | Federal Ministry of Education, Science and Research | 03/2017 – 12/2020
Website: <https://jp-demographic.eu/projects/agewellaccounts/>

The AgeWellAccounts project focused on the measurement and analysis of wellbeing from a life course perspective.

Heart Attacks and Socio-Economic Environment in the City of Vienna (Heart Attacks)

PI: Michael Kuhn | City of Vienna, MA 7 – Kultur, Wissenschafts- und Forschungsförderung, OLV1000340 | 01/2020 – 07/2020
Website: <https://www.oeaw.ac.at/vid/research/research-projects/heart-attacks>

To find out whether the residential district where people live affects their risk factors and chances of survival after a heart attack, this project analysed spatial and socio-economic inequalities in medical outcomes based on an exclusive dataset from the Vienna General Hospital.

6. Österreichischer Familienbericht

PI: Isabella Buber-Ennser, Bernhard Binder-Hammer, Bernhard Riederer | Republic of Austria, BBG-GZ 5195.03248 | 07/2019 – 03/2020

The Austrian family report included Wittgenstein Centre contributions on demographic developments and the current state of family structures, intergenerational relationships, and the risks of poverty and social exclusion for families.

Displaced Persons in Austria Survey (DiPAS)

PI: Isabella Buber-Ennser | VID/OeAW, IIASA, WU | 2015 – 2020
Website: <https://www.oeaw.ac.at/vid/research/research-projects/dipas>

DiPAS was the first social survey, not only in Austria, but in Europe, that focused on the individuals seeking asylum in Europe in 2015.

Lower Female Employment in Vienna: What Role Do Motherhood and Migration Background Play? (WieFERt)

PI: Bernhard Riederer | City of Vienna, MA7 – Kultur, Wissenschafts- und Forschungsförderung | 03/2019 – 12/2019
Website: <https://www.oeaw.ac.at/vid/research/research-projects/wiefert>

The project analysed female employment in Austria, and especially in Vienna.

Measuring Labour Mobility and Migration Using Big Data (RAND)

PI at VID: Guy Abel | EC-DG for Employment, Social Affairs and Inclusion, VC/2017/0716 | 02/2018 – 12/2019
Website: <https://www.oeaw.ac.at/vid/research/research-projects/rand#c105128>

This project developed methodologies to provide recent estimates of (labour) mobility stocks and flows in the EU using data from different sources, including from social media.

Cohort Fertility in Former Yugoslavia

PI: Kryštof Zeman | Federal Ministry of Science, Research and Economy, HR 25/2018 | 01/2018 – 12/2019
Website: <https://www.oeaw.ac.at/vid/research/research-projects/cohort-fertility-in-former-yugoslavia>

This project analysed the cohort fertility levels and structures in the former Yugoslavia using data from recent and past population censuses that asked women how many children they have ever had.

Demography and Education in Niger: A Prospective Analysis (DEMEDU-NIGER)

PI: Anne Goujon | UNICEF | 12/2017 – 12/2019
Website: <https://iiasa.ac.at/projects/demedu-niger>

The aim of this project was to project the population of Niger by age, gender, education, ethnicity and region according to different scenarios.

The Future of the Protestant Church: Estimates for Austria and for the Provinces of Burgenland, Carinthia and Vienna

PI: Anne Goujon | Evangelische Kirche A.u.H.B. in Österreich | 10/2019

This study investigated the possible effects of demography (in particular fertility and migration) and the trend towards withdrawal from religious institutions on the future membership numbers of the Protestant Church.

Early Fertility Desires: Hidden Drivers of Union Formation? (FERTUFORM)

PI: Natalie Nitsche | FWF, M2188-G16 | 04/2017 – 06/2019
Website: <https://www.oeaw.ac.at/vid/research/research-projects/fertuform>

This project studied how childbearing preferences early in life may drive union formation outcomes.

Exploring Pathways of Demographic Transition of Selected Developing Countries while Assessing their Propensity of Harnessing a Demographic Dividend (DemographicDivi)

PI: Wolfgang Lutz | GIZ | 09/2018 – 04/2019

APCC Special Report: Health, Demography and Climate Change (SR Health)

PI: Raya Muttarak | Austrian Climate and Energy Fund, KR16AC0K13161 | 01/2017 – 12/2018
Website: <https://austriaca.at/8430-0>

Addressing the complex relationship between climate change, health and population dynamics, this Special Report provides a comprehensive literature review of research on Austria, and of other research at the European and the global level.

Global Migration and Educational Expansion: Scenarios and Projections of Population-Level Interactions (MIGRED)

PI: Bilal Barakat | UNESCO Global Education Monitoring Report (GEMR) | 03/2017 – 02/2018
Website: <https://iiasa.ac.at/projects/migred>

This cross-country analysis of data on international migration and education was a background report for the Global Education Monitoring Report (GEMR).

Sustainable European Welfare Societies

PI: Raya Muttarak | Research Council of Norway, 236930/H20 | 2014 – 2018

The project analysed how researchers and policymakers may tackle issues of social welfare and environmental sustainability in coordinated and mutually supportive ways across policy fields.

Refereed WIC Publications 2018–2022

2022

Belmin, C., Hoffmann, R., Pichler, P.-P., & Weisz, H. (2022). Fertility transition powered by women's access to electricity and modern cooking fuels. *Nature Sustainability*, 5(3), Article 3. <https://doi.org/10.1038/s41893-021-00830-3>

Berghammer, C. (2022). Childcare and housework during the first lockdown in Austria: Traditional division or new roles? *Journal of Family Research*, 34(1), Article 1. <https://doi.org/10.20377/jfr-701>

Berghammer, C., & Adserà, A. (2022). Growing inequality during the Great Recession: Labour market institutions and the education gap in unemployment across Europe and in the United States. *Acta Sociologica*, 65(4), 374–397. <https://doi.org/10.1177/00016993221083226>

Bloom, D. E., Kuhn, M., & Prettnner, K. (2022). Modern infectious diseases: Macroeconomic impacts and policy responses. *Journal of Economic Literature*, 60(1), 85–131. <https://doi.org/10.1257/jel.20201642>

Bora, J. K., Saikia, N., Kebede, E. B., & Lutz, W. (2022). Revisiting the causes of fertility decline in Bangladesh: The relative importance of female education and family planning programs. *Asian Population Studies*. <https://doi.org/10.1080/17441730.2022.2028253>

Brzozowska, Z., Beaujouan, E., & Zeman, K. (2022). Is two still best? Change in parity-specific fertility across education in low-fertility countries. *Population Research and Policy Review*. <https://doi.org/10.1007/s11113-022-09716-4>

Chao, F., KC, S., & Ombao, H. (2022). Estimation and probabilistic projection of levels and trends in the sex ratio at birth in seven provinces of Nepal from 1980 to 2050: A Bayesian modeling approach. *BMC Public Health*, 22(1), Article 1. <https://doi.org/10.1186/s12889-022-12693-0>

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Hoffmann, R., Muttarak, R., Peisker, J., & Stanig, P. (2022). Climate change experiences raise environmental concerns and promote Green voting. *Nature Climate Change*, 12(2), Article 2. <https://doi.org/10.1038/s41558-021-01263-8>

Kebede, E., Striessnig, E., & Goujon, A. (2022). The relative importance of women's education on fertility desires in sub-Saharan Africa: A multilevel analysis. *Population Studies*, 76(1), 137–156. <https://doi.org/10.1080/00324728.2021.1892170>

Marois, G., Rotkirch, A., & Lutz, W. (2022). Future population ageing and productivity in Finland under different education and fertility scenarios. *Finn-*

ish Yearbook of Population Research, 56, 137–160. <https://doi.org/10.23979/fypr.119666>

Marois, G., Zhelenkova, E., & Ali, B. (2022). Labour force projections in India until 2060 and implications for the demographic dividend. *Social Indicators Research*. <https://doi.org/10.1007/s11205-022-02968-9>

Mason, A., Lee, R., & Network, members of the N. (2022). Six ways population change will affect the global economy. *Population and Development Review*, 48(1), 51–73. <https://doi.org/10.1111/padr.12469>

Spitzer, S., & Sheikh, M. (2022). Health misperception and healthcare utilisation among older Europeans. *The Journal of the Economics of Ageing*, 22, 100383. <https://doi.org/10.1016/j.jeoa.2022.100383>

Spitzer, S., Shaikh, M., & Weber, D. (2022). Older Europeans 'health perception and their adaptive behaviour during the COVID 19-pandemic. *European Journal of Public Health*, 32(2), 322–327. <https://doi.org/10.1093/eu-rpub/ckab221>

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Wu, J., KC, S., & Luy, M. (2022). The gender gap in life expectancy in urban and rural China, 2013–2018. *Frontiers in Public Health*, 10, 749238. <https://doi.org/10.3389/fpubh.2022.749238>

2021

- Anagnostou, P., Tasoulis, S., Vrahatis, A. G., et al. (2021). Enhancing the human health status prediction: The ATHLOS project. *Applied Artificial Intelligence*, 35(11), 834–856. <https://doi.org/10.1080/08839514.2021.1935591>
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