

Economic Frontiers (EF) Program Self-Assessment Report 2021–2024

**Michael Kuhn
Program Director**

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EF Program Activities and Goals

Program organization: Following its inception from scratch, the [EF program](#) has been conceived to cover four fields:¹

- Economics of disruptive changes ([EDC](#)), touching on aspects of resilience,
- Economics of equal life chances ([EELC](#)), touching on aspects of heterogeneity/inequality and human capital,
- Economic governance of transitional change ([EGTC](#)), touching on aspects of governance,
- Economic development and wellbeing in a finite and interlinked world ([EFW](#)), touching on aspects of sustainability.

Over the first three years of the program, the EDC and EELC fields have been developed with priority although much of the thematic research relates to more than one field, generating a close integration of “working lines” across fields wherever this is appropriate from a substantive or analytic perspective (see the attribution of EF research topics to the four fields in Table 1 below).

Science-oriented objectives from the research plan: The following three objectives, as taken from the 2021-2024 research plan, relate to scientific achievements:

- a) Advance the frontiers of research in the EELC and EDC fields (and develop research groups).
- b) Establish a cutting-edge research agenda and initiate research on the EGTC and EFW fields.
- c) Collaborate with other programs on multidisciplinary approaches within EF research and contribute economic components to modeling outside EF to leverage impact.

In the following, we describe in detail in which ways these three goals have been met. In doing so, we do not respond goal by goal, but due to their interlinkage, we provide a holistic account with some summary conclusions towards the end of the section.

Program Remit and Positioning: The EF program has been conceived to [take economics beyond the frontiers of mainstream analysis](#), not the least by embedding it within the IIASA research contexts, while at the same time [leveraging the rigorous principles and methods of economics](#) that stretch beyond pragmatic “toolbox” applications. To address the first ambition, EF aims at taking a profound account of (i) [complexity](#) and [uncertainty](#) and ways to incorporating them into [decision making](#); (ii) the [heterogeneity](#) and [diversity](#) of the population in terms of their preferences and “endowments”, behaviors, and resulting outcomes; (iii) the interlinkages between transitions and policy making and the [distribution](#) and [inequality](#) of resources and outcomes across socio-economic, demographic or spatial strata; (iv) an orientation on multidimensional [wellbeing](#) rather than GDP; (v) the [embeddedness of the economic system](#) into a population, climate and eco-system, including the full set of interactions, and resulting from this the need to take a [multidisciplinary](#) perspective. Addressing these issues entails an advancement of [economic models beyond their state of the art](#).

To address the second ambition, EF aims at harnessing the [comparative strengths of economic modelling](#), namely (a) the [understanding of behaviors as outcome](#) of preferences, expectations, information/rationality, constraints and incentives; (b) the [unified modelling of behaviors and wellbeing](#) outcomes; (c) the [rigorous derivation of decision-rules](#) together with the underlying monetary and non-monetary [valuations](#), a joint understanding of which is key for policy making; (d) a

¹ Please follow links for further documentation and references.

thorough and endogenous accounting for the **dynamic feedback** between **micro-decisions and macro-outcomes** within the economic system; (e) the clearcut **distinction of optimal as opposed to suboptimal outcomes** within decentralized economies, where the latter can be attributed to wrong incentives as opposed to missing information or lack of rationality, together with an **identification of policy rules** that are apt to improve welfare.

Development of modelling frameworks and research themes: Following the above principles and its prime objectives for the initial years, EF has developed three **flagship modelling frameworks**:

- (i) an advanced **optimal control-model** allowing for the rigorous analysis of decision-rules and the underlying valuations under stochastic **regime-switching** disruptions, including among others eco-system destruction, climate tipping, technological breakthroughs (2-Stage Optimal Control with Stochastic Switches - **2SOCS**),
- (ii) an advanced and **demographically realistic model of overlapping generations** of **heterogeneous** households modelled along their entire **life cycle** to trace out **diverse behavioral responses at different life stages** to environmental, technological, and socio-economic transitions, as well as the resulting outcomes over time and across socio-economic strata and generations (Model of Inequality Within and Across Generations - **MIWAG**), and
- (iii) a dynamic model of **intertemporal decision-making of heterogeneous households** facing environmental or economic **risks** (Model of Risk Behaviors - **MORIBE**).

These frameworks, complemented by a set of other models and tools, form the basis for providing, in specific applications, **policy-oriented analysis** towards understanding:

- what behavioral changes are required to **achieve social and environmental transformations**,
- what policies and institutional reforms are needed to **bring about the required incentives** in an effective, efficient, and equitable way, and
- what is the **impact on wellbeing** across social strata, geographical scales, and time.

Notably, while the 2SOCS and MIWAG frameworks are “naturally” lodged with the EDC and EELC fields, respectively, MORIBE is lodged between the two lines. The application of modified versions of the frameworks to topics across research fields generates further integration on the methodological side.

From a **thematic perspective**, the research undertaken in EF can be grouped into five areas, as illustrated in Table 1. The table reports for each of these themes exemplary key research that has been completed or is ongoing, as well as how it is linked to the four fields and whether it involves cross program or external collaborations. Aspects of the work and collaborations, together with some highlights will be developed in the following.

Themes	EELC	EDC	EGTC	EFW	Framework	IIASA Collaboration	External Collaboration
1) Resilience and optimal decisions under stochastic disruption							
Development of COVID vaccine		Dark blue	Light blue		2SOCS		Uni Padova
DICE model with climate tipping		Dark blue	Light blue		2SOCS		Uni Padova
Conceptualizing Resilience		Dark blue			2SOCS		
2) Inequality in human capital accumulation and wellbeing within and across generations							
Redistributive Effects of Pension Reforms	Dark blue		Light blue		MIWAG	POPJUS	TU Vienna, Austrian National Bank
Inequality in longevity expansion (RIWAG, Austrian Grant)	Dark blue			Light blue	MIWAG		TU Vienna, Vienna Institute of Demography
3) Preventive and adaptive behavior of actors in the presence of risk							
Household responses to disaster (flood) risks	Dark blue	Dark blue	Light blue		MORIBE	POPJUS	TU Vienna
Farming responses to economic and environmental shocks (PVARGLOBIOM; Austrian Grant)	Dark blue	Dark blue			MORIBE	BNR	
4) Climate and energy transitions: inequality, wellbeing, policy							
JustTrans4All (SI internal grant)	Dark blue					ECE, POPJUS	
JUSTCOAL (Austrian Grant)	Dark blue	Dark blue	Light blue		2SOCS	(follow-up: BNR, POPJUS)	TU Vienna
MULTIFUTURES (Horizon Europe)	Dark blue	Light blue	Dark blue	Light blue	MIWAG		HE Consortium
Environmental policy analysis		Dark blue	Dark blue		Various		Indian Inst of Mgt. Ahmedabad, U Bologna & others
5) Health, innovation, and population							
COVID-19 containment	Dark blue	Dark blue	Dark blue		SIR/SIS models	ASA, POPJUS	TU Vienna, Carnegie Mellon, U Tilburg, Harvard School of Public Health & others
Health systems transitions, medical progress	Light blue		Dark blue	Dark blue	Various		Vienna Uni of Econ & Business, U Bologna & others
Economic burden of disease	Light blue			Dark blue	(Harvard) Health Macro Model		Harvard School of Public Health, Uni Heidelberg, Vienna University of Econ and Business
Population change			Light blue	Dark blue	Various	POPJUS	Various
Chapter 5 Flagship Report	Dark blue			Dark blue	FeliX systems model /YoGL indicator	POPJUS, ECE	

Table 1: EF key research. Notes: Dark blue = prime field(s); light blue = supplementary field(s)

1) Resilience and optimal decisions under stochastic disruption

EF researchers have focused on developing the [2SOCS framework](#). A key strength of the model is that it allows to develop in great detail the [nexus of anticipative ex-ante choices](#) (e.g. in regard to risk mitigation or the build-up of adaptation capital, but also in regard to the build-up of pollution or the running down of crucial resources) and the pathways of [ex-post adaptation](#) to a possible shock, where the states of the system around the (random) arrival of the shock provide the mathematical nexus. This allows to map out in great detail the interdependencies between the choices over time and across regimes. The calculation of the emergent (monetary) valuations of different system states allows for practical economic and policy applications. EF researchers have initially applied the 2SOCS model to [study](#) the linkage between lock-down policies against [COVID-19 and R&D investments](#) into speeding up the stochastic arrival of a vaccine as a positive disruption towards changing the containment of the disease. A [second early application](#) is the employment of the model to study policies aimed at [pollution control](#) across an age-structured population [under the risk of climate disruption](#).

In the course of a [YSSP project](#) led by EF, the 2SOCS modelling has been applied to the Nordhaus DICE model to allow for the study of how different types of [disruptive climate tipping events](#) (polar ice meltdown; carbon source-sink reversion; severe dip in economic productivity; direct destruction of capital) bear on the Social Cost of Carbon and optimal abatement policies ex-ante and ex-post as well as in the presence or absence of anticipation. The work is currently being developed towards a journal publication. Furthermore, EF employs 2SOCS to derive [model-based metrics](#) that can be employed for the [assessment and valuation of policies](#) under the shadow of disruptive events. EF researchers have thus derived a model-based [measure of resilience](#) that embraces the core components of resistance, recovery and robustness and keeps track in a forward-looking way of the resilience against the risk of cascading future shocks. In a second application in progress, EF researchers derive the [value of information on unknown disruptive processes](#).

A version of the 2SOCS model is employed in the [JUSTCOAL](#) project, where the disruptive shock corresponds to changes of energy prices on the world market or exogenous political decisions. (see also under 4) below). An application towards understanding how [policymakers should take into account the scope for social tipping](#) is in process.

2) Inequality in human capital accumulation within and across generations

With the purpose of rigorously accounting for [socioeconomic and demographic heterogeneity](#) in the behavioral responses and outcomes of socio-economic, demographic, technological, political and environmental [transition processes](#), researchers at EF have developed the [MIWAG framework](#). MIWAG derives [rich behavioral choices, including educational and health investments](#), consumption choices, labor supply of individuals (or households) along the life cycle, based on a [realistic calibration \(based on Bayesian melding\)](#) to demographic and economic data, and allows to calculate the [distribution of economic and non-economic outcomes, including wellbeing](#). Individual life cycles reflect detailed socio-economic heterogeneity as well as the cohort the individual belongs to. Cohorts are then aggregated to reflect the socio-economic and demographic make-up of a heterogeneous population. Based on this, [counterfactual analysis](#) is employed to [identify the impacts of alternative transition or policy scenarios on the population under study](#).

Building on the premise that many pension systems exacerbate inequality by redistributing funds from short-lived and typically poorer individuals to long-lived and richer individuals, the MIWAG model has been applied to study the [impact on the distribution of life-cycle wealth of a range of pension reforms](#) that are currently debated. The model is calibrated to the Austrian economy, allows for self-

selection of individuals into education groups and reveals the strong variation across pension schemes in terms of their impact on inequality across education groups.

In an [Austrian National Bank funded research project](#), EF researchers employ the MIWAG model to identify the [drivers behind the growing income gap in life expectancy](#) in the US for cohorts born between 1900 and 1960. They identify that differential income growth, medical progress against age-related diseases as well as non-age-related reductions in mortality explain differential longevity growth to roughly equal parts. Half of the differential growth across income groups and cohorts can be explained by social mobility, where individuals with favorable childhood traits increasingly select themselves into higher education and, thus, higher income groups, while leaving those with the most disadvantageous traits in the lowest income groups and with a much lower increase in longevity.

3) Preventive and adaptive behavior of actors in the presence of risk

In an effort to understand the impact of (potential) disruptions on heterogeneous populations, researchers at EF have developed the [MORIBE](#) framework, which allows to study the [dynamic prevention efforts and adaptation responses of heterogeneous agents](#) to a sequence of recurring shocks. Calibrated to socio-economic panel data from Vietnam and Thailand, the model has been specified to study the allocation (in terms of allocation of financial vis-à-vis non-financial assets, preventive effort, and locational choices) by households who differ in education and, thus, earning potential as well as risk awareness. [The analysis](#) reveals strong educational gradients in the incentives to protect against risks as well as in outcomes and analysis of different mitigating policies.

In the EF-led Austrian National Bank funded project [PVARGLOBIOM](#), researchers from EF and IBF/BNR study how [financial market shocks on agricultural prices](#) drive land-use decisions and related changes in greenhouse gas emissions. EF researchers contribute to this analysis a variation of the MORIBE model that studies the [dynamic decisions on land-use and technological inputs of heterogeneous farming households](#) which are exposed to price shocks. Outcomes from this model will subsequently serve as input to the GLOBIOM model as executed by IBF/BNR.

4) Climate and energy transitions: inequality, wellbeing, policy

Various strands of EF research have been directed towards a better understanding of the socio-economic [drivers and impacts of climate and energy transitions](#). As participants of the [JustTrans4All](#) SI project, EF researchers team up with colleagues from POPJUS and ECE to [study](#) how [net zero energy transitions](#) can be structured in a [just and inclusive](#) way. Jointly with POPJUS they have developed data and empirical designs to [operationalize the dimensions of decent living standards \(DLS\)](#) by way of Development and Health Survey data for a range of predominantly Global South countries (R&R with Nature Comm). In addition, they are developing [empirical designs to capture the link between DLS performance](#), climate change and health.

EF researchers have acquired two project grants aimed at studying aspects of the climate transition. [JUSTCOAL](#) examines how the [transition out of coal](#) should be [structured to further the welfare of \(former\) coal mining regions](#). For this, we consider a multi-sector regional economy and adopt the perspective of a regional decision-maker who is allocating investments (or divestments) into coal and renewable energy infrastructures and manufacturing with the aim of maximizing intertemporal regional welfare, including population health and employment opportunities. Particular attention is given to the [joint timing of the phase out and build-up of an alternative industry](#), to the question by which policies a social optimum can be implemented within a decentralized economy of firms and households, and what are the [implications of potential disruptions](#), such as an international energy

crisis or the arrival of effective carbon capture and storage technologies. The approach also forms the basis of EF's contribution to an ongoing cross-program (BNR, POPJUS, EF) integrated modelling effort towards understanding [global change](#) from a joint bio-physical *and* socio-economic perspective.

EF participates in the Horizon Europe [MULTIFUTURES](#) project that develops **new and unconventional policy pathways** for the EU to meet their **net zero** obligations in a way that harnesses wellbeing beyond mere economic performance as measured by GDP. EF researchers are leading the **modelling work package “Exploring and simulating alternative transition scenarios”**. While this includes leadership on the linkage across a variety of partner models to address technological change and life-style change as pathways towards a transition, it also involves a conceptualization and analysis of beyond-GDP indicators as performance metrics for the policy assessment, as well as an application of the MIWAG model to **study the impact of transitions on household lifestyle behavior and wellbeing** across different generations and socio-economic strata.

Finally, EF researchers have worked on a number of projects relating to environmental policy making, including a bottom-up integrated optimization model on the [energy transition in Gujarat, India](#); the application of dynamic game theory to understand the [impact of emission taxes on pollution control](#) and R&D investments into abatement technologies; and the [role of policy making and technological progress](#) within the nexus of environmental pollution, life expectancy, and economic growth.

5) Health, innovation, and population

EF has developed a complementary research agenda on the **economics of health and health systems** as well as **development, population and technology**. This newly places IIASA in the fields of health economics and population economics, as two fields that are **inherently important for the transitional research** undertaken within IIASA. Following its inception during the ongoing **COVID-19** pandemic, EF has engaged in an ambitious research program on **containment policies within advanced Susceptible-Infected-Recovered (SIR) frameworks**, but also on various other aspects of the COVID-19 pandemic and infectious diseases in general. Aside from the work on the relationship between vaccine development and non-pharmaceutical interventions (see under 1) above), EF researchers have applied SIR type modelling to understand the [relationship between vaccine roll out and lockdown](#) policies, showing that these may be both policy substitutes or complements, depending on the particular regime, and that vastly different policy regimes may apply for very similar disease parameters and preferences about the preservation of lives and livelihoods. EF researchers have also published work on [lockdown and testing policies in disease networks](#) (accounting for possible transmission across different regions or subgroups of the population), and on the optimal choice of non-pharmaceutical interventions along [the development of a pandemic into an endemic disease](#), including the scope for viral mutation, immunity loss and the build-up of bodily resilience within the host. On the empirical side, EF researchers have employed (i) econometric methods to establish [the relationship between climate conditions and viral spread](#); (ii) innovative Bayesian melding techniques together with simulation analysis to understand the [impact of vaccine availability on case-fatality rates](#); and (iii) the economic burden of disease analysis (see below) to understand the potential [macroeconomic costs of COVID-19 under a herd immunity](#) approach. Finally, EF has contributed to a prominently published survey on the [macroeconomic impact of modern infectious diseases](#).

EF has enquired into the **nexus of health care systems, medical progress, and population change**. This includes two simulation studies based on multi-sector macroeconomic models that integrate demographically realistic life-cycle foundations of overlapping generations of individuals whose health and longevity depend on the provision of health care. These have been applied to (i) quantifying the [impact of the US health insurance expansion](#) on medical progress, life expectancy, (excessive) health care spending, longevity, and welfare across generations; and (ii) studying the [macroeconomic and](#)

[welfare impact of healthcare policy responses](#) to medical progress and economic growth within a capacity constrained and crowded public healthcare system. Ongoing research applies advanced time series techniques to study the [role of medical innovation for longevity and economic growth](#) between 1890–2010. EF researchers contribute to research that applies advanced macrosimulation techniques to Global Burden of Disease data in order to establish the [economic burden of disease](#). Recent studies, published in prestigious medical/public health journals, include the calculation of the [economic burden of cancer](#) (including 29 specific types) as well as the [economic burden of COPD](#) for a set of 204 countries and territories worldwide.

EF has also enquired into the [dynamics of population change and its economic ramifications](#). This includes research on how the [economic impact of an ageing population on economic growth](#) in the Global North can be reined in by adjustments in retirement and on whether the [trend towards declining populations](#) can be reined in by greater investments into the health and education of individuals. Based on calibrations for India and China, recent work has studied how [population change can be \(optimally\) controlled](#) through costly pro- or anti-natalist policies towards a stationary population structure. Recently, EF researchers have contributed to a survey on the [causes and consequences of fertility decline in high-income economies](#) that has been accepted as invited contribution to the prominent Annual Review of Economics. Finally, in collaboration with researchers from POPJUS and ECE, researchers from EF led the development of chapter 5 on “Global Systems Analysis for Understanding the Drivers of Sustainable Wellbeing” of IIASA’s [50-years flagship report](#), which included the first attempt at [integrating and evaluating the Years of Good Life \(YoGL\) wellbeing indicator within a global systems model](#).

Integrating EF research into IIASA: EF has sought to strike a [balance between establishing its modelling frameworks](#) as a basis for EF’s “signature” contribution to scientific and policy analysis; [engaging with external partners](#) from economics and other fields (see last column of Table 1) with the aim toward [building a network](#) that bridges economics and other disciplines in a systemic way; and [internal collaborations with other IIASA programs](#) aimed at harnessing complementary capabilities. Regarding [cross-cutting activities](#) EF has engaged in formal efforts, including participation in SI projects and applications, joint research grants and cross-program YSSP mentoring, and informal collaborations, including the cross-program development of papers and research projects. The following provides some examples:

- **Providing economic underpinnings for global models**, specifically during the PVARGLOBIOM project jointly with BNR, where detailed micro-modelling of the intertemporal decisions of farmers in response to price shocks helps to calibrate the more macro-oriented GLOBIOM, while the calibration of the MORIBE model will benefit from GLOBIOM regarding the specification of the macro-environment. Similar efforts are under way with BNR and POPJUS towards the integrated modelling of global change.
- **Collaboration on the study of population risk behavior** jointly with POPJUS. Benefits arise from the integration of empirical (POPJUS) and theoretical (EF) modelling capabilities.
- **Leveraging data with economic analysis:** The MIWAG framework is based on detailed population data e.g. on educational or family structures. EF researchers are collaborating with POPJUS with the aim of enhancing and applying this data to economic contexts.
- **Lead on IIASA-wide efforts:** When developing the case study on energy transition in South Africa for the IIASA-OECD task force and chapter 5 of the flagship report on global systems modelling, EF has convened IIASA researchers from all programs for the purpose of co-developing [integrated projects](#).

- **Contributing an economic perspective on key concepts such as justice and wellbeing** in the context of the JustTrans4All SI (ECE/POPJUS), the Flagship Report (ECE/POPJUS), and a collaboration with ECE on the Austrian Assessment Report. Similar perspectives are added by EF's work on **tipping points and resilience**. The multi-disciplinary exchange is clarifying conceptualizations, enhancing a mutual understanding of different conceptual entry points, and facilitating the exchange between IIASA and economic audiences.
- **Leveraging capacity building:** EF researchers have co-mentored jointly with ASA and BNR colleagues YSSP scholars with the aim of enhancing cross-disciplinary expertise and integrated thinking.

Altogether, EF is harnessing IIASA's scientific and policy impact through its modelling frameworks, by opening economics-oriented scientific and policy communities (health, population, environment, and climate) to IIASA, and by facilitating for IIASA researchers the engagement with economic analysis and economic thinking. By tying together economic approaches across frameworks and topics EF leverages the strength of economic analysis beyond the more isolated and topic-focused economic approaches within other programs.

Goal achievement and Outlook: Altogether, EF has managed to develop and put into place **three key modelling frameworks as an analytical foundation** for performing analysis on a broad range of topics that touch on disruptive change & resilience and/or population heterogeneity in behaviors and outcomes (Goal (a)). These frameworks have been demonstrably **applied to several contexts** already, with further applications ongoing (in various stages of development). The **generality of the models** allows EF to **address a wide range** of topical **policy contexts**, including the study of risk responses; energy and climate transitions; environmental and climate policy making; as well as health and social policies; policymaking in respect to infectious diseases (Goal (b)). In developing its research agenda EF has been careful to **integrate its research fields both conceptually and through the researchers** working on them. This integration stretches not only across EELC and EDC as the two fields under primary development, but in a context-driven way includes also the EGTC and EFW fields. EF has thus laid the foundation towards developing them further (Goal (b)).

During a number of projects but also by way of less formal interaction, EF has **integrated its expertise with all other substantive research programs**. Areas which have been co-developed relate, in particular, to **COVID-policies; health and social policies; just (climate) transitions; and household responses to disaster and economic risks**. Further areas under development include agricultural transitions, health, climate, and more specifically the nexus through infectious diseases (Goal (c)). These collaborations also demonstrate the value and potential for **harnessing IIASA research across the board by integrating in a deep-dive the strong points of economic thinking** in terms of a rigorous foundation of dynamic behaviors, decision-rules and valuations in preferences, incentives, and the relevant economic, technological, political, demographic and social constraints.

While the **EF modelling frameworks** that have been established over the initial years **support a broad array of research themes**, including topical areas to be identified in response to the evaluation and as part of the new research plan, EF hosts **additional modelling competency**, including (i) vintage optimal control modelling to study planning problems in regard to human and animal population but also vintages of capital or technology; (ii) advanced techniques in dynamic game theory to explore strategic, political and governance aspects of transitions; (iii) structural economic methods for complementary empirical research; and (iv) financial economic and econometric expertise on climate and environmental transitions. These competencies can **support the future research agenda**.

Overall Program Achievements on Policy Impact and External Networks

Impact-oriented objectives from the research plan

The following two objectives, as taken from the 2021-2024 research plan, relate to generating policy and scientific impact:

- d) Provide a platform for discussing (economic) policy and developing research toward social and environmental transformation. This forum brings together economically relevant aspects of research from all IIASA programs and will be open to relevant external (e.g., NMO) stakeholders.
- e) Introduce systems thinking and EF insights into economic policy debates.

In the following we describe in detail in which ways these two goals have been met. Again, we provide a holistic account with some summary conclusions towards the end of the Section.

Working towards policy impact

The focus of EF's activity during the early years has been on the development of its key modelling frameworks (as discussed in the previous section) with the aim of building a scientifically solid and trusted basis for policy analysis, assessment and advice. Thus, to some extent the application of these frameworks towards generating policy impact is forward looking with the first steps having been taken through the JUSTCOAL and MULTIFUTURES research projects, which already take the frameworks to a (more) applied stage. Aside from these projects, EF researchers have engaged in a number of activities that have already left a policy impact or have been oriented towards establishing EF's presence in the policy arena.

Towards **building a policy and scientific forum for their work on disruptive changes**, EF researchers have picked up a [keynote invitation](#) to present and discuss their work on resilience at the 2023 "Istat Risikokonferenz" (**Risk Conference**), a high level gathering in Germany of **risk managers of prominent companies** from the manufacturing and energy sectors, including inter alia Porsche (Germany), Volkswagen (Germany), OMV (Austria), Vattenfall AB (Sweden), and SLB (former Schlumberger Technologies, US, European Division). The work on resilience has also been presented to and positively received by the [PEER Network](#) in 2024. Moreover, EF researchers have been invited and contributed to a panel on "**Building Back Better: After the 'Shock' and Beyond**", [Berlin Demography Days 2024](#).

Drawing on the program's work on equal life chances, EF researchers have carried out work on the [generational impacts of COVID 19](#) that was **supported by the UNFPA** and featured prominently in **UNFPA and UNDESA seminars** and workshops. This work is building on the **National Transfer Accounts (NTAs)**, a global initiative aimed at establishing a set of intergenerational accounts worldwide, to which **EF researchers are contributing in a leading capacity for Austria and Europe**. As part of this network, they have contributed to a conference celebrating the [use of NTAs in China](#) for supporting policy responses to population ageing, [the 14th Global Meeting on Building Sustainable Generational Economies](#) in Paris, and to a [conference on sustainable development and demographic changes in Uzbekistan](#), in which EF researchers explained how to use NTAs for assessing the demographic dividend, or the potential economic boosts coming from a favorable demographic structure. Recent work on the distributional impact of pension reform has been presented at the Austrian policy forum "[Denkräume St. Lambrecht](#)".

Tying in with their work on climate and energy transitions, members of EF have joined as lead authors, the chapter 5 team on “[demand-side transitions](#)” of the [Second Austrian Assessment Report](#) (AAR2, 2022-2024). They have also contributed to the [chapter 6 on "Energy Systems"](#) in the [IPCC's sixth assessment report \(AR6\) in Working Group III](#) (Mitigation). EF also acts as an IIASA representative on the [European Energy Research Alliance \(EERA\) – Bioenergy](#), engaging inter alia in the preparation of a “Bioenergy Position Paper” that identifies research gaps and approaches. They are also contributing to EERA’s joint program on “Clean energy transition for sustainable society (e3s)” through a [White Paper on energy demand reduction](#). In 2021, EF researchers have teamed up with researchers from POPJUS to produce a [policy brief on the linkages between SDG7 \(Accessing clean energy\) and SDG 10 \(Reducing inequality\)](#) for a high-level report by UNDESA’s [SDG7 Technical Advisory Group](#) on the use of energy access to leverage SDG attainment. EF researchers have also contributed to a report on ["Synchronizing energy transitions toward possible Net Zero for India: Affordable and clean energy for all"](#) commissioned by the Office of the Principle Scientific Advisor (PSA) to the Government of India and Nuclear Power Corporation of India Limited (NPCIL). Finally, EF researchers have contributed to a [VoxEU policy brief](#) on a sustainable digital transformation.

Concerning work on health and population, EF has contributed a [keynote presentation to the 4th Symposium on Population Medicine & Public Health](#), organized by the Chinese Academy of Medical Sciences & the Peking Union Medical College. The topic was on [optimal health care spending](#) and informed [Chinese policymakers and scientists](#) about the fact that while health care systems may be spending inefficiently at a micro-level, health care spending at the macro level is likely to be too low from a welfare perspective. EF’s work on [COVID19 containment](#) has been communicated through [Vox EU policy briefs](#) ([Brief 1](#), [Brief 2](#)).

Since 2021 the EF program has taken the [IIASA lead on the OECD-IIASA Strategic Task Force on Systems Thinking, Anticipation and Resilience](#), coordinating the engagement with OECD on the matter. Specifically, EF researchers have teamed up with colleagues from other programs and OECD units to draw up a large-scale grant proposal for EU funding on the development of integrated policy pathways towards a just and inclusive net-zero transition in South Africa in cooperation with South African researchers. Despite the initial interest on the part of the EU DG Climate, unfortunately funding was not forthcoming. Following an invitation to provide [feedback on the OECD multidimensional fragility framework](#), EF has hosted a mini workshop in 2021 in which participants from IIASA and OECD discussed aspects of the framework and notions of fragility.

Finally, EF presented their work on the inclusion of wellbeing into global systems modelling, as part of the [Flagship Report](#), at a global [launch event](#) on the occasion of the 78th UN Assembly and mid-term review of Sustainable Development Goals, as well as during a EU Commission library talk.

Network building

Besides their membership in the policy-oriented EEARE and PEER networks, as well as the IIASA-OECD Strategic Task Force, EF researchers are strongly engaged in [formal and informal scientific networks](#). Per cross-affiliations of various program scientists, EF is strongly tied in with the Wittgenstein Centre and the Austrian Academy of Science’s Vienna Institute of Demography. Cross-affiliations also exist with the Technical University of Vienna, the Okinawa Institute of Science and Technology, the Indian Institute of Management Ahmedabad, and the New School in New York.

Several EF researchers are **co-opted members of the Field Committees on “Population Economics” and “Health Economics” of the German Economic Society** as well as members and officers of the **Austrian Economic Association**. Close collaborations also exist with various **commissions of the Austrian Academy of Sciences and Statistics Austria**. On a less formal basis, EF researchers are linked into strong **authorship networks** on Optimal Control and Dynamic Game Theory (e.g. Jon Caulkins, Carnegie Mellon; Georges Zaccour, Gerad and HEC Montreal; Fouad el Ouardighi, ESSEC Business School; Peter Kort, Tilburg University; Luca Lambertini, Bologna University); population, health and development economics (Hippolyte d’Albis, Paris School of Economics; Uwe Sunde, Ludwig-Maximilians-Universität Munich; Holger Strulik, Uni Göttingen; Ron Lee, U Berkeley; David Bloom, Harvard School of Public Health) and environmental and climate economics (Pauli Lappi, U Helsinki; Gernot Wagner, Columbia) amongst others.

To embed their work in the field of EDC in the scientific community and to provide a new forum for researchers in this field, EF has initiated a **network on “Modelling resilience and disruptive changes”**, which is organized around two **workshops**, an **inaugurating one in 2022** and one forthcoming in autumn 2024, and a series of **biannual seminars**. Speakers so far have included Anne-Sophie Crepin (Beijer Institute), Aart de Zeeuw (Uni Tilburg), and Eli Fenichel (Yale). Further members of the network include Frederik van der Ploeg (Oxford), Amos Zemel (Ben-Gurion University), and Florian Wagener (U Amsterdam) among others. Related to this network is EF's co-organization and hosting of the **8th Viennese Workshop** on "Heterogeneous Dynamic Models of Economic and Population Systems" in 2023.

Finally, EF has initiated the **Econ4Um Seminar Series**, which aims at bringing together IIASA and external colleagues with an **interest in economics or systems analysis of economic issues** and has so far featured 15 sessions based on presentations of both internal and external speakers. Prominent visiting speakers include Georges Zaccour (Gerad and HEC Montreal) and Fouad el Ouardighi (ESSEC Business School).

Capacity building and community services

Over the past three years, EF has hosted **seven YSSP scholars** from a range of countries (AT, CHN, Ghana, IND, IT) who have successfully completed work on inter alia, the impact of mining activities on regional economic growth and forest destruction in Brazil (joint supervision with BNR; report to revise & resubmit with Nature Communications); the inclusion of tipping points into the DICE model; unequal access to pharmaceutical abortion in Ghana; allocation of vaccines in the presence of supply rationing in India; and the scope for international climate agreements that couple emissions reductions with preferential technology access (joint with ASA; **winner of the 2023 Mikhalevich award**).

EF researchers have co-supervised two **PhD students**, tying in their work with the program's agenda on disruptive change and risk responses. In addition, the program has hosted one intern, working on the impact of developing aid on decent living standards and preparing this for her Master thesis.

EF researchers are active in providing regular **university courses in economics and operations research**. In addition, EF researchers have given an **invited lecture at Erasmus University Rotterdam on the economics of COVID-19** and its containment. Moreover, EF researchers have taught a session for the DAAD – University of Potsdam Alumni Seminar ‘Risk-Management – Governing Uncertainty in a Complex World’.

EF researchers have been active in the organization of a number of conferences, most notably the **Wittgenstein Conferences 2022** (on depopulation) and **2023** (on heterogeneity of populations).

Finally, as part of EF's efforts of **establishing an open modelling environment** in the mid to long-term, the **2SOCS model framework** and the underlying **vintage optimal control modelling** have been made available as **toolboxes on GitHub**. Furthermore, the code for the **MORIBE model** is also available via GitHub. The MIWAG model will be made available after further work and verification of the code.

Goal achievement and Outlook

Over the past three years, the EF program has in many ways laid the foundation for generating policy impact. While the primary focus was to some extent on the development of the key modelling frameworks that form the scientific basis for policy analysis and advice, significant effort was expended on **introducing EF and its research to the respective scientific and policy communities**. This has been achieved by a mix of activities, including the **engagement with policy-oriented networks** (EERA, PEER, NTA) as, indeed, with **OECD**; the presentation of EF at scientific and policy fora, and participation in **community activities** such as IPCC VI and the Austrian Assessment Report. These efforts have been accompanied by **active engagement in capacity building**, notably YSSP, and the implementation of first modelling structures in an open modelling way (Goal (b)).

EF has also successfully engaged in creating a **research network on the “Modelling of resilience and disruptive changes”**, drawing the **active interest of top researchers** in the field. While EF researchers are already well connected within networks on population (e.g. the National Transfer Account network), building a similar network is envisaged in respect to the modelling of population heterogeneity. In addition, EF has initiated and is successfully running the **Econ4Um Seminar Series, functioning as an IIASA-wide forum for exchange on economics topics**. Given its firm establishment, the next step is its active promotion as a forum of exchange between IIASA and external researchers, policymakers and other stakeholders on economic policy issues in the context of socio-environmental transformations (Goal (b)).

Based on these foundations EF has **stepped up its efforts in establishing a foothold in policy applications** both through grant applications (with notably the European Horizon Grants having a strongly applied nature) and engagement with a number of NMOs on a variety of themes (e.g. natural capital accounting and food transitions).

EF Budget, Staff, and External Projects

	2021	2022	2023	2024
Total budget	521.670	413.842	527.973	530.245
Income from External Projects	-	-	-	105.861
Income from Internal Projects	-	21.748	36.225	15.504
Core allocation	521.670	392.094	491.748	408.880
Expenses	299.280	381.994	478.602	526.000
Total FTEs	3,38	5,18	6,97	7,87
FTEs scientific	2,38	4,18	5,97	6,87
FTEs non-scientific	1,00	1,00	1,00	1,00

The start-up nature of the EF program is strongly reflected in the progression of its budget and staff FTEs. Both personnel and core budget spending were closely linked to hiring staff that was key for the development of the core frameworks of the program. Thus, availability of such (specialist) staff only from the mid-term onwards and ongoing COVID-restrictions on activities explain the significant underspending in 2021. Both FTEs and spending were then gradually increased in line with the available internal and external project funding.² In particular the successful acquisition of external funding in 2023 has allowed for a significant expansion of staffing. With further grant applications on the way, EF expects further expansion as well as a significant increase in the external funding share.

In line with the build-up of the group of core researchers and its research agenda, EF has also expanded the number of guest researchers to tie in additional expertise and formalize collaborations on methods and topics that are key for EF. Overall, EF researchers come from a range of countries, including Austria, China, Finland, Germany, Ghana, India, Italy, South Korea, Morocco, Russia, Spain, Vietnam, and USA. EF also strives to arrive at an equitable gender balance, which in 2024 stands at 39%.

	2021	2022	2023	2024
Total FTEs	3.38	5.18	6.97	7.87
R1	1	3	4	3
R2	2	5	10	12
R3	0	0	1	1
R4	1	1	1	1
O-5	1	1	1	1
Total Staff	5	10	17	18

² Note that while the PVARGLOBIOM project was initiated in 2022, spending was deferred to 2024 due to a late start that was due to difficulties in recruiting appropriate expertise.

List of staff working in EF over the period 2021-2024.

Name	Staff Category	Period
Michael Kuhn	Scientific, Program Director, Principal Research Scholar	2021–present
Cynthia Festin	Professional, Operational	2021–present
Caesar Agula	Scientific, Research Assistant, YSSP	2023
Michael Freiburger	Scientific, Research Scholar	2021–present
Alexia Fürnkranz-Prskawetz	Scientific, Research Scholar	2023–present
Amrutha Gopinathan	Scientific, Research Assistant, YSSP	2024
Dieter Grass	Scientific, Research Scholar, Guest	2023–present
Jinhyeok Jang	Scientific, Research Assistant, YSSP	2024
Yuliya Kulikova	Scientific, Research Scholar	2022–present
Zhu Kunxin	Scientific, Research Assistant, YSSP	2024
Pauli Lappi	Scientific, Research Scholar, Guest	2023–2024
Andreas Lichtenberger	Scientific, Research Assistant, YSSP	2022
Qi Liu	Scientific, Research Scholar, Guest	2023–present
Anna Monisso	Scientific, Research Assistant, Guest	2023
Maddalena Muttoni	Scientific, Research Assistant, YSSP	2022
Omkar Patange	Scientific, Research Scholar	2022–present
Claudia Reiter	Scientific, Research Scholar, Guest	2023–present
Miguel Sanchez-Romero	Scientific, Research Scholar, Guest	2021–present
Willi Semmler	Scientific, Senior Research Scholar, Guest	2023–present
Zhimin Shi	Scientific, Research Assistant, YSSP	2022
Rajdeep Singh	Scientific, Research Assistant, YSSP	2023
Ibrahim Tahri	Scientific, Research Scholar	2024–present
Ha Vu	Scientific, Research Scholar	2024–present
Stefan Wrzaczek	Scientific, Research Scholar	2021–present
Huiying Ye	Scientific, Research Assistant, YSSP	2023

Externally Funded Projects

Project: PVARGLOBIOM

Title: Long-term spillover impacts of financial markets on the environment

Period: 01-NOV-22 till 31-OCT-26

EF Program Share: EUR 73,085.75

Abstract: The proposed project aims to capture the medium to long-term spillover effects of financial markets and related stakeholders such as regulatory institutions on climate-relevant emissions from land-use and changes to its pattern. EF is collaborating with IBF and developing an intertemporal model of the land-use and technology choices of (partially) forward-looking and heterogeneous farming households in the presence of financial market risks and possible credit constraints. The detailed model of intertemporal behaviors will be calibrated based on VAR analysis of price movements. Its output on risk responses in terms of land-use and technology will inform the calibration of IBF's GLOBIOM model.

Project: JUSTCOAL

Title: Modelling the regional welfare impacts of coal transitions in the context of net-zero climate goals

Period: 01-NOV-23 till 31-OCT-26

Total project funding: EUR 324,574.87

IIASA Share: EUR 249,588.21

Abstract: Coal, the most carbon-intensive fossil fuel, is also central to many regional economies that rely on its mining, transportation, energy production or exports. In this context, just coal transition entails finding ways for coal phase-out without impacting the regional economies. This would ensure that policies aimed at global emissions reduction and environmental protection do not cause undue harm to local communities that have a major dependence on coal-based industries for their subsistence and employment. With a focus on just transitions, we propose to study and model the welfare impacts of energy transitions for regional, coal-dependent economies. Our approach, grounded in optimal control theory, includes modelling on how coal-to-renewable transitions should be structured at a regional level when taking explicit account of the labor market, health and welfare implications for the local population. Further, we develop scenarios for just transitions based on gradual versus disruptive changes in regulations and technologies to inform regional policies with respect to economies that are under different stages of development and coal transitions.

Project: MULTIFUTURES

Title: A multi-methods approach towards developing novel policy options towards developing multi-dimensional transition futures

Period: 01-JAN-24 till 30-JUN-27

IIASA Share: EUR 395,389.95

Abstract: MultiFutures systematically broadens the scope for policy action towards sustainable societies by assessing and developing transition scenarios based on alternative economic paradigms. This involves extending established transition scenarios (e.g. the EC's 'Long term strategic vision' scenarios or the IEA's net zero scenarios) to include alternative economic paradigms that are based on a wide spectrum of sound economic and social theories and have demonstrated potential to address global challenges. These paradigms introduce new policy options and instruments, which we aim to critically assess regarding their relevance, effectiveness, and potential trade-offs. EF leads a work package on the development of an integrated modelling framework and will contribute the RIWAG model to study the impact of policy pathways on lifestyle (behaviors) and economic and non-economic outcomes across the socio-economic and age strata of a population.

Program Specific SWOT Analysis

Strengths

- EF's three modeling framework are based on highly advanced methodology, are general and, for this reason, adjustable to many current and future topics relevant for IIASA.
- EF is one of few groups capable of integrating the strength of economic analysis (endogenous modeling of behaviors, optimal decision-rules, rigorous modeling of institutions and policies) with heterogeneity, uncertainty and system complexity.
- Reliance on own rather than adopted models and frameworks.
- Strong integration of research methods and fields within EF.
- Researchers embedded in long-standing and high-profile external research collaborations; EF has successfully established scientific visibility.

Weaknesses

- Possible overdiversification in terms of themes, but notably this is partly reflecting the fact that EF actively develops unified frameworks to different areas and partly reflecting EF's role as a provider of “deep-dive” economic analysis across diverse topics.
- With the focus on framework building so far, the applications’ angle needs to be rolled out.
- NMO ties in terms of actual model applications should be strengthened, and more follow-up on initial contacts is needed.
- IIASA internal collaborations have been successfully initiated but should be formalized and strengthened (funding!).
- External funding is still low (but growing).

Opportunities

- Connecting IIASA (back) into economic research and debate; and vice versa strengthening economic thinking and concerns within systems science community.
- Capacity building in the above regard.
- Methods, nexus of topics and its embeddedness within IIASA create significant differentiation from mainstream economic units (methods), specialized economic units (integration of topics) and multidisciplinary institutions that cover economics by off-the-hook methods.
- With established frameworks on the ground, EF researchers have additional modelling tools (vintage optimal control, dynamic game theory, structural methods, financial economics) to their avail to tackle emergent themes.

Threats

- Model complexity may inhibit applicability (conversion into simpler tools needed) and makes funding acquisition more difficult.
- Both the development of economic modeling and even more the process to publications are tedious and lengthy.
- Risk of falling between all chairs in positioning (too economically nitty-gritty for general or systems audience; too systems oriented for economic audience).
- Not yet too big to fail.
- Economics is an extremely competitive field for publications and grant acquisition.

List of Publications

Peer-reviewed publications

Journal articles

1. Feichtinger, G. & Wrzaczek, S. (2024). **The optimal momentum of population growth and decline.** *Theoretical Population Biology* 155 51-66. [10.1016/j.tpb.2023.12.002](https://doi.org/10.1016/j.tpb.2023.12.002).
2. Grass, D., Wrzaczek, S., Caulkins, J.P., Feichtinger, G., Hartl, R.F., Kort, P.M., Kuhn, M., Fürnkranz-Prskawetz, A., Sanchez-Romero, M., & Seidl, A. (2024). **Riding the waves from epidemic to endemic: Viral mutations, immunological change and policy responses.** *Theoretical Population Biology* 156 46-65. [10.1016/j.tpb.2024.02.002](https://doi.org/10.1016/j.tpb.2024.02.002).
3. Parilina, E.M., Wrzaczek, S., & Zaccour, G. (2024). **Dynamic Oligopolistic Competition with Uncertainty and Supply Disruption Effects.** *International Game Theory Review (IGTR)* e2440009. [10.1142/S0219198924400097](https://doi.org/10.1142/S0219198924400097).
4. Parker, D.N. & Semmler, W. (2024). **Monetary Policy and the Evolution of Wealth Disparity: An Assessment Using US Survey of Consumer Finance Data.** *Computational Economics* [10.1007/s10614-024-10560-1](https://doi.org/10.1007/s10614-024-10560-1). (In Press)
5. Feichtinger, G. & Wrzaczek, S. (2024). **The optimal transition to a stationary population for concentrated vitality rates.** *Demographic Research* 50 171-184. [10.4054/DemRes.2024.50.6](https://doi.org/10.4054/DemRes.2024.50.6).
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7. Semmler, W. & Young, B. (2023). **Threats of sovereign debt overhang in the EU, the new fiscal rules and the perils of policy drift.** *Economia Politica* [10.1007/s40888-023-00319-6](https://doi.org/10.1007/s40888-023-00319-6).
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9. Sanchez-Romero, M., Schuster, P., & Fürnkranz-Prskawetz, A. (2023). **Redistributive effects of pension reforms: who are the winners and losers?** *Journal of Pension Economics and Finance* 1-27. [10.1017/S147474722300015X](https://doi.org/10.1017/S147474722300015X).
10. Caulkins, J.P., Grass, D., Feichtinger, G., Hartl, R.F., Kort, P.M., Kuhn, M., Fürnkranz-Prskawetz, A., Sanchez-Romero, M., Seidl, A., & Wrzaczek, S. (2023). **The hammer and the jab: Are COVID-19 lockdowns and vaccinations complements or substitutes?** *European Journal of Operational Research* 311 (1) 233-250. [10.1016/j.ejor.2023.04.033](https://doi.org/10.1016/j.ejor.2023.04.033).
11. Bloom, D.E., Kuhn, M., & Prettnner, K. (2023). **Fertility in High-Income Countries: Trends, Patterns, Determinants, and Consequences.** *SSRN Electronic Journal* [10.2139/ssrn.4597716](https://doi.org/10.2139/ssrn.4597716).
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13. Chen, S., Kuhn, M., Prettnner, K., Yu, F., Yang, T., Bärnighausen, T., Bloom, D.E., & Wang, C. (2023). **The global economic burden of chronic obstructive pulmonary disease for 204 countries and territories in 2020–50: a health-augmented macroeconomic modelling study.** *The Lancet Global Health* 11 (8) 1183-1193. [10.1016/S2214-109X\(23\)00217-6](https://doi.org/10.1016/S2214-109X(23)00217-6).
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18. Hartl, R.F., Kort, P.M., & Wrzaczek, S. (2023). **Reputation or warranty, what is more effective against planned obsolescence?** *International Journal of Production Research* 61 9399-954. [10.1080/00207543.2021.2020929](https://doi.org/10.1080/00207543.2021.2020929).
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21. Buratto, A., Muttoni, M., Wrzaczek, S., & Freiburger, M. (2022). **Should the COVID-19 lockdown be relaxed or intensified in case a vaccine becomes available?** *PLoS ONE* 17 (9) e0273557. [10.1371/journal.pone.0273557](https://doi.org/10.1371/journal.pone.0273557).
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Books and book chapters

1. Kuhn, M. (2023). **Medical Progress, Aging, and Sustainability of Health Care Finance**. In: *The Routledge Handbook of the Economics of Ageing*. Eds. Bloom, D.E., Souza-Posa, A., & Sunde, U., pp. 61-83 London, UK: Routledge. ISBN 978-036771-332-4 **10.4324/9781003150398-5**.
2. Sanchez-Romero, M. & Prskawetz, A. (2023). **Social Security Reforms in Heterogeneous Aging Populations**. In: *The Routledge Handbook of the Economics of Ageing*. Eds. Bloom, D.E., Souza-Posa, A., & Sunde, U., pp. 199-216 London, UK: Routledge. ISBN 978-036771-332-4 **10.4324/9781003150398-13**.
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Non-refereed publications

IIASA working papers, reports and policy briefs

1. Sanchez-Romero, M., Marsicano, M., & Kuhn, M. (2024). **Explaining the increasing inequality in life expectancy across income groups**. IIASA Working Paper. Laxenburg, Austria: WP-24-011
2. Freiberger, M., Hoffmann, R., & Fürnkranz-Prskawetz, A. (2024). **Should I stay or should I go: Modelling disaster risk behaviour using a dynamic household level approach**. IIASA Working Paper. Laxenburg, Austria: WP-24-010
3. Kuhn, M. & Wrzaczek, S. (2024). **A model-based measure for the resilience of resource use under the risk of disruption**. IIASA Working Paper. Laxenburg, Austria: WP-24-009
4. Wrzaczek, S., Feichtinger, G., Fent, T., & Novak, A. (2024). **To grow or to fluctuate: Optimal paths to demographic equilibria**. IIASA Working Paper. Laxenburg, Austria: WP-24-008
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7. Eker, S., Liu, Q., Reiter, C., & Kuhn, M. (2023). **Full of Economic-Environment Linkages and Integration dX/dt (FeliX): Technical Model Documentation**. IIASA Report. Laxenburg: IIASA
8. Rella, S.A., Kulikova, Y., Minnegalieva, A.R., & Kondrashov, F.A. (2023). **Complex vaccination strategies prevent the emergence of vaccine resistance**. IIASA Working Paper. Laxenburg, Austria: WP-23-005
9. Freiberger, M., Kuhn, M., & Wrzaczek, S. (2023). **Modeling health shocks**. IIASA Working Paper. Laxenburg, Austria: WP-23-002

Other external publications

1. Garg, A., Patange, O., Vishwanathan, S.S., Nag, T., Singh, U., & Avashia, V. (2024). **Synchronizing energy transitions toward possible Net Zero for India: Affordable and clean energy for all**. Office of the Principle Scientific Advisor (PSA) to Government of India and Nuclear Power Corporation of India Limited (NPCIL)
2. Fent, T., Wrzaczek, S., Feichtinger, G., Novak, A. (2024). **Fertility decline and age-structure in China and India**. VID Working Paper 01/2024, Vienna, Austria.

3. **Kuhn, M.**, Minniti, A., Prettnner, K., & Venturini, F. (2023). **Medical Innovation, Life Expectancy, and Economic Growth**. SSRN Electronic Journal 10.2139/ssrn.4491818.
4. Sobotka, T., Zeman, K., Brzozowska, Z., Di Lego, V., **Potančoková, M.** , **Gailey, N.**, Binder-Hammer, B., **Spitzer, S.** , **Fürnkranz-Prskawetz, A.**, **Kuhn, M.**, Prettnner, K., & Siskova, M. (2022). **European Demographic Datasheet 2022**. Wittgenstein Centre (IIASA, VID/OEAW, WU), Vienna, Austria.
5. SDG7 Technical Advisory Group (2021). **Leveraging Energy Action for Advancing the Sustainable Development Goals: Policy Briefs in Support of the High-Level Political Forum**. United Nations Department of Economic and Social Affairs (UN DESA), New York, USA.

Selected Initiatives, Lectures and other Capacity Building Efforts

EF-led initiatives

- EF has acted as IIASA lead on the [IIASA-OECD Strategic Taskforce](#) on Systems Thinking, Anticipation and Resilience.
- EF is organizing a [Network on “Modelling resilience and disruptive changes”](#) (embracing researchers from inter alia Austria, Germany, Israel, Norway, Sweden, UK, US): [Workshop](#) and bi-annual seminars.
- EF is organizing the [Econ4Um Seminar Series](#).
- EF is committed to and actively advancing [open modelling](#).

Contribution to networks

- EF is acting as IIASA lead contact on the [EERA – Bioenergy Network](#) and engaging e.g. on the production of a White Paper on the reduction of energy demand.
- EF researchers are representing [Austria on the NTA-Network](#).

Global efforts

- EF has contributed a [policy brief on the linkages between SDG7 \(Accessing clean energy\) and SDG 10 \(Reducing inequality\)](#) to the UNDESA SDG7 Technical Advisory Group. The policy brief was presented as a UNDESA High Level Policy Forum Side Event (2021).
- EF researchers have acted as contributing authors to Chapter 6 “Energy Systems” of Working Group 3 of the [6th IPCC Assessment Report \(A6\)](#) and are acting as lead authors on chapter 5 “Navigating demand-side transformations towards net-zero” of the [2nd Austrian Assessment Report](#).
- EF researchers have contributed to a report on "[Synchronizing energy transitions toward possible Net Zero for India: Affordable and clean energy for all](#)" commissioned by the Office of the Principle Scientific Advisor (PSA) to [Government of India](#) and Nuclear Power Corporation of India Limited (NPCIL).

Invited lectures and keynotes

- An EF researcher was invited to give a [keynote](#) on "Conceptualising Resilience in a Decision-theoretic Context" at the [istat Risikokonferenz 2023](#), organized by the istat-Institute (Germany)
- An EF researcher was invited to give a [keynote](#) on “An economic approach to optimal health care spending” to the 4th Symposium on Population Medicine & Public Health (2021), organized by the [Chinese Academy of Medical Sciences & the Peking Union Medical College](#).
- An EF researcher has given the [keynote](#) on “The role of private and public transfers to sustain the generational economy. An application of National Transfer Accounts (NTA) in an ageing Europe”, to the [CEPAR International Conference: Population Ageing: Causes, Consequences and Responses, 2023](#), UNSW Sydney

Capacity building

- EF has supervised four [YSSP students](#) (AT, Ghana, IND, IT) and co-supervised three YSSP students (AT, CHN) over the time frame 2021–2023; in 2024 EF will supervise three YSSP students (IND, CHN/US, S Korea). One co-supervised student won the 2023 [Mikhalevich Award](#). Four of the 2021–2023 YSSP reports are currently in submission/revision with journals; two more are expected for submission.
- EF has held training workshops [organized by UNDESA and UNFPA](#) and targeted at policy makers in the [use of National Transfer Accounts \(NTAs\)](#) and population modelling.

- EF has engaged in the supervision of **two PhD students (Technical University Vienna; University of Padova)** (both successfully completed) and an intern **who completed her MSc Thesis (University of Bologna)** based on her work at EF.
- EF researchers were invited to give a **guest lecture on 'Modelling COVID-19: Introduction and applications'** as part of the Master Program at **Erasmus University, Rotterdam**.

Hosting

- **Pauli Lappi** (U Helsinki; 1 Nov 2023 – 31 Jan 2024) as part of the international collaborations of his **Academy of Finland grant**. He collaborated with EF researchers on the modelling of mining contracts.

Professional

- An EF member is acting as **2024 president of the Austrian Economic Society** (NOeG) and acted as **2023 vice president**.
- EF members are acting as **co-opted members of the field committees on Health Economics and Population Economics** of the German Economic Society; they also engage as co-organizers to the **Austrian Society of Operations Research (ÖGOR)**; as well as **“Population Europe”** experts.
- EF members act (or have acted during the 2021-2023 period) as members of the **editorial boards** of the following journals: AIMS Journal of Environmental Sciences (Special Edition guest editorship) COVID-19 Economics, Journal of Demographic Economics, Journal of Dynamics and Games, Journal of Econometrics and Statistics, Journal of the Economics of Ageing, Population and Environment, Vienna Yearbook of Population Research).