

1. Anita, Sebastian:

Titel: Regional Control Problems for Structured Population Dynamics

Abstract: We consider some control problems related to structured population dynamics with diffusion. Firstly, we investigate the regional control for an optimal harvesting problem (the control acts in a subregion ω of the whole domain Ω). Using the necessary optimality conditions, for a fixed ω , we get the structure of the harvesting effort which gives the maximum harvest; with this optimal effort we investigate the best choice of the subregion ω in order to maximize the harvest. We introduce an iterative numerical method to increase the total harvest at each iteration by changing the subregion where the effort acts. We also consider the problem of eradication of a structured pest population dynamics with diffusion and logistic term, which is a zero-stabilization problem with constraints. We derive a necessary condition and a sufficient condition for zero-stabilizability. We formulate and investigate a related optimal control problem which takes into account the cost of intervention in the subregion ω .

2. Augeraud-Veron, Emmanuelle; Ducrot, Arnaud:

Titel: Taking into account perception of environmental quality: how space matters?

Abstract: The perception of environmental quality is a variable that affects people's behaviour, particularly in terms of consumption. This externality has been studied in a global framework by many authors. Through this work, we wish to study to which extent the distance from sources of pollution modifies the behaviour of individuals. The study of this question will be done through the use of spatial externalities, leading to the study of non-local equation systems. We will focus in particular on the nature of the convergence of optimal trajectories and how this convergence is impacted by the more or less global nature of the environmental externality affecting individuals.

3. Boucekkine, Raouf; Melindi-Ghidi, Paolo:

Titel: Particularism, dominant minorities and institutional change

Abstract: We develop a theory of institutional transition from dictatorship to minority dominant-based regimes. We depart from the standard political transition framework à la Acemoglu-Robinson in four essential ways: (i) population is heterogenous, there is a minority/majority split, heterogeneity being generic, simply reflecting subgroup size; (ii) there is no median voter in the post-dictatorship period, political and economic competition is favorable to the minority (fiscal particularism); (iii) (windfall) resources are introduced, and (iv) we distinguish between labor income and resources, and labor

supply is endogenous. We first document empirically fiscal particularism, its connection with resource endowment, and the impact of both on revolutionary bursts. Second, we construct a full-fledged model incorporating the four characteristics outlined above. We show, among others, that polarization is a necessary and sufficient condition for revolutions, while resource rents are not: they do matter though when polarization is low. Consistently with empirics, countries engaging in revolutions tend to be slightly less resource-rich than other countries. We also outline the interplay between resource rents, polarization and labor market conditions at the dawn of institutional change.

4. Davidov, Alexey:

Titel: On optimal steady state in the dynamic of exploited population with diffusion

Abstract: Optimization of stationary solution in the dynamic of an exploited population is one of the problem, which is the focus of many studies. We consider a population distributed on the circle, dynamic of which is described by parabolic equation with reaction term like logistic one and permanent harvesting, which is the product of population density and bounded autonomous control. We show that there exist optimal harvesting mode and prove that for any initial nonzero nonnegative population distribution the respective dynamic tends to the steady state. Thus the problem is reduced to the optimization of the state.

5. Dawid, Herbert, Muehlheusser, Gerd:

Titel: Smart Products: Liability, Timing of Market Introduction, and Investments in Product Safety

Abstract: This paper addresses the role of product liability for the emergence and development of smart products such as autonomous vehicles (AVs). We analyze how the liability regime affects innovative activities, as well as the timing of market introduction and market penetration of such smart products. We develop a dynamic model in which at each point in time, a potential (monopolistic) innovator decides on how much to invest in the safety stock of the smart product and on the product price, once it has been launched. Calibrating the model to the U.S. car market, our analysis reveals policy-relevant trade-offs when shifting more liability on the producers of AVs. First, while this improves the safety of AVs in the long run, the safety stock is accumulated more slowly. Second, it delays the market introduction of AVs, and also slows down market penetration, which hampers the innovator's incentives for safety investments in the short- and intermediate term. As a result, the safety level of AVs at a given point in time decreases as the liability regime becomes more stringent. Furthermore, there is a threshold for the innovator's burden of liability beyond which

she forgoes to develop the AV altogether. Finally, we find that direct AV safety regulation is welfare-superior compared to a stringent liability regime, as it induces higher levels of AV safety in the short and intermediate term.

6. De Frutos, Javier; Lopez, Paula; Martin-Herran, Guiomar:

Titel: Analytical characterization of equilibrium strategies in a multiregional transboundary pollution differential game with spatially distributed controls

Abstract: We analyze a transboundary pollution differential game where, in addition to the standard time dimension, a spatial dimension is introduced to capture the different geographical relationships among regions. Each region behaves strategically and aims to maximize its welfare net of environmental damage caused by the stock of pollution. Each region controls its own emission rate. The dynamics of the state variable (pollution stock) is defined by a two dimensional parabolic partial differential equation. The control variables (emissions) are spatially distributed variables. The model allows for a, possibly large, number of agents with predetermined spatial relationships. For a special functional form previously used in the literature of transboundary pollution dynamic games we analytically characterize the feedback Nash equilibrium and evaluate the impact of the introduction of the spatial dimension in the model. We show that at the equilibrium both the level and the location of emissions of each region depend on the particular geographical relationship among agents. The model is capable to analyze the optimal intraregional distribution of the emissions. We prove that, even in a simplified model, the geographical considerations of the model can modify the decision on where to locate the pollutant emissions. We conclude that the spatial aspects of the model play a no negligible role.

7. Dijk, Hermien:

Titel: Health and labor supply over the life cycle: How important is mental health?

Abstract: Health problems can have a major impact on labour supply. As physical health generally declines with age, current lifecycle models mostly study the relation between health and labour market outcomes at later ages (e.g., early retirement) and use health measures that generally follow physical health. However, mental health problems account for a major component of overall health impairment and these mental health problems generally start earlier in life than physical health problems. As such, important mechanisms, such as the effect of labour market experience on wages, might play a different role depending on whether one focuses on physical or mental health problems. Using a structural, lifecycle, model, we assess the relative importance of mental health problems as opposed to physical health problems in determining

labour market outcomes. The model is calibrated using a representative panel of Dutch individuals.

8. Fabbri, Giorgio:

Titel: A spatiotemporal framework for the analytical study of optimal growth under transboundary pollution

Abstract: We construct a spatiotemporal frame for the study of optimal growth under transboundary pollution. Space is continuous and polluting emissions originate in the intensity of use of the production input. Pollution flows across locations following a diffusion process. The objective functional of the economy is to set the optimal production policy over time and space to maximize welfare from consumption, taking into account a negative local pollution externality and the diffusive nature of pollution. Our framework allows for space and time dependent preferences and productivity, and does not restrict diffusion speed to be space-independent. This provides a comprehensive setting to analyze pollution diffusion with a close account of geographic heterogeneity. The involved optimization problem is infinite-dimensional. We propose an alternative method for an analytical characterization of the optimal paths and the asymptotic spatial distributions. The method builds on a deep economic concept of pollution spatiotemporal welfare effect, which makes it definitely useful for economic analysis.

9. Faggian, Sylvia; Kort, Peter M.:

Titel: A dynamic model of the firm with one-hoss shay depreciation

Abstract: We investigate a firm's optimal investment behavior over time, in which capital accumulation is modeled with one-hoss shay depreciation. This means that the service flow of the asset is constant over the lifetime of the asset after which it is retired. The firm's objective is to maximize the discounted cash flow stream over the planning period, where the instantaneous cash flow consists of the difference between revenue and investment costs. The dynamic equation of the capital stock contains a delay term to reflect that all capital stock acquired at a certain time t , depreciates at time $t + T$, where T is the fixed lifetime of the underlying asset. In particular we analyse trajectories and optimal policies in the long run, with techniques similar to those developed by Faggian, Gozzi and Kort (2019) for optimal investment for vintage capital models.

10. Federico, Salvatore; Boucekine, Raouf; Fabbri, Giorgio; Gozzi, Fausto:

Titel: Growth and agglomeration in the heterogeneous space: a generalized AK approach

Abstract: We provide an optimal growth spatio-temporal setting with capital accumulation and diffusion across space to study the link between economic growth triggered by capital spatio-temporal dynamics and agglomeration across space. The technology is AK, K being broad capital. The social welfare function is Benthamite. In sharp contrast to the related literature, which considers homogeneous space, we derive optimal location outcomes for any given space distributions for technology and population. Both the transitional spatio-temporal dynamics and the asymptotic spatial distributions are computed in closed form. Concerning the latter, we find, among other results, that: (i) due to inequality aversion, the consumption per capital distribution is much flatter than the distribution of capital per capita; (ii) endogenous spillovers inherent in capital spatio-temporal dynamics occur as capital distribution is much less concentrated than the (pre-specified) technological distribution; (iii) the distance to the center (or to the core) is an essential determinant of the shapes of the asymptotic distributions, that is relative location matters.

11. Freiberger, Michael, Kuhn, Michael, Wrzaczek, Stefan:

Titel: Prepare or react? Integrating large health shocks into life-cycle models

Abstract: The majority of models describing the life-cycle health investments take an ex-ante stance, with individuals being able to foresee the development of their health perfectly. However health shocks with significant impacts on the individual life (severe life-threatening diseases, accidents, chronic diseases) should not be averaged into a mean value, as they have the potential to put the entire life-course on a different trajectory. In this paper we introduce a dynamic optimal control framework incorporating a stochastic health shock with individuals allocating their resources to consumption and different kinds of health investments over their life-cycle. We distinguish between general health care and shock specific prevention, acute and chronic care. This setup enables us e.g. to analyze how the shock risk shapes the individual behaviour with respect to the different types of health expenditures and how medical shocks change the trajectories of consumption and savings. The newly developed transformation techniques allow us to investigate the optimal decisions made in anticipation of a potential health shock and the optimal reaction to all possible shock scenarios. We are able to obtain analytic expressions for the consumption and health investment profiles before and after the shock and identify the driving forces for the decisions. Furthermore we extend the value of life concept to other aspects of individual health. Finally we illustrate our findings by calculation a numerical solution calibrated to an individual facing a potential cancer diagnosis in the US.

12. Gozzi, Fausto:

Titel: A mean field game approach to economic inequalities across space

Abstract: tba

13. Heijdra, Ben J., Heijnen, Pim:

Titel: Reversible environmental catastrophes with disconnected generations

Abstract: We study environmental policy in a stylized economy-ecology model featuring multiple deterministic stable steady-state ecological equilibria. The economy-ecology does not settle in either of the deterministic steady states as the environmental system is hit by random shocks. Individuals live for two periods and derive utility from the (stochastic) quality of the environment. They feature warm-glow preferences and therefore will engage in private abatement in order to slightly influence the stochastic process governing environmental quality. The government may also conduct abatement activities or introduce environmental taxes. We solve for the market equilibrium abstracting from public abatement and taxes and show that the ecological process may get stuck for extended periods of time fluctuating around the heavily polluted (low quality) deterministic steady state. These events are called environmental catastrophes. They are not irreversible, however, as the system typically switches back to the basin of attraction associated with the good (high quality) deterministic steady state. The paper also compares the stationary distributions for environmental quality and individuals' welfare arising under the unmanaged economy and in the first-best social optimum.

14. Kort, Peter M.; Hartl, Richard F.; Wrzaczek, Stefan:

Titel: Planned obsolescence: a dynamic analysis

Abstract: We consider a firm that is producing a durable good. The disadvantage of a durable good that does not break down is that a consumer only needs to buy once. This in contrast with a durable good that breaks down often, because then every time the consumer has to decide whether to purchase this product again. If the consumer decides positively, the firm's revenue goes up. On the other hand, if a product breaks down too often, the consumer is more inclined to decide not to buy this product anymore. The above makes clear that when in the production process the firm decides about the quality of the product it faces the following trade off: a high quality implies a high reputation but a low breakdown probability so that consumers will not repurchase too often, whereas a low quality means that the product breaks down soon, implying that consumers need to buy this product again but at the same time this damages the

product's reputation, which reduces demand. The paper investigates this problem in a dynamic model of the firm that explicitly takes account of the time the product is sold and the age of the product. First the optimal steady state problem (OSSP) is investigated and then the transient behavior is analyzed. We present several scenarios and obtain surprising results, e.g., that for high variance of the time to breakdown, an increase in the legal warranty period can make firms reduce the average time to breakdown.

15. Kuhn, Michael, Sanchez-Romero, Miquel:

Titel: Medical progress as a driver of (unequal) life cycle outcomes

Abstract: Motivated by the fact that within-cohort inequality in wealth and in life expectancy increase over the life cycle, we propose a normative framework for studying how heterogeneous individuals, who differ by ability and initial health conditions, accumulate human capital, assets, social security wealth, and health deficits over the life cycle. To do so, we implement a life cycle model in which individuals face mortality risk and optimally decide about their education, consumption, their labor supply (intensive and extensive margins), and on their health care expenditure, which is used to reduce the speed of accumulation of health deficits and hence their risk of dying. Based on a calibration for the US, we study how productivity growth and medical progress bear on the life-cycle behaviors and outcomes of set of birth cohorts ranging between 1910 and 1970. We identify a key role for medical progress in driving increases in health care spending and life expectancy as well as for the expansion of education and the reversal from an initial tendency towards earlier retirement to a postponement. We also find that both productivity growth and medical progress contribute considerably to growing inequality.

16. Kühn, Christian:

Titel: Adaptive network dynamics

Abstract: In this talk, I am going to outline several recent results for adaptive network dynamics with a focus on bifurcations and their prediction. Adaptive networks combine dynamics of and on networks and can lead to complex heterogeneous population dynamics, e.g., in epidemic or voter models. I shall focus on critical transitions in these two model classes.

17. Lancker, Kira; Quaas, Martin; Tahvonen, Olli:

Titel: Vintages of wind turbines

Abstract: On- and offshore wind energy is one of the most important pillars of the transition to renewable electricity (RE) in many countries. RE support and expansion of wind energy use have been triggering the development of higher and more efficient generations of windmills. Yet, sites with good wind speed conditions which are also suitable for the construction of windmills are limited. The question thus arises, at which points in time and at which sites to optimally replace older vintages of windmills by new ones with more advanced technology. In this paper, we develop a vintage capital model of wind electricity generation, developed using the vintage forest model. For a given site, we derive conditions for the optimal replacement period and how it depends on the technical progress, depreciation, installation costs, energy price and rate of interest. We then proceed to include heterogeneous quality of sites for wind energy generation, and technical progress due to learning by doing. The model is parameterized using data for wind energy generation in Northern Europe.

18. Palokangas, Tapio:

Titel: Optimal Taxation with Endogenous Population Growth and the Risk of Environmental Disaster

Abstract: This study considers a market economy where firms produce goods from labor and capital and households save in capital, spend on mortality-decreasing health care and derive utility from their consumption and number of children, without caring of their adult offspring. The economy faces the risk that population growth and capital accumulation triggers a deadly environmental disaster. To solve optimal public policy, a leader-follower game between the government and the representative household is constructed. This shows that to restore the Pareto optimum, only a temporary tax on capital income before the occurrence of the disaster is needed.

19. Prettner, Klaus, Strulik, Holger:

Titel: Innovation, automation and inequality: Policy challenges in the race against the machine

Abstract: We analyze the effects of R&D-driven automation on economic growth, education, and inequality when high-skilled workers are complements to machines and low-skilled workers are substitutes for machines. The model predicts that innovation-driven growth leads to an increasing population share of college graduates, increasing income and wealth inequality, and a declining labor share. We use the model to

analyze the effects of redistribution. We show that it is difficult to improve income of low-skilled individuals as long as both technology and education are endogenous. This is true irrespective of whether redistribution is financed by progressive wage taxation or by a robot tax. Only when higher education is stationary, redistribution unambiguously benefits the poor. We show that education subsidies affect the economy differently depending on their mode of funding and that they may actually reduce education. Finally, we extend the model by fair wage concerns and show how automation could induce involuntary low-skilled unemployment.

20. Sanchez-Romero, Miguel; Schuster, Philip, Prskawetz, Alexia:

Titel: The impact of introducing a pension sustainability factor on inequality and growth

Abstract: We implement an overlapping generations model in which heterogeneous individuals optimally choose the number of years of education, health investment, consumption path, and labor supply. Vital rates (mortality and fertility) are assumed to depend on the level of education. To account for economic and demographic heterogeneity within each cohort, we assume individuals differ according to their learning ability, initial health deficits, and disutility from the effort of attending schooling. The results are based on counterfactual experiments run for Austria, in which we analyze the effect that different sustainability factors may have on inequality and growth.

21. Tavhonen, Olli, Quaas, M.:

Titel: Optimal and Markov-perfect Nash equilibria in harvesting age-structured semelparous species

Abstract: We specify an analytically solvable age-structured harvesting model for collectively optimal and Markov-perfect Nash equilibria for semelparous species (death after reproduction). The model has any number of age-classes and is assumed to be harvested from one or two age classes. The collectively optimal harvests are obtained in closed form as functions of the number of individuals in the given age class. The existence of sustainable solutions is shown to depend on fundamental biological factors and rate of discount in addition to the internal delays in the age-structured system. In a symmetric game all actors harvest both age classes and the existence of sustainable Nash equilibrium depends on the objective functional properties besides the rate of discount. In an asymmetric game, the sustainability depends on how the number of actors are divided into groups harvesting population age classes in different locations. The collectively optimal and Nash equilibria are shown to be globally asymptotically stable for optimal feedback solutions. Stochastic recruitment makes harvesting more conservative in both the optimal solution and various Nash equilibria.

22. Upmann, Thorsten, Uecker, Hannes, Hammann, Liv, Blasius, Bernd:

Titel: Optimal Stock-Enhancement Activities for a Spatially Distributed Renewable Resource

Abstract: We explore a bio-economic model of a renewable resource, discretely or continuously distributed in space. Opposite to standard harvesting models where the agent is interested in the take-out from the stock, we consider the case of an agent who is, either because of ecological concerns or because of economic incentives, interested in the conservation and enhancement of the abundance of the resource, and who may foster its growth by some costly stock-enhancement activity such as breeding, farming or nourishing. We show that the optimal stock-enhancement policy may feature heterogeneous (or patterned) steady states, and compute optimal time-dependent paths to govern the system from some initial state to a patterned optimal steady state.

23. Yegorov, Yuri:

Titel: Economic geographical model of historical dynamics of countries

Abstract: The paper models spatial evolution of countries and accounts for economics, geography and military force. The economy is agricultural, without technological progress, and is modeled by spatially distributed AK model, where production is proportional to the land size. There are two types of costs: defense (with IRS) and transport (with DRS). A country is an open system, and its borders can change over time depending on military pressure from both sides. A king maximizes discounted utility flow from two terms: country size (his wealth) and per capita consumption of the population of his country. The model exhibits multiple equilibria, with a possibility to have both small and large countries for a rich set of parameters. Historical applications regarding dynamics of empires are discussed.