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2024 / 01

A note on the relation between the Shapley value and the core of 3-player transferable utility games

Pierre Dehez, Pier Mario Pacini

We reconsider the necessary and sufficient conditions under which the Shapley value of a 3-player superadditive game belongs to the core. We then compute the proportion of games whose Shapley value belongs to the core within the set of balanced superadditive games.

Keywords : Core ; Shapley value

JEL codes : C71

2024 / 02

Does Democracy Inevitably Lead to Aggressive Redistribution? A Family Perspective

Simon Fan, Yu Pang, Pierre Pestieau

This paper explains why democracies marked by inequalities may not experience aggressive redistribution through the lens of parent-child interactions. Parental concerns about the negative impacts of high taxation on their children's motivation to study and pursue high-paying careers deter the poor majority from harboring an inclination to expropriate the rich. We construct an overlapping generations model in which workers vote on the redistributive policy under majority rule, while considering the incentive costs that the policy imposes on their children. We analyze the stationary Markov perfect equilibrium where the likelihood that a moderate income tax can be credibly enforced increases with the degree of parental altruism. In an extended model where career prospects are jointly determined by study efforts and received educational resources, we provide an analytical and numerical characterization of the conditions under which full redistribution does not materialize in the steady state under both private and public school systems.

Keywords : Credible tax policy ; parental altruism ; Markov perfect equilibrium ; education ; majority voting

JEL codes : D72, H31, I24

2024 / 03

Pensions soutenables

Jean Hindriks

Ce rapport propose un état des lieux des pensions légales en Belgique et des pistes concrètes de réformes graduelles dans un cadre d'ensemble cohérent pour assurer la soutenabilité financière et l'adéquation sociale de nos régimes de pension. Dans la première partie, le rapport met en perspective la discussion sur les pensions en insistant sur l'urgence du vieillissement et le double sens du concept de soutenabilité qui s'adresse à la fois aux retraités actuels et aux retraités futurs. Il discute du double basculement : le basculement démographique et le basculement budgétaire. Les séries statistiques longues des dépenses et recettes de la sécurité sociale sont reconstituées pour la période 1995 et 2022. Ces séries révèlent un déficit croissant de notre sécurité sociale qui est comblé par le budget de l'Etat. Les inégalités de carrières sont mises en évidence sur base des données administratives et la réforme récente des pensions est présentée. Dans la seconde partie, le rapport propose un cadre cohérent pour assurer à la fois la soutenabilité financière et l'adéquation sociale de nos pensions au travers d'un Compte Pension. Les ajustements proposés sont graduels et préservent les droits du passé. Des projections comparent les effets d'une réforme de l'indexation (indexation reform) et d'une réforme du taux d'acquisition (accrual reform). L'adéquation sociale des pensions est abordée au travers d'un mécanisme de compensation pour la pénibilité des métiers et pour les écarts de longévité. Ce mécanisme

Keywords : Sécurité sociale ; pension ; vieillissement ; soutenabilité financière ; inégalité

JEL codes : H55, J11, J14, J26

2024 / 04

Identifying when thresholds from the Paris Agreement are breached : the minmax average, a novel smoothing approach

Mathieu Van Vyve

Identifying when a given threshold has been breached in the global temperature record has become of crucial importance since the Paris Agreement. However there is no formally agreed methodology for this. In this work we show why local smoothing methodologies like the moving average and other climate modeling based approaches are fundamentally ill-suited for this purpose, and propose a better one, that we call the minmax average. It has strong links with the isotonic regression, is conceptually simple and is arguably closer to the intuitive meaning of "breaching the threshold" in the climate discourse, all favorable features for acceptability. When applied to the global mean surface temperature anomaly (GMSTA) record from Berkeley Earth, we obtain the following conclusions. First, the rate of increase has been $\sim +0.25^{\circ}\text{C}$ per decade since 1995. Second, based on this new estimate alone, we should plausibly expect the GMSTA to reach 1.49°C in 2023 and not go below that on average in the medium-term future. When taking into account the record temperatures of the second half of 2023, not having breached the 1.5°C threshold already in July 2023 is only possible with record long and/or deep La Nina in the following years.

2024 / 05

How to Manage the End of Life. An international perspective

Sergio Perelman, Pierre Pestieau

This paper aims to explore the diverse strategies employed by various countries in managing end-of-life care. It examines the interplay between the State, the marketplace, and the family in navigating this critical phase of the human lifecycle. The core argument presented advocates for a paradigm shift away from intensive medical interventions towards an increased emphasis on palliative care. This proposed transition holds significant potential benefits, including the reduction of social insurance costs, minimizing out-of-pocket expenditures for families, and alleviating unnecessary suffering for patients.

Keywords : End-of-life care ; palliative care ; aggressive medical intervention ; healthcare costs

2024 / 06

Measuring the extent of synergies among innovation actors and their contributions: the Helix as a cooperative game

Pierre Dehez, Eustache Mègnigbèto

We generalize the 3-player game introduced by Mègnigbèto (2018) to analyze the synergies existing between universities, the industry and the government in the Triple Helix, a model of research and innovation introduced by Leydesdorff and Etzkowitz (1995). We consider situations involving any number of actors and we allow for a differentiation of their contributions. The resulting game has nonnegative Harsanyi dividends, implying its convexity. The relative size of the core measures the extent of the synergies and the Shapley value measures the contribution of each actor to these synergies.

2024 / 07

Interactions of Imbalance Settlement with Energy and Reserve Markets in Multi-Product European Balancing Markets

Jacques Cartuyvels, Gilles Bertrand, Anthony Papavasiliou

This paper provides a framework for analyzing the interaction of imbalance settlement with the clearing of real-time energy and reserve markets. We characterize the optimal strategies of price-taking flexibility providers that can participate in sequential capacity auctions for automatic and manual frequency restoration reserves, followed by an auction that is conducted by the system operator for activating balancing energy. We establish equilibria based on three market features: (i) reserve demand curves, (ii) the activation strategy implemented by the system operator, and (iii) the imbalance settlement scheme. The optimal activation strategy is derived and the effect of the imbalance pricing scheme on bidding incentives, cost efficiency, and reserve prices is discussed.

Keywords : Electricity Markets Design ; Balancing Markets ; Multi-Product Markets ; Reserve

2024 / 08

Leniency in antitrust investigations as a cooperative game

Pierre Dehez, Samuel Ferey

Leniency programs in antitrust investigations exist in Europe since the late nineties. They cover secret agreements and concerted practices between companies, and provide total or partial immunity to companies reporting evidence. This raises the question of assessing correctly the contribution of each company that take part in a leniency program. This question is formalized within a cooperative game with transferable utility. The resulting game being convex, its core is nonempty and contains the Shapley value in its center. It defines a reference allocation that treats the participants symmetrically. In practice, companies report sequentially leading to allocations that are vertices of the core.

Keywords : Competition law ; leniency programs ; core ; Shapley value

JEL codes : L40, K21, C71

2024 / 09

Temporally Dynamic, Cohort-Varying Value-Added Models

Garritt L. Page, Ernesto San Martin, David Torres Iribarra, Sébastien Van Bellegem

We aim to estimate school value-added dynamically in time. Our principal motivation for doing so is to establish school effectiveness persistence while taking into account the temporal dependence that typically exists in school performance from one year to the next. We propose two methods of incorporating temporal dependence in value-added models. In the first we model the random school effects that are commonly present in value-added models with an auto-regressive process. In the second approach, we incorporate dependence in value-added estimators by modeling the performance of one cohort based on the previous cohort's performance. An identification analysis allows us to make explicit the meaning of the corresponding value-added indicators: based on these meanings, we show that each model is useful for monitoring specific aspects of school persistence. Furthermore, we carefully detail how value-added can be estimated over time. We show through simulations that ignoring temporal dependence when it exists results in diminished efficiency in value-added estimation while incorporating it results in improved estimation (even when temporal dependence is weak). Finally, we illustrate the methodology by considering two cohorts from Chile's national standardized test in mathematics.

Keywords : School value persistence ; value-added models ; temporal dependence

2024 / 10

How the rise of teleworking will reshape labor markets and cities

Toshitaka Gokan, Sergei Kichko, Jesse A. Matheson, Jacques-François Thisse

Since 2020, London experienced a 400% increase in teleworking among skilled workers. We propose a model that studies the implications of teleworking on (i) the residential structure of cities, (ii) the wage structure between skilled and unskilled workers, and (iii) the provision of local service in central and residential areas. Increased teleworking reduces the willingness to pay for residential proximity to the city center, and thus induces the residential movement of skilled workers towards the suburbs. The magnitude of this structural change, and its effect on labor markets and skilled/unskilled wage inequality, depends on the desirability of local services available in central and residential areas. In a two-city extension, teleworking moves skilled workers from the productive (and expensive) city to the less productive city. This has implications for residential structure and individual welfare in both cities. We find empirical evidence on changes in housing prices, skilled wage premium, and location changes for local services businesses in England consistent with the model's predictions.

Keywords : Telecommuting ; working from home ; local labor markets ; local consumer services ; gentrified cities ; inter-city commuting

JEL codes : J60, R00

2024 / 11

Axiomatization of the core of positive games

Pierre Dehez

The core is an additive solution on the set of convex transferable utility games. We show that additivity, together with efficiency, individual rationality and the null player property, characterizes the core of positive games.

Keywords : Core ; convex games ; positive games

JEL codes : C71

2024 / 12

Optimal Age-based Policies for Pandemics: An Economic Analysis of Covid-19 and Beyond

Luiz Brotherhood, Philipp Kircher, Cezar Santos, Michele Tertilt

This paper investigates the importance of the age composition for pandemic policy design. To do so, it introduces an economic framework with age heterogeneity, individual choice, and incomplete information, emphasizing the value of testing. Calibrating the model to the US Covid-19 pandemic reveals an 80% reduction in death toll due to voluntary actions and the lockdown implemented in the US. The optimal lockdown, however, is more stringent than what was implemented in the US. Moreover, the social planner follows an asymmetric approach by locking down the young relatively more than the old. We underscore the importance of testing, showing its impact on reduced deaths, lower economic costs and laxer lockdown. We use the framework to provide systematic insights into pandemics caused by different viruses (among others the Spanish flu), and underline the influence of economic conditions on optimal policies.

Keywords : Covid-19 ; testing ; social distancing ; age ; age-specific policies

JEL codes : E17, C63, D62, I10, I18

2024 / 13

Sorting through Cheap Talk: Theory and Evidence from a Labor Market

John J. Horton, Ramesh Johari, Philipp Kircher

In a labor market model with cheap talk, employers can send messages about their willingness to pay for higher-ability workers, which job-seekers can use to direct their search and tailor their wage bid. Introducing such messages leads—under certain conditions—to an informative separating equilibrium that affects the number of applications, types of applications, and wage bids across firms. This model is used to interpret an experiment conducted in a large online labor market: employers were given the opportunity to state their relative willingness to pay for more experienced workers, and workers can easily condition their search on this information. Preferences were collected for all employers but only treated employers had their signal revealed to job-seekers. In response to revelation of the cheap talk signal, job-seekers targeted their applications to employers of the right “type,” and they tailored their wage bids, affecting who was matched to whom and at what wage. The treatment increased measures of match quality through better sorting, illustrating the power of cheap talk for talent matching.

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Grandchild care and eldercare. A quid pro quo arrangement

Mathieu Lefebvre, Pierre Pestieau, Jérôme Schoenmaeckers

The phenomenon of grandparents assuming the role of caretakers for their grandchildren is both substantial and on the rise, a trend partially attributed to mothers’ increasing participation in the workforce. While altruism is commonly believed to be the primary driver behind such caregiving, we propose to examine an additional motivation: the expectation among grandparents that they will receive care from their offspring in the event of their own incapacity. This paper aims to investigate this hypothesis from both theoretical and empirical perspectives. Initially, we construct a theoretical framework, delineating a Subgame Perfect Nash Equilibrium, wherein the grandparent first commits to caring for the grandchild, followed by the anticipation of receiving care from their adult child in scenarios of disability. Subsequently, we empirically test the feasibility of this model by analyzing data sourced from the Survey of Health, Ageing and Retirement in Europe (SHARE). Our results confirm that elderly who took care of their grandchildren receive more support from their children in the case of a loss of autonomy.

Keywords : Long-term care ; Intergenerational transfers ; Informal care

JEL codes : D13, J14, D64

2024 / 15

Comment gérer la fin de vie ? Les dispositions adoptées dans les pays industrialisés

Sergio Perelman, Pierre Pestieau

Il n'y a pas un siècle on parlait à peine des retraites. C'était le temps où l'espérance de vie ne dépassait pas 65 ans. Avec l'allongement de la durée de la vie, les retraites sont devenues une priorité de la politique sociale. L'allongement de la vie a continué. Il a donné lieu à l'émergence d'incapacités liées au grand âge. On s'est alors intéressé à la dépendance et à la perte d'autonomie réclamant des soins de longue durée. Depuis peu l'attention s'est portée sur la dernière étape de notre existence, la fin de vie. L'expression 'fin de vie' est on ne peut pas plus ambiguë. A quel moment peut-on parler de fin de vie ? Pour un jeune adulte qui meurt dans un accident de la route, elle ne dure qu'un instant. Pour une personne souffrant de ce qu'on appelle pudiquement une longue maladie, elle peut durer des mois, voire des années. Dans de nombreux pays, on parle de fin de vie lorsqu'il n'y a plus d'espoir. A partir de là, s'enclenche un programme de soins qui prend une toute autre nature et un mode de remboursement extrêmement généreux. On a donc deux définitions de la fin de vie. Soit elle commence lorsqu'il n'y a plus d'espoir, ce qui n'empêche pas de recourir à des traitements plus ou moins agressifs visant à prolonger la vie. Soit elle commence lorsque le patient entre dans un programme de soins palliatifs ou tout autre programme apparenté. Cette dernière définition est plus restrictive. On notera que dans certains pays anglo-saxons les termes soins de fin de vie (end of life EOL) et soins palliatifs sont

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Foundations of Cities

Jacques-François Thisse, Matthew A. Turner, Philip Ushchev

How do people choose work and residence locations when commuting is costly and productivity spillovers, increasing returns to scale, or first nature advantage, reward the concentration of employment. We describe such an equilibrium city in a simple geography populated by agents with heterogeneous preferences over workplace-residence pairs. The behavior of equilibrium cities is more complex than previously understood. Heterogeneous location preferences are sufficient for equilibrium centralization of employment and residence. Increasing returns and productivity spillovers can disperse employment. An increase in commuting costs may decentralize residence and employment. Our results shed new light on classical urban economics and are important for our understanding of quantitative spatial models.

Keywords : Urban economics ; Spatial equilibrium ; Agglomeration effects

2024 / 17

Technological Change in Quantities

Jan Eeckhout, Philipp Kircher, Cristina Lafuente

Skill-biased technological change has long been linked to rising wage inequality. New technologies also allow firms to expand their scope of their operation. We formalize such quantity-biased technological change and calibrate the model to German matched employer-employee data. The calibration attributes substantial changes in the firm size distribution and in wages to this channel. Quantity-biased technological change spreads out the firm size distribution with a moderating influence on wage inequality within blue and white collar occupations, yet it increases inequality between these occupations. The quantity-bias component in the blue collar occupations alone moderates inequality within and between occupations.

Keywords : Quantity-bias ; scale-bias ; technological change ; skill-bias ; firm size distribution ; wage inequality

JEL codes : J23, J32, O33

2024 / 18

The Intriguing Relation Between Parenting Styles and Eldercare

Simon Fan, Yu Pang, Pierre Pestieau

This paper develops an overlapping generations model analyzing parenting choices from a life cycle perspective. Young parents educate their children to foster their human capital development. Strict discipline requires minimal time from parents yet but can strain intergenerational relations. Pedagogical practice preserves familial bonds but demands significant time and effort, adversely affecting parental income. As parents age, they desire caregiving support from their adult children, who may bring earlier conflicts with their parents into the care environment. We suggest that the prevalence of strict discipline declines when the probability of living into old adulthood increases. We then incorporate health investments into the model to endogenize longevity and investigate the transitional dynamics of life expectancy, parenting styles, and human capital stock. Moreover, we examine how the interaction between parenting styles and monetary transfers induces children's provision of eldercare in a bargaining framework. We characterize multiple stationary Markov perfect equilibria, shedding light on the observed diversity in parenting across different cultures.

Keywords : Parenting ; longevity ; old-age support ; human capital ; health investment

JEL codes : I19, I21, J14

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Future versus Today's Improvements: the Trade-off of Place-based Policies

Max Brès, Philipp Kircher, David Koll

This paper provides causal evidence on the impact of subsidy re-allocation between high technology sectors and low-skill sectors on local labor markets. We exploit a policy targeting under-performing employment areas, France's Aides à Finalité Régionale, which relaxes rules governing the allocation of firm subsidies while keeping their level constant. In response, policy makers re-allocate subsidies away from research and development to mainly low-skilled manufacturing and service sectors. It triggers a persistent improvement of employment, mainly through increased low-skilled manufacturing employment and at the expense of R&D related occupations. In the long term, though, labor income and productivity decrease. Finally, at the individual level, workers employed in manufacturing at the time of the treatment benefit on average of 2% higher hourly wage even 10 years after the policy was lifted.

Keywords : Subsidy allocation ; place-based policies ; manufacturing ; R&D ; employment and wages ; underperforming are

JEL codes : H25, J21, J31

2024 / 20

Fédéralisme Belge en chiffres - Partie 1 : La densité politique

Jean Hindriks, Alexandre Lamfalussy

Ce rapport rassemble de manière claire, lisible et rigoureuse les chiffres du personnel politique et des coûts de notre fédéralisme belge. Il établit un inventaire inédit de nos structures politiques avec 7 parlements, 6 gouvernements, 5 niveaux de pouvoirs et un effectif total de 31 806 mandataires politique (plus de 1 mandataire par km²). Selon les régions, les densités politiques varient du simple au double et les coûts du simple au triple. Ces chiffres illustrent le poids, la complexité et les disparités de nos institutions politiques du niveau fédéral au niveau local des villes, communes et provinces en passant par le niveau régional et communautaire. Un besoin de simplification et d'intégration s'impose pour amplifier l'action publique.

Keywords : Fédéralisme, Gouvernance politique, Pouvoirs locaux

JEL codes : H1, H7

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Fédéralisme Belge en chiffres - Partie 2 : Les emplois publics

Jean Hindriks, Alexandre Lamfalussy

Ce rapport rassemble de manière claire, lisible et rigoureuse les chiffres de l'emploi public mesuré en équivalent temps plein sur base de la définition ONSS du périmètre des administrations publiques. Il établit un inventaire cohérent et actualisé de la répartition et de l'évolution de l'emploi public sans et avec le secteur de la santé et de l'action sociale. Selon les régions et provinces, la part de l'emploi public (relativement à l'emploi total) varie sensiblement mais la densité de l'emploi public (relativement à la population) varie moins. Les disparités des parts de l'emploi public reflètent les disparités des taux d'emploi. Le niveau et la ventilation des dépenses publiques sont aussi brièvement analysés et comparés aux pays voisins.

Keywords : Fédéralisme, Fonctionnaires, Administrations publiques

JEL codes : H1, H7, H83

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Fédéralisme Belge en chiffres - Partie 3 : Les disparités et dynamiques d'emploi

Jean Hindriks, Alexandre Lamfalussy

La Belgique s'est fixée pour objectif d'atteindre un taux d'emploi de 80% en 2030. Les écarts entre régions sont importants et aucune région n'a encore atteint l'objectif de 80% de taux d'emploi. Dans ce rapport, nous mettons en lumière la richesse des données géolocalisées pour analyser le marché de l'emploi en Belgique. Ce rapport évalue la situation actuelle et son évolution sur base des flux électroniques des données administratives d'emploi de la BCSS et du Steunpunt Werk. En nous concentrant sur les chiffres de l'emploi (et de l'inactivité) selon le lieu de résidence (par opposition au lieu de travail), nous révélons des disparités et des dynamiques propres aux régions, provinces, villes et communes, mais aussi des dynamiques distinctes selon les groupes d'âge et le genre. Un résultat interpellant de l'analyse est que 80% des disparités de l'emploi entre villes et communes sont intrarégionales. Cette part est constante depuis 2006.

Keywords : Fédéralisme, Emploi, Chômage, Disparité régionale

JEL codes : H1, J2, J4

2024 / 23

Ideal efforts and consensus in a multi-layer network game

Ana Mauleon, Mariam Nanumyan, Vincent Vannetelbosch

We study a network game on a fixed multi-layer network of two types of relationships. The social interactions in the first layer carries a pressure to conform with the social norm within the layer. The second layer provides additional strategic complementarities from players' interaction. Players are endowed with personal ideal efforts and are heterogeneous in their ideal efforts and productivity. Each player repeatedly chooses her effort level in the network game and updates her ideal effort based on the new effort choice. Each player suffers disutility when her effort differs from her neighbors' efforts or is inconsistent with her ideal effort. We find the pure Nash equilibrium of the game in each period and provide conditions for the convergence of efforts and ideals to a steady state. Furthermore, we provide conditions for emerging long-run consensus about ideals in groups of players and the entire network.

Keywords : Multi-layer networks ; network games ; personal norms ; social norms ; strategic complementarities

JEL codes : A14 ; C72 ; D85

2024 / 24

Asymmetric Models for Realized Covariances

Luc Bauwens, Emilija Dzuverovic, Christian Hafner

We introduce asymmetric effects in the BEKK-type conditional autoregressive Wishart model for realized covariance matrices. The asymmetry terms are specified either by interacting the lagged realized covariances with the signs of the lagged daily returns or by using the decomposition of the lagged realized covariance matrix into positive, negative, and mixed semi-covariances, thus relying on the lagged intra-daily returns and their signs. We provide a detailed comparison of models with different complexity, for example with respect to restrictions on the parameter matrices. In an extensive empirical study, our results suggest that the asymmetric models outperform the symmetric one in terms of statistical and economic criteria. The asymmetric models using the signs of the daily returns tend to have a better in-sample fit and out-of-sample predictive ability than the models using the signed intra-daily returns.

Keywords : High frequency data ; asymmetric volatility ; realized covariance ; conditional autoregressive Wishart model

2024 / 25

High-Order Reduced-Gradient Methods for Composite Variational Inequalities

Yurii Nesterov

This paper can be seen as an attempt of rethinking the Extra-Gradient Philosophy for solving Variational Inequality Problems. We show that the properly defined Reduced Gradients can be used instead for finding approximate solutions to Composite Variational Inequalities by the higher-order schemes. Our methods are optimal since their performance is proportional to the lower worst-case complexity bounds for corresponding problem classes. They enjoy the provable hot-start capabilities even being applied to minimization problems. The primal version of our schemes demonstrates a linear rate of convergence under an appropriate uniform monotonicity assumption.

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Convex quartic problems: homogenized gradient method and preconditioning

Radu-Alexandru Dragomir, Yurii Nesterov

We consider a convex minimization problem for which the objective is the sum of a homogeneous polynomial of degree four and a linear term. Such task arises as a subproblem in algorithms for quadratic inverse problems with a difference-of-convex structure. We design a first-order method called Homogenized Gradient, along with an accelerated version, which enjoy fast convergence rates of respectively $O(\kappa^2/K^2)$ and $O(\kappa^2/K^4)$ in relative accuracy, where K is the iteration counter. The constant κ is the quartic condition number of the problem. Then, we show that for a certain class of problems, it is possible to compute a preconditioner n , where n is the problem dimension. To establish this, we study the more general problem of finding the best quadratic approximation of an l_p norm composed with a quadratic map. Our construction involves a generalization of the so-called Lewis weights.

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Gradient Methods for Stochastic Optimization in Relative Scale

Yurii Nesterov, Anton Rodomanov

We propose a new concept of a relatively inexact stochastic subgradient and present novel first-order methods that can use such objects to approximately solve convex optimization problems in relative scale. An important example where relatively inexact subgradients naturally arise is given by the Power or Lanczos algorithms for computing an approximate leading eigenvector of a symmetric positive semidefinite matrix. Using these algorithms as subroutines in our methods, we get new optimization schemes that can provably solve certain large-scale Semidefinite Programming problems with relative accuracy guarantees by using only matrix-vector products.

Keywords : Convex optimization ; optimization in relative scale ; gradient methods ; randomization ; convergence guarantees ; eigenvalues ; singular values ; power method ; Lanczos algorithm

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Characterizing path-length matrices of unrooted binary trees

Daniele Catanzaro, Raffaele Pesenti, Roberto Ronco

We extend some recent results on the necessary and sufficient conditions that a symmetric integer matrix of order $n \geq 3$ must satisfy to encode the Path-Length Matrix (PLM) of a Unrooted Binary Tree (UBT) with n leaves. This problem is at the core of the combinatorics of the Balanced Minimum Evolution Problem, a NP-hard problem much studied in the literature on molecular phylogenetics. We show that, for any natural $3 \leq n \leq 11$, a reduced set of known conditions, excluding Buneman's strong four-point conditions, is both necessary and sufficient to characterize PLMs of UBTs. In addition, we present a second and more general characterization based solely on linear conditions derived from the topological properties of UBTs.

Keywords : Combinatorial optimization ; tree realization ; balanced minimum evolution ; unrooted binary trees ; path-length matrices ; Kraft conditions ; Buneman's four-point conditions

2024 / 29

Parenting and Eldercare: Positive and Normative Analyses

Simon Fan, Yu Pang, Pierre Pestieau

Global trends in delayed childbearing and population aging have intertwined parenting and eldercare, necessitating concurrent attention to young children and elderly parents. This paper develops an overlapping-generations model where young adults, exhibiting two-sided altruism, educate their children to promote human capital accumulation and provide caregiving for their aging parents. Education can be attained through financial investments and the implementation of harsh discipline, which demands minimal parental resources but can strain parent-child relations. Eldercare is labor intensive, with its quality decreasing with the frequency of childhood discipline. Our positive analysis suggests that extended longevity may reduce the prevalence of harsh parenting, and enhanced altruism towards the elderly benefits them but can have adverse effects on private savings and children's human capital. We then examine the steady-state first-best solution and the second-best public policies. When intergenerational altruism is limited, we advocate for the idea of taxing labor and subsidizing education from a novel perspective of adjusting parenting styles and promoting eldercare.

Keywords : Parenting style ; Human capital ; Longevity ; Long-term care

JEL codes : I21, J13, J24

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A Dynamic Programming Approach for the Job Sequencing and Tool Switching Problem

Emma Legrand, Vianney Coppé, Daniele Catanzaro, Pierre Schaus

We present a new dynamic programming-based exact solution algorithm for the Job Sequencing and Tool Switching Problem (JS-TSP), a combinatorial optimization problem originating from manufacturing systems and encompassing the Traveling Salesman Problem as a special case. We propose a new family of lower bounds for the optimal solution to the problem, which are provably tighter than existing bounds in the literature and enhance both solution quality and pruning efficiency. We propose the use of A^* and its any-time variant to explore the solution space of the problem as well as a specific data structure, called FreeTools, both to keep track of the state information and to compute incremental costs throughout the implicit search efficiently. Extensive computational experiments show that the presented approach brings significant performance improvements over state-of-the-art methods for the JS-TSP, including branch-and-bound and integer linear programming formulations.

Keywords : Combinatorial optimization ; job sequencing ; tool switching ; branch and bound ; A^* ; dynamic programming

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A Tutorial on Box-Total Dual Integrality

Emiliano Lancini, Francesco Pisanu

Total Dual Integrality (TDIness) and its stronger version, box-TDIness, are two fundamental properties of linear systems in combinatorial optimization, first introduced by Edmonds and Giles in the late 70's. These properties are deeply connected to linear algebra, Diophantine equations, Hilbert bases, polyhedral integrality, and min-max relations in linear programming duality. This work provides a comprehensive view of the topic, including a presentation of classical results, and a survey on recent results.

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On strong integrality properties of the perfect matching polytope

Roland Grappe, Mathieu Lacroix, Francesco Pisanu

This paper investigates integrality properties of perfect matching polytopes, focusing on box-total dual integrality and integer decomposition properties. We begin by characterizing the graphs whose perfect matching polytope is a slice of the nonnegative orthant, identifying these as the solid graphs introduced by de Carvalho, Lucchesi, and Murty in *On a Conjecture of Lovász Concerning Bricks: I. The Characteristic of a Matching Covered Graph* (Journal of Combinatorial Theory, Series B). As a result, we show that the perfect matching polytope of solid graphs admits a compact description, and we establish that deciding the box-total dual integrality of a perfect matching polytope can be done in polynomial time. Additionally, we characterize the conditions under which perfect matching polytopes of two fundamental graph classes, namely near-bricks and bicritical graphs, are box-totally dual integral. We discuss implications of these results for identifying perfect matching polytopes with the integer decomposition property.

Keywords : Perfect matching polytope ; Box-totally dual integral polyhedron ; Integer decomposition property

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Alliances and Technological Partnerships in Contests

Jérôme Dollinger

This paper analyses the formation of alliances and technological partnerships in contests. Alliances enhance the probability of winning at the cost of sharing the prize if won, while technological partnerships reduce the marginal cost of the effort invested in the contest by the members. When agents cannot form technological partnerships, I find that no alliance can be stable. When agents exhibit extreme free riding behaviour at equilibrium, the stabilisation of the grand alliance by technological cooperation requires restrictive assumptions on the set of blocking agents. Nevertheless, When the agents manifest less free riding intentions, the threat of being excluded from a global technological partnership is sufficient to ensure the stability of the grand alliance in the long run. This indicates that when the free riding behaviours are not extreme, the ability to exclude is a sufficient condition for the global technological cooperation to annihilate competition in contests. In that context, the existence of technological partnerships facilitates the formation of alliances.

Keywords : Contests ; Alliances ; Technological partnerships ; Stability

JEL codes : C70, D72, D74