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2023 / 01

A Massively Parallel Exact Solution Algorithm for the Balanced Minimum Evolution Problem

Daniele Catanzaro, Martin Frohn, Olivier Gascuel, Raffaele Pesenti

We build upon recent theoretical advances on the Balanced Minimum Evolution Problem (BMEP) to design a new massively parallel exact solution algorithm that proves to be up to one order of magnitude faster than the current state-of-the-art under the same computing settings and environment. We also investigate, for the first time, the theoretical connections between numerical stability and statistical consistency of the BMEP and we show that some rescaling techniques introduced to numerically stabilize the problem may affect negatively the statistical consistency of the optimal solution to the problem.

Keywords : Combinatorial optimization ; integer programming ; network realization ; network design ; balanced minimum evolution ; phylogenetics ; distance methods ; parallel branch-and-bound

2023 / 02

Macroeconomics of aging

Thierry Betti, Mathieu Lefebvre, Pierre Pestieau

The purpose of this chapter is to analyze the effects that population aging, and specifically the increase in longevity, may have on capital accumulation and the welfare of society. Throughout our analysis, we use as back bone a two-period overlapping generation model with variable longevity, distinguishing between the case when longevity increase is exogenous and the case when it is endogenous, namely partially the responsibility of individuals or governments. In each section, we first provide the result arising from our central model and then review the relevant literature. **Keywords**: Longevity, OLG models, Capital accumulation.

Keywords : Longevity ; OLG models ; Capital accumulation

JEL codes : H55, I12, I13, J10, J11

2023 / 03

Local Farsightedness in Network Formation

Pierre de Callatay, Ana Mauleon, Vincent Vannetelbosch

We propose the concept of local- k farsighted consistent network for analysing network formation games where players only consider a limited number of feasible networks. A network g is said to be local- k farsightedly consistent if, for any network g' within the distance- k neighbourhood of g , either g is not defeated by g' , or g defeats g' . We show that if the utility function is (componentwise) egalitarian or satisfies reversibility or excludes externalities across components, then local- k farsightedness is more likely to be a good proxy for what would happen when players have full knowledge of all feasible networks.

Keywords : Networks ; local farsightedness ; stability

JEL codes : A14, C70, D20

2023 / 04

R&D and Market Sharing Agreements

Jérôme Dollinger, Ana Mauleon, Vincent Vannetelbosch

We analyze the formation of R&D alliances and market sharing (MS) agreements by which firms commit not to enter in each other's territory in oligopolistic markets. We show that R&D alliance structures are stable only in the presence of MS agreements. Thus, long lasting R&D alliances could signal the existence of some MS agreement in the industry. We characterize the set of stable symmetric pairs of coalition structures with identical R&D and MS structure. In addition, we show the stability of a class of asymmetric pairs of coalition structures where the most efficient firms form both an R&D and a MS agreement while the other firms do not form any MS agreement but form two smaller R&D alliances. Even though MS agreements are detrimental for consumers, we show that stable cooperation in terms of R&D is yet a better outcome for consumers than no cooperation at all.

Keywords : R&D alliances ; Market sharing agreements ; Oligopoly ; Cournot competition ; Stability

JEL codes : C70, L13, L40

2023 / 05

Direction Identification and Minimax Estimation by Generalized Eigenvalue Problem in High Dimensional Sparse Regression

Mathieu Sauvenier, Sébastien Van Belleghem

In high-dimensional sparse linear regression, the selection and the estimation of the parameters are studied based on an L0 -constraint on the direction of the vector of parameters. We first establish a general result for the direction of the vector of parameters, which is identified through the leading generalized eigenspace of measurable matrices. Based on this result, we suggest addressing the best subset selection problem from a new perspective by solving an empirical generalized eigenvalue problem to estimate the direction of the high-dimensional vector of parameters. We then study a new estimator based on the RIFLE algorithm and demonstrate a nonasymptotic bound of the L2 risk, the minimax convergence of the estimator and a central limit theorem. Simulations show the superiority of the proposed inference over some known l0 constrained estimators.

Keywords : High-dimensional model ; sparsity ; generalized eigenvalue problem ; identification ; best subset selection ; minimax L0 estimation ; central limit theorem

JEL codes : C30, C55, C59

2023 / 06

Ratings and Reciprocity

Johannes Johnen, Robin Ng

Evidence suggests online ratings and reviews are motivated by reciprocity. We incorporate a standard model of reciprocity into a model of ratings to capture that consumers are only willing to make the effort to rate a seller if this seller provides a sufficient value-for-money. Using this model, we explore how firms use prices to impact their own ratings. We show that firms harvest ratings: they offer lower prices in early periods to trigger consumers' reciprocal behaviour and obtain a good rating and larger profits in the future. Because also low-quality firms harvest ratings, reciprocity makes ratings less-informative about quality. Based on this mechanism, (i) we argue that reciprocity-based ratings cause rating inflation; (ii) we show that a marketplace that facilitates ratings (e.g. through reminders, one-click ratings etc.) may get more ratings, but also less-informative ratings; (iii) a marketplace that screens the quality of sellers makes ratings less-informative if the screening is insufficient. We show that even as ratings become less-informative, consumers can benefit from lower prices. Nonetheless consumers prefer more-informative ratings than average sellers. We apply these results to characterise when a two-sided platform wants to facilitate ratings, and thereby undermines the informativeness of ratings and harms consumers.

Keywords : Reciprocity ; Ratings and Reviews ; Digital Economy ; Reputation

JEL codes : D21, D83, D90, L10

2023 / 07

Time for Tea: Measuring Discounting for Money and Consumption without the Utility Confound

Mohammed Abdellaoui, Emmanuel Kemel, Amma Panin, Ferdinand M. Vieider

We present a novel method—called risk equivalents—that uses a single measure to elicit discount rates while avoiding concerns about the shape of the utility function. The method is valid under discounted expected utility (DEU), and also under several of its behavioral extensions including more general models that account for a biased perception of time and risk (such as time- or likelihood-insensitivity). We implement the method in a field experiment in India measuring inter-temporal discount rates for money and the consumption of tea. We empirically observe that discount rates elicited by traditional methods are related to utility curvature, whereas discount rates elicited by risk equivalents are not. Risk equivalents also mitigate differences in discount rates measured for money and for tea, suggesting that unaddressed utility curvature may play a role in results that demonstrate good-specific discounting. Risk equivalents are general, fast and tractable, three features that are particularly useful in field studies.

Keywords : Time discounting ; money vs consumption ; utility confound

JEL codes : D03; D81; D91

2023 / 08

Goodness-of-fit test in high-dimensional linear sparse models

Mathieu Sauvenier, Sébastien Van Belleghem

A goodness-of-fit test for the outcome of variable selection in a high dimensional linear model is studied. The test minimizes a moment condition that reflects the sparsity constraint. Testing this constraint is possible thanks to a high dimensional central limit Theorem that is proved under heteroskedasticity. To implement the test a multiple-splitting projection test procedure that has been recently proposed in the literature is employed. Monte Carlo experiments demonstrate the power of the test. A real data application considers the problem of selecting predictors to nowcast quarterly GDP. The empirical results show that it is possible to select a minimal number of variables such that every larger set of variables would pass the goodness-of-fit test.

Keywords : High dimensional model ; Sparsity ; Goodness-of-Fit ; Projection test ; Nowcasting

2023 / 09

Market Equilibria in Cross-Border Balancing Platforms

Jacques Cartuyvels, Gilles Bertrand, Anthony Papavasiliou

The next phase of electricity markets integration in Europe will see the introduction of pan-European balancing platforms, MARI and PICASSO, for the trading of manual and automatic frequency restoration reserve. This paper provides an analytical framework for the study of pricing asymmetries between European member states in this context. The pricing asymmetries are due to balancing incentive components and consist of the unilateral introduction by a member state of either (i) an adder on the imbalance price and balancing price, (ii) an adder on the imbalance price solely, or (iii) the introduction of a real-time price for the trading of real-time balancing capacity. Our analytical framework allows us to characterize the optimal bidding strategy of flexible assets under the different designs and to derive the resulting equilibria. Our analysis demonstrates that adders without the trading of balancing capacity create inefficiencies by distorting the merit order and tend to be detrimental to the member state that introduces it.

Keywords : Balancing market ; cross-border balancing ; frequency restoration reserve ; real-time market for reserve

2023 / 10

Cooperative product games

Pierre Dehez

A cooperative product game is a transferable utility game defined by associating the product of given players' weights to coalitions. This idea has been introduced by Rosales (2014) in an unpublished memo. Here we analyze a modified version and cover the Shapley value to which we provide an axiomatic foundation.

2023 / 11

Matching markets with farsighted couples

Ata Atay, Sylvain Funck, Ana Mauleon, Vincent Vannetelbosch

We adopt the notion of the farsighted stable set to determine which matchings are stable when agents are farsighted in matching markets with couples. We show that a singleton matching is a farsighted stable set if and only if the matching is stable. Thus, matchings that are stable with myopic agents remain stable when agents become farsighted. Examples of farsighted stable sets containing multiple non-stable matchings are provided for markets with and without stable matchings. For couples markets where the farsighted stable set does not exist, we propose the DEM farsighted stable set to predict the matchings that are stable when agents are farsighted.

Keywords : Matching with couples ; stable sets ; farsighted agents

JEL codes : C70 ; C78 ; D47

2023 / 12

Unions and key players in network games with conflicts and spillovers

Ana Mauleon, Mariam Nanumyan, Simon Schopohl, Vincent Vannetelbosch

We study network games with social and private dissonance where each player in the network exerts some costly efforts. We allow for cooperative behavior in the sense that players may belong to unions and members of each union choose their efforts by maximizing the joint utility of the union. Each player not only benefits from the aggregate effort and efforts of network neighbors are strategic complements, but also suffers disutility when her effort differs from her neighbors' efforts or is inconsistent with her ideal effort. We characterize the unique Nash equilibrium of the network game with unions and we define a union intercentrality measure for finding the key player whose removal has the highest impact on the aggregate effort level. In addition, we explore the role of unions in fostering effort levels and we consider two alternative policies: the key addition to an existing union (the player who increases the most the aggregate effort by joining the union) and the key union that generates the highest total effort. Finally, we investigate the stability of unions.

Keywords : Social networks ; peer effects ; key players ; unions ; social and private dissonance

JEL codes : A14 ; C72 ; D85 ; L14

2023 / 13

Multinational Taxation under Pressure: The Role of Tax Deductibility

Xuyang Chen, Jean Hindriks

To address international profit shifting by multinational enterprises, a number of countries are broadening their tax bases and using turnover tax to secure corporate tax revenues. This paper investigates the impact of tax deductibility on multinationals' behavior and corporate taxes by considering a model of corporate tax competition with two countries and a tax haven. A pure profit tax (with either separate accounting or formula apportionment) giving deductions for all costs can preserve production efficiency at the expense of tax base erosion. In contrast, a turnover tax with no deductibility of costs can eliminate profit shifting incentives at the expense of production distortion. We show that profit tax with formula apportionment dominates the other two tax regimes when the output elasticity is high and tax capacity is intermediate. In other cases, turnover tax (profit tax with separate accounting) can dominate under low (high) tax capacity. We then analyze the general case to allow for partial tax deductibility and revisit the Diamond-Mirrlees production efficiency theorem in the profit shifting context. We show that less deductibility can yield more revenue when tax capacity is low, but that revenue increases with deductibility when tax capacity is sufficiently high. Simulations further suggest that the optimal deductibility rate increases with the tax capacity and the output elasticity.

Keywords : Corporate taxes ; Profit shifting ; Tax haven ; Tax deductibility ; Tax competition ; Digital economy ; Extractive sector

JEL codes : H25, H71, H73, F23, D24

2023 / 14

Social mobility and populist values

Sergio Perelman, Pierre Pestieau

Despite some successes in Europe, the welfare state has not been able to renew itself to meet the challenge of various social divides. The major source of these divides is undoubtedly the failure of the social elevator. One might conjecture that the welfare state has probably been too preoccupied with income inequality and poverty and not enough with social mobility. To support this hypothesis, it is important to have good measures of intergenerational mobility and of populist attitudes to compare them with indicators of redistribution. If redistribution and social mobility are indeed found to be negatively correlated, this would invalidate the famous Gatsby Curve. In this paper, we rely on the several waves of the European Social Survey (ESS) to elicit indicators of mobility and of populism and show how the lack of social mobility can explain populist attitudes across a number of European countries.

Keywords : Populism ; social mobility ; education policy ; Gatsby curve

JEL codes : H20 ; H31 ; H50

2023 / 15

Non-Price Strategies of Marketplaces: A Survey

Paul Belleflamme, Johannes Johnen

Two-sided platforms have a great impact on markets nowadays. Especially, online marketplaces design markets and choose many of the rules that govern how buyers and sellers interact. Researchers studied two-sided platforms very actively over the last two decades. We review the economic literature from two angles: we focus on marketplaces and we concentrate on non-price strategies that marketplaces employ to govern interactions (like user steering, self-preferencing, rating and review systems, data and targeting, privacy, and user protection).

Keywords : Two-Sided Platforms ; Marketplaces ; Platform Governance ; Platform Strategy ; Platform Regulation ; Platform Self-Regulation

2023 / 16

Sustainability of pension reforms: An EU-wide political stress

Sefane Cetin, Jean Hindriks

Many countries have adopted various pension reforms to deal with aging population. Those reforms involve some balance between "refinancing" (contribution increase) and "retrenchment" (benefit cut). The question we address is whether policymakers have the future capacity to sustain the legislated pension reforms in the EU given the growing influence of the elderly in the democratic process. To answer this question, we draw on the 2021 Economic Policy Committee (EPC) projections of pension benefit rates that we compare with the policy adjustments over the amount of refinancing and benefit cut arising from continuously negotiated reforms over time between the successive cohorts of workers and retirees. We compute the optimal bargaining trajectory of benefit and contribution rates that match the aging population. We then use the "democratic gap" as a political stress test. This democratic gap measures how the implicit bargaining power that rationalizes the projected pension benefits deviates from the population shares. We complement the analysis with the "benefit gap" that measures how the projected pension benefits deviate from the bargaining outcome when bargaining power evolves according to population aging.

Keywords : Pension reform ; Aging ; Bargaining ; Sustainability ; Stress test

JEL codes : D63, H55, J18

2023 / 17

Dividing the expected payoff resulting from joint actions

Pierre Dehez

We consider situations where players hit targets with known probabilities and are rewarded according to given rules. The division of the expected payoff resulting from their joint actions is studied in the context of transferable utility games, using the Shapley value as the allocation rule.

Keywords : Probability games ; product games ; Shapley value

JEL codes : C71

2023 / 18

The contribution of realized covariance models to the economic value of volatility timing

Luc Bauwens, Yongdeng Xu

Realized covariance models specify the conditional expectation of a realized covariance matrix as a function of past realized covariance matrices through a GARCH-type structure. We compare the forecasting performance of several such models in terms of economic value, measured through economic loss functions, on two datasets. Our empirical results indicate that the (HEAVY-type) models that use realized volatilities yield economic value and significantly surpass the (GARCH) models that use only daily returns for daily and weekly horizons. Among the HEAVY-type models, for a dataset of twenty-nine stocks, those that are specified to capture the heterogeneity of the dynamics of the individual conditional variance processes and to allow these to differ from the correlation processes (namely, DCC-type models) are more beneficial than the models that impose the same dynamics to the variance and covariance processes (namely, BEKK-type models), whereas for the dataset of three assets, the different models perform similarly. Finally, using a directly rescaled intra-day covariance to estimate the full-day covariance provides more economic value than using the overnight returns, as the latter tend to yield noisy estimators of the overnight covariance, impairing their predictive capacity.

Keywords : Volatility timing ; realized volatility ; high-frequency data ; forecasting

JEL codes : G11, G17, C32, C58

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Realized Covariance Models with Time-varying Parameters and Spillover Effects

Luc Bauwens, Edoardo Otranto

A realized covariance model specifies a dynamic process for a conditional covariance matrix of daily asset returns as a function of past realized variances and covariances. We propose parsimonious parameterizations enabling a spillover effect in the conditional variance equations, and a specific nonlinear, time-varying, impact of the lagged realized covariance between each asset pair on the corresponding conditional covariance. We introduce these parameterizations in BEKK, DCC and HAR type scalar models. In an application relative to the components of the Dow Jones index, we find that the extended models improve the fit and the out-of-sample forecast performances of their less flexible scalar versions.

Keywords : Realized volatility ; spillover effect ; attenuation effect ; time-varying parameters

JEL codes : G11, G17, C32, C58

2023 / 20

Optimizing over Path-Length Matrices of Unrooted Binary Trees

Daniele Catanzaro, Raffaele Pesenti, Allan Sapucaia, Laurence Wolsey

We characterize the set Θ_n of the path-length matrices induced by unrooted binary trees with n leaves, based in part on a strengthening of results on the tree realization problem. In addition, we present several new valid inequalities and polyhedral results for the convex hull of Θ_n . We then focus on the Balanced Minimum Evolution Problem (BMEP), a NP-hard nonlinear optimization problem over Θ_n much studied in the literature on molecular phylogenetics. Working in an extended space, our characterization leads to a first integer linear programming formulation for the BMEP. Modifying this formulation and strengthening the valid inequalities derived earlier by lifting leads to a second formulation which constitutes the core of a branch-and-cut algorithm. Including a new primal heuristic and several separation oracles, this algorithm significantly outperforms the best available exact algorithm for BMEP, based on a dedicated massively parallel branch-and-bound algorithm.

Keywords : Combinatorial optimization ; integer programming ; polyhedral combinatorics ; branch-&-cut ; path-length matrices ; unrooted binary trees ; tree realization ; Kraft's equality ; Buneman's four-point condition ; balanced minimum evolution

2023 / 21

An evolution strategy approach for the Balanced Minimum Evolution Problem

Andrea Gasparin, Federico Julian Camerota Verdù, Daniele Catanzaro

Motivation: The Balanced Minimum Evolution (BME) is a powerful distance based phylogenetic estimation model introduced by Desper and Gascuel and nowadays implemented in popular tools for phylogenetic analyses. It was proven to be computationally less demanding than more sophisticated estimation methods, e.g. maximum likelihood or Bayesian inference, while preserving the statistical consistency and the ability of running with almost any kind of data for which a dissimilarity measure is available. BME can be stated in terms of a nonlinear non-convex combinatorial optimisation problem, usually referred to as the Balanced Minimum Evolution Problem (BMEP). Currently, the state-of-the-art among approximate methods for the BMEP is represented by FastME (version 2.0), a software which implements several deterministic phylogenetic construction heuristics combined with a local search on specific neighbourhoods derived by classical topological tree rearrangements. These combinations, however, may not guarantee convergence to close-to-optimal solutions to the problem due to the lack of solution space exploration, a phenomenon which is exacerbated when tackling molecular datasets characterised by a large number of taxa. Results: To overcome such convergence issues, in this article we propose a novel metaheuristic, named PhyloES, which exploits the combination of an exploration phase based on Evolution Strategies, a special type of evolutionary algorithm, with a refinement phase based on two local search algorithms. Extensive computational experiments show that PhyloES consistently outperforms FastME, especially when tackling larger datasets, providing solutions characterised by a shorter tree length but also significantly different from the topological perspective.

2023 / 22

Basic income versus fairness: redistribution with inactive agents

Antoine Germain

This paper studies redistributive transfers between inactive, unemployed and employed agents. In a model with fully heterogeneous preferences and arbitrarily unequal skills, labor market inactivity arises from home production and disutility of participation. The social objective champions the ethics of equality of opportunity while upholding the Pareto principle. In the Mirrleesian second-best, it turns out that welfare analysis is reduced to a sufficient statistic. Its empirical application suggests that an inactivity benefit would not be welfare-improving in most high-income countries. Overall, the equity gains of introducing a basic income with respect to equality of opportunity are tenuous, whatever its efficiency costs.

JEL codes : D63 ; D82 ; H21 ; H23 ; H24 ; I38

2023 / 23

Bidding and Investment in Wholesale Electricity Markets: Discriminatory versus Uniform-Price Auctions

Bert Willems, Yueting Yu

We compare uniform and discriminatory-price auctions in wholesale electricity markets, studying both long-run investment incentives and short-run bidding behaviors. We develop a monopolistic competition model with a continuum of generation technologies ranging from base load to peak load, free entry and uncertain elastic demand. Our findings reveal that discriminatory-price auctions are inefficient because consumers' willingness to pay exceeds the marginal costs and investment incentives are distorted. Despite having an equal total installed capacity, the generation mix under discriminatory-price auctions skews towards a shortage of base-load technologies. Consequently, this results in a lower long-run consumer surplus.

JEL codes : D44, D47, L94

2023 / 24

Education, mobility and redistribution

Pierre Pestieau, Maria Racionero

Recent evidence suggests that social mobility has declined in many developed countries despite some of them pursuing proactive redistribution policies. In this paper we characterize the optimal mix of income tax and education policies that a government should adopt to maximize a long-term social objective that includes considerations for income redistribution and upward mobility. We show that switching from an elitist to a meritocratic education system, or from a short-term to a long-term vision of social welfare, fosters upward mobility but it can sometimes lead to increased inequality.

Keywords : Social mobility ; education policy ; Great Gatsby curve

JEL codes : H20, H31, H50

2023 / 25

The effect of national industry shocks on local employment: impacts on geographical inequality and inefficiency

David Dorn, Philipp Kircher, Oliver Salzmann

We analyse the effect of national industry shocks on local employment. By providing a novel structural view on the Bartik framework, we show that the difference in national and regional employment growth trends can be attributed to within-region spillovers. These spillovers can be quantified in a simple regression of regional employment change predictions versus actual regional employment changes, where regional employment change predictions are based on national shocks. We find consistent evidence that a predicted change in employment by 1% is associated with a 1.3% change in actual employment in a region. We hypothesize that agglomeration plays a key role in explaining the difference between the predicted and the actual employment growth. When we allow for non-linearities in a variety of setups, we find that the main driver of agglomeration effects are regions with particularly strong growth in employment which outperform their predictions. Taking the employment weighted mean as inflection point, regions with below mean predicted employment growth show a roughly 1:1 translation of predicted job creation to actual job creation. For regions with above mean predictions this ratio increases to 1:1.7.

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Social mobility, education and populism

Sergio Perelman, Pierre Pestieau, Maria Racionero

In this article, we show that the populist attitudes that lead to extremists voting and social unrests can be explained by the breakdown of the social elevator, i.e. the decline in social mobility. This explanation seems to apply to all the 27 European countries studied. It is particularly surprising in countries like Belgium and France, which devote around 30% of their GDP to social protection. It would seem that these welfare states naively believed that simply combating poverty and social inequality was enough to revive the social elevator. This does not seem to be the case.

Keywords : Populism ; social mobility ; education policy ; Gatsby curve

JEL codes : H20 ; H31 ; H50

Encourager à travailler plus longtemps sans pénaliser ceux qui ne le peuvent pas

Laurent Collot, Jean Hindriks

Si nous voulons maintenir la pérennité de nos pensions, nous allons devoir travailler plus longtemps. Comment faire cela sans porter atteinte à ceux qui ont commencé leur carrière plus tôt et qui sont exposés à des métiers pénibles. Dans cet article, nous proposons d'intégrer l'âge de début de carrière et la pénibilité des métiers explicitement dans notre régime de pension. L'âge d'accès à la pension est indexé sur l'âge de début de carrière. Une enveloppe de métiers pénibles est fixée par niveaux de revenu avec une distribution organisée entre partenaires sociaux au sein des secteurs. La compensation pénibilité se fait sous forme d'années d'anticipation de pension. Nous calculons le coût budgétaire de la compensation que nous finançons par un ajustement des pensions les plus élevées. Nos résultats suggèrent que la compensation pénibilité n'est pas si pénible. Par exemple, octroyer 3 années d'anticipation pénibilité à 30% des travailleurs du premier quintile de salaires, 2 années à 15% des travailleurs du second quintile et 1 année à 7% des travailleurs du troisième quintile impliquent une perte de 1% de la pension moyenne du 4ème quintile et de 4,69% de la pension moyenne du 5ème quintile.

Keywords : Social security ; pension ; retirement, ageing

JEL codes : H55, J11, J14, J26