dsili@unime.it - dsili15@ku.edu.tr
Università degli Studi di Messina, Messina, Sicily, Italy Piazza Pugliatti, 1 - 98122 Messina
www.linkedin.com/in/duygu-sili

Duygu Sili

Research Interests

Microeconomics, market design, mechanism design, matching theory and its application

Education

2015 - 2022, Koç University **PhD** in Economics
Dissertation: Three Essays on Matching Theory and Application of School Choice Problems
2013 - 2015, Bilkent University **MA in Economics**,Turkey
2006 - 2012, Bilkent University **BS in Mathematics**

Postdoctoral Scholar August-January 2024

Viterbi Endowed Postdoctoral Fellowship, Simons Laufer Mathematical Sciences Institute (SLMath, formerly MSRI), Market and Mechanism Design Program, Berkeley, California.

Current Job

Visting Assistant Professor Department of Economics at Universidad Carlos III de Madrid, Spain

Working Papers

An Application to Kidney Exchange
July, 2025

Ömer Faruk Sahin, Duygu Sili, M. Utku Ünver, Özgür Yılmaz, Optimal Dynamic Matching under Local Compatibility:

In the past two decades, the design and establishment of living donor kidney exchange clearinghouses have been a major success story in market design. Instead of batching and optimizing exchanges over a fixed pool of incompatible patient–donor pairs, the busiest programs operate the exchange dynamically, matching pairs as they arrive. This feature has also sparked interest in dynamic matching mechanisms. For general matching problems with high-dimensional state spaces, a full characterization of optimal dynamic matching mechanisms remains elusive, and only approximate solutions are known.
We develop a new methodology that characterizes and computes dynamically optimal mechanisms for bilateral matching across arbitrary state spaces, provided that the compatibility between agent types follows a linear spatial structure. This technique can be used to characterize optimal dynamic kidney exchange mechanisms and has applications to other spatial matching problems. Our approach leverages second-order properties of the value function, extending recent advances in Markov Decision Processes and queueing systems, which have traditionally focused only on substitutable components.

September 2025

Antonio Miralles, D.Sili, Pietro Salmaso, Claudia Meo Within Public School Segregation: Theory and Evidence from Italy.

By allowing parents to express preferences regarding potential classmates during the application process, Italian public schools ensure a wide choice among legally uncontestable student distributions across classrooms. We model a simplified game in which public schools competing in underdemanded catchment areas eventually sort students into classrooms based on their economic and sociocultural status (ESCS), as a dominant strategic behavior, in a sort of prisoner's dilemma. The resulting testable hypothesis suggests that catchment areas experiencing persistent demographic decline are more likely to exhibit within-school segregation. To evaluate this hypothesis, we utilize data from the INVALSI assessments for elementary and middle schools. Specifically, we compute two municipality-averaged indices of within-school segregation based on ESCS, employing dissimilarity and distance measures. According to our fixed-effects regressions, a one-percent higher decline in the local school enrolling population over the past five years is associated with an increase of 0.041 (dissimilarity) and 0.058 (distance) in the within-school segregation indices.

October 2025

D.Sili, Ali Nalbant, Barıs Yıldız, A Centralized Mechanism for Customer-Service Provider Matching in Last-Mile Delivery.

The rapid growth of e-commerce and urbanization has led to significant transformations in urban logistics systems, amplifying the economic, social, and environmental impacts of last-mile delivery. This paper introduces a novel centralized mechanism designed to optimize the matching of customers and service providers in last-mile delivery networks. The proposed framework addresses inefficiencies and negative externalities associated with conventional decentralized systems by reallocating customers based on dynamic pricing and preference-driven mechanisms. We define and analyze a new matching problem, demonstrating the existence of Nash equilibria and exploring the non-uniqueness of these equilibria, which opens opportunities for welfare maximization.

October 2025

The core of our contribution lies in the development of a Mixed Integer Programming (MIP) model capable of identifying welfare-maximizing equilibria, coupled with a scalable heuristic algorithm for real-world applications. Through computational experiments, we validate the efficiency and effectiveness of our model in reducing congestion, minimizing emissions, and improving logistical performance. This study bridges the gap between theoretical market design and practical urban logistics, contributing to the discourse on sustainable delivery systems and the optimization of resource allocation in rapidly evolving urban environments.

Working Paper

D.Sili,Ö.Yılmaz, Costly Multi-hospital Dynamic Kidney Exchange,Ömer Faruk Sahin.

October, 2025

Jobmarket Paper

In this paper, we model and analyze multi-hospital dynamic kidney exchange, accounting for coordination costs, stochastic pair arrivals, and strategic hospital behavior. We propose a Markov Decision Process (MDP) framework that yields threshold-based decision rules for when each hospital should match pairs internally versus engage in inter-hospital exchange. Our analysis shows that inter-hospital exchanges are optimal only when the expected surplus from collaboration exceeds the coordination cost; otherwise, hospitals prefer to wait or match internally. We establish structural properties of the value function—concavity in each hospital's pool and supermodularity or submodularity across hospitals—reflecting whether donor–patient pairs are complementary or substitutable. In all scenarios, the optimal dynamic policy is threshold-based: each hospital waits until its pool is sufficiently large relative to the other's before initiating an exchange. Numerical simulations validate the efficiency of these threshold policies, showing that inter-hospital matches occur predominantly in complementary states while intra-hospital matching prevails in substitutable states. The policy implication is clear: reducing coordination costs and aligning hospitals' incentives (e.g., via cost reimbursement) would foster greater collaboration and significantly improve transplant efficiency

D.Sili, A Numerical Study of Common Enrollment in School Choice: A School Assignment Problem.

2024

Inter-district school choice programs aim to reduce segregation and enhance educational equity by allowing students to attend schools outside their home districts. However, balancing individual satisfaction, equitable funding, and demographic diversity remains challenging. Building on Hafalir et al. (2022), we perform 1,100 simulations comparing two variants of the Student-Proposing Deferred Acceptance (SPDA) mechanism—a balanced version enforcing strict student exchanges and an unbalanced version allowing flexibility. In our model of two districts with 20 schools and 1,000 students (with a 100:400 minority-majority split per district), key parameters such as the student-specific score weight, negative type correlation, home district loyalty, school ranking similarity, and district bias are varied. Our results reveal that while the unbalanced SPDA generally yields higher better-off percentages (indicating greater individual efficiency), it risks imbalanced student flows; in contrast, the balanced SPDA achieves more uniform demographic distributions at the expense of lower individual outcomes. Notably, some findings deviate from theoretical predictions, underscoring the need for adaptive, data-driven policies to optimize both efficiency and equity in school choice systems.

D.Sili, A Numerical Study of Interdistrict School Choice: A School Assignment Problem.

2024

An application of a theory of student assignment problem, *inter-district school choice* where a student can be allotted to a school outside of her district is analyzed. The model is a matching with contracts between students and districts where a contract determines the specific school within the district that the student applies. Four policy goals are taken into account: individual rationality, improving student welfare, balanced exchange policy and student diversity in each district. The balanced exchange policy is that the number of students that each district admits from the other district must be equal to the number of students that it transfer to the others. We simulate the real life scenarios by embedding different positive coefficients into the utility functions of each student defined for each school and vice versa.

D.Sili, K.Yıldız, Impact of An Additional Donor in Lung/Kidney Exchange

2014-2015

Master Thesis

Work in Progress

2013

D. Sili, R. Ilkılıç, Project Proposal on Networks in Economics

A study on networks in economics.

Work Experience

21 September 2025- | Department of Economics at Universidad Carlos III de Madrid, Spain
Visiting Assistant Professor
I am teaching undergraduate microeconomic theory and conducting full-time research in the Department of Economics.

28 March 2024- 25 September 2025 | Università degli Studi di Messina, Italy
Postdoctoral Researcher at Economics
The program studies the allocation of children to public schools and classrooms, workers to different positions, and competitive bidding. Evaluations must take into account egalitarian aspects and favoritism. The researcher will perform the following activities: Mapping of allocation mechanisms and segregation of disadvantaged students among schools and classes within schools in Italian municipalities. Theoretical and computational design of School Choice and Classmate Choice mechanisms, focusing on segregation and efficiency.

15 February-July 2024 | Koç University, Turkey
Postdoctoral Scholar at Department of Industrial Enginnering
European Research Council (ERC) funded project in GoodMobility Lab at Koc University Turkey. It is related with the broad area of transportation science and logistics.

12 February-June 2024 | Koç University,Turkey
Instructor
Engineering Economics

August 21, 2023 - December 20, 2023 | Simons Laufer Mathematical Sciences Institute (SLMath, formerly MSRI) Berkeley, California
Postdoctoral Scholar
Mathematics and Computer Science of Market and Mechanism Program, Under the guidance of Peter Biro

January-August 2023 | Koç University, Turkey
Postdoctoral Scholar at Department of Industrial Enginnering
European Research Council (ERC) funded project in GoodMobility Lab at Koc University Turkey. It is related with the broad area of transportation science and logistics.

February-June 2023 | Koç University,Turkey
Instructor
Engineering Economics

2015 - 2022 | Koç University,Turkey
Teaching Assistant
Microeconomics Theory for Graduate Students, Game Theory, Microeconomics Theory, Econometrics

2013 - 2015 | Bilkent University,Turkey
Teaching Assistant
Microeconomics Theory, Introduction to Probability and Statistics, Introduction to Economics

Projects

April,2021-January,2022	ERC-FUNDED Research Project of Erdem Yörük at Koç University Research Assistant, "The Politics of Welfare in Emerging Market Economies"
2011-2012	Senior Undergradute Projects Mathematics in Bilkent University, Turkey Senior Undergradute Projects Mathematics in Bilkent University D.Sili, A.Kerimov, Graph Theory and Ramsey Coloring for Graphs, 2012 D.Sili, S.Sertöz, Infinite Iterated Exponential and Lambert W function, 2011

Fellowships

2013-2015, Full Merit M.A Scholarship, Bilkent University, Economics

2015-2021, Full Merit PhD Scholarship, Koç University, Economics

2023, Viterbi Endowed Postdoctoral Fellowship, Institute (SLMath, formerly MSRI) Market and Mechanism Design Program, Berkeley,CA.

MARCH, 2024-OCTOBER, 2025, Postdoctoral Fellowship at Economics
Supervisor of Prof. Dr Antonio Miralles Asensio, Università degli Studi di Messina, Italy

Workshops and Conferences

EU-funded Training Workshops in Computational Social Sciences,Social ComQuant Project partners, GESIS – Leibniz Institute, December, 2021

Data Analysis and Scientific Programming with Python Workshop

EC,2020

ACM Conference on Economics and Computation,2020

ASSA,2021
American Economic Association
Annual Meeting

ICE-TEA2022
Turkish Economic Association

Connections Workshop: Mathematics and Computer Science of Market and Mechanism Design
Simon Laufer Mathematical Sciences Institute (formerly MSRI
7-8 September 2023

Introductory Workshop: Mathematics and Computer Science of Market and Mechanism Design
Simon Laufer Mathematical Sciences Institute (formerly MSRI
11-15 September 2023

Online and Matching-Based Market Design workshop, 26-27 October,2023
Simons Institute for the Theory of Computing

Algorithms, Approximation, and Learning in Market and Mechanism Design
Simon Laufer Mathematical Sciences Institute (formerly MSRI
6-9 November 2023

ASSA 2024
American Economic Association
Annual Meeting

17th Meeting of the Social Choice and Welfare Society
Paris, 2-6 July 2024

2024 Conference on Mechanism and Institution Design (CMID 2024)
8-12 July, Budapest

2025 The 14th Conference on Economic Design (coed2025)
Society for Economic Design (SFED)
23 - 25June, University of Essex, UK

2025 Match in Practice
15-19 May, University of Messina, Italy

Qualifications

Computer:	Working knowledge of Mat lab,Latex,Python
Familiar OS :	Windows,Java
Foreign Languages :	Turkish (native), English (Fluent), German (intermediate – still learning), Italian (intermediate – still learning)
Soft Skills :	Works well in team, good at problem solving

Graduate Courses Taken

Dynamic Programming, Advanced Microeconomics Theory, Networks Model Optimization Stochastic Models Applications, Economics of Information and Contracts Interpolation and Approximation,Experimental Economics, Financial Economics Advanced Macroeconomics Theory, Data science for Operational Research, Forecasting

References

Özgür Yılmaz
Associate Professor of Economics
Koç University
+90 212 338 1627
ozyilmaz@ku.edu.tr
PhD Thesis Advisor

Antonio Miralles Asensio
Professor of Economics
Università degli Studi di Messina/ Universitat Autònoma de Barcelona
ECON-01/A
amirallesasensio@unime.it

Barıs Yıldız
Assistant Professor of Industrial Engineering
Koç University
+90 (212) 338-1795
byildiz@ku.edu.tr.

Muhammed Ali Yıldırım
Associate Professor of Economics
Senior Research Fellow at the Growth Lab, Center for International Development at Harvard University
Koç University
+90 212 338 15 16

mayildirim@ku.edu.tr
yildirim@gmail.com