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Design, Incentives and Outcomes: Essays on Allocation Under Constraints

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Essays on Allocation Under Constraints

by Prakriti Thami

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Abstract
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The first chapter examines the impact of intrinsic truth-telling preferences on consumer welfare within a priority pricing mechanism, in which individuals can gain faster access to services by paying a higher fee. While traditional models assume fully strategic behavior, empirical evidence increasingly points to an intrinsic preference for truth-telling. I develop a theoretical model showing that priority pricing yields higher welfare relative to uniform pricing only when the proportion of non-truthful agents exceeds a critical threshold. An online experiment further reveals that the welfare effects depend not only on incentives created by the pricing structures and truth-telling preferences but also on individuals' beliefs about others' truthfulness. This contributes to a more nuanced understanding of how behavioral preferences and belief heterogeneity shape the welfare outcomes of pricing mechanisms.

The second chapter investigates how the design of the pricing scheme influences cost containment and patient selection under prospective payment systems, where providers are reimbursed a fixed price that does not vary with the volume or intensity of services delivered. We develop a theoretical model in which heterogeneous users are served by both public and private providers. Private providers can select which patients to serve, while public providers must accept all applicants. We show that total costs in such a setting depend on the number of prices used. Using the Swedish personal assistance system as a motivating example, we conduct a numerical analysis demonstrating that modest changes to a single-price system can generate substantial cost savings. These results offer practical guidance for designing payment schemes that promote cost-efficiency.

The third chapter examines the trade-off between equity—ensuring fair distribution—and efficiency—treating the largest number of patients—in allocating blood supply across different blood types. While allowing patients to receive blood from any compatible type can promote equitable access, it may reduce the total number of patients treated. I derive a criterion under which pooling compatible blood types improves equity without sacrificing efficiency, and demonstrate how it can be incorporated into iterative pooling procedures. This offers guidance for balancing equity and efficiency in the allocation of blood supply.

Key words
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MADE IN SWEDEN

Dedicated to my grandfather
Bhakta Bahadur Thami

Contents

Abstract

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"I come as one, but I stand as ten thousand."
— Maya Angelou

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Prakriti Thami
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Introduction

Introduction

Scarcity is a defining challenge in the provision of healthcare and public services, where the tension between pragmatic concerns like efficiency (cost, time, or operational capacity) and ethical imperatives (who to prioritize, what is fair) places high demands on determining who gets what, when, and why. From scheduling urgent care and reimbursing service providers to allocating scarce medical resources like blood supply, decision-makers must translate these trade-offs into allocation mechanisms that are both ethically sound and operationally efficient.

While economic theory offers elegant solutions—often relying on idealized assumptions such as full rationality, perfect information, and frictionless implementation—their effectiveness in practice depends on how individuals respond to incentives and the institutional and behavioral context in which they are applied. The market design literature, to which this thesis contributes, bridges theory and implementation. It seeks to aid the development of allocation mechanisms that not only perform well in theory, but also remain effective under real-world frictions.

Focusing on healthcare and related public service settings, this thesis contributes to that agenda by examining how individual behavioral preferences, incentive structures, and institutional frameworks shape the allocation of scarce resources. It comprises three self-contained papers, each addressing a distinct applied microeconomic question at the intersection of mechanism design, behavioral economics, and public policy.

The first paper asks: How do truth-telling preferences shape total consumer welfare in priority pricing mechanisms, where individuals can gain faster access to services by paying a higher fee?

The second paper investigates: How does the structure of pricing schemes in mixed public–private systems influence provider incentives for patient selection and affect public costs?

The third paper considers: How can equitable access be promoted in allocation settings constrained by supply and biological compatibility, without compromising efficiency—that is, without reducing the total number of patients treated?

Each paper addresses a distinct friction: Paper I examines deviations from full rationality in self-reporting behavior, Paper II addresses incentive problems arising from pricing design in a mixed-provider system, and Paper III analyzes equity–efficiency trade-offs under biological compatibility constraints. While methodologically diverse—combining theoretical modelling, incentivized experiments, and simulation-based policy analysis—each study evaluates how its respective mechanism

performs when behavioral and institutional features of real-world settings are taken into account. In doing so, they contribute to ongoing policy debates around pricing design, and fairness and efficiency in the provision of healthcare and related public services.

Summary and Contributions

This section presents detailed overviews of the three papers comprising this thesis, highlighting their main research questions, methodologies, key findings, and contributions.

Paper I – Truth-Telling in a Priority Pricing Mechanism

The first paper investigates how intrinsic preferences for truth-telling affect welfare outcomes under priority pricing (PP) mechanisms. PP allows individuals to pay higher fees for faster access to services, aiming to allocate limited resources efficiently by inducing self-selection based on willingness to pay. Common applications include fast-track healthcare, expedited visa processing, and public service queues. However, the implicit assumption underlying this approach to allocation—as reflected in traditional models of optimal pricing (see, e.g., Laffont & Tirole, 1993; Wilson, 1993)—is that individuals will always misrepresent private information when it benefits them. Yet empirical evidence suggests that many individuals have an intrinsic preference for truth-telling, even at personal cost (Abeler et al., 2019).

This behavioral insight is incorporated into a theoretical framework to better understand when allocation under PP improves consumer welfare in settings where some individuals are truthful while others act strategically. The model reveals a key threshold: PP improves welfare relative to uniform pricing only if the probability of encountering a strategic, misreporting individual exceeds this threshold. This implies, first, that the benefits of PP materialize only when a sufficient proportion of individuals are inclined to misreport, and second, that PP may enhance welfare in low-truthfulness populations but reduce it when truth-telling is prevalent.

To test these predictions, I conducted a pre-registered online experiment simulating a stylized appointment allocation scenario. Participants were randomly assigned to either a priority pricing (PP) condition—where reporting a higher level of need incurred a fee—or a free-of-charge condition. Each participant was privately assigned a level of need and asked to report it, knowing that earlier appointments (and thus higher payoffs) would be allocated based on reported need. Participants were also randomly assigned to either high- or low-truthfulness groups. To align participants' beliefs with their assigned group, those in high-truthfulness groups received prompts suggesting that most group members were likely to report their need truthfully, while those in low-truthfulness groups received prompts implying that others in the group might be more inclined to misreport. Participant truthfulness propensity was observed in an initial stage (adapted from Campos-Mercade, 2022), and this measure was used to reweight the data during analysis, allowing for the simulation of groups with high or low baseline truthfulness propensities.

In doing so, I find that while priority pricing (PP) reduced misreporting relative to the free allocation condition, it did not eliminate it. Moreover, contrary to theoretical expectations, PP did

not produce significantly different misreporting rates between simulated high- and low-truthfulness groups. This appears to be driven in part by behavior shaped by expectations about others' truthfulness: participants were more likely to report truthfully when they believed others in their group would do the same, and vice versa.

These insights have important implications for the design of allocation mechanisms in contexts where need is privately observed and difficult to verify—such as healthcare and other government-administered services. They suggest that the performance of PP depends not only on the financial incentives it creates but also on prevailing truth-telling norms and belief structures. Accordingly, interventions that shift beliefs—such as public awareness campaigns or transparency initiatives—could serve as effective complements to pricing incentives.

Paper II – Multiple Pricing for Personal Assistance Services

The second paper, co-authored and published in Economic Modelling (2024), investigates how prospective payment schemes, where service providers are reimbursed based on pre-determined prices rather than actual costs, affect cost containment in publicly funded healthcare systems. While such schemes are often motivated by concerns about cost-efficiency, it is well known that they also create incentives for service providers to reject (or "dump") high-cost users in favor of more profitable ones (e.g. Eggleston, 2000; Ellis, 1998; Newhouse, 1996).

Prior research has primarily focused on the equity implications, examining how selection affects access for users with different cost types (e.g. Agerholm et al., 2015; Brown et al., 2014; Geruso & McGuire, 2016). We shift the focus to efficiency by analyzing how such selection behavior can increase the total service provision cost. Specifically, when high-cost users are absorbed by public providers that cannot refuse service, the government effectively pays twice—once through inflated payments to private providers and again through losses incurred by the public sector.

We develop a theoretical model of a setting where both public and private providers deliver services financed by a third-party payer. The model incorporates three key elements: (1) heterogeneous user cost types, (2) private providers' ability to engage in strategic selection of users, and (3) reimbursement rates set by the third-party payer, subject to a cap beyond which the service providers must cover costs themselves. In this type of setting, we show that introducing a multiple pricing scheme—where reimbursement rates vary with observable user cost characteristics—reduces the losses incurred by public providers. The model characterizes optimal pricing at different levels of granularity, and simulations show that more refined pricing leads private providers to serve a broader range of user cost types without raising total service provision costs.

To ground the model in a real-world setting, we use Sweden's personal assistance program as a motivating example. In Sweden, individuals with significant long-term impairments are entitled to receive personal assistance for activities of daily living from either public (municipal) or private providers. Both provider types are reimbursed at a fixed hourly rate set by the central government. While private providers are permitted to reject service requests, municipalities are legally required to accept all users who approach them. Because the program is funded through a capped central government budget, any deficits arising from service provision must be absorbed by the providers themselves.

Calibrating our model to this setting, we find that even a modest reform—moving from the current uniform price to a two-tiered system—would reduce municipal losses by approximately 8%, while holding total central government spending constant. Sweden's Social Insurance Inspectorate (ISF 2021:11, 2021) has, in fact, even formally recommended that our model be "developed, tested, and evaluated" as a potential solution for personal assistance pricing.

The model and its insights, however, apply more broadly to service provision systems with mixed public and private providers, where private providers play a significant role, have discretion over whom to serve, and user needs are sufficiently predictable to permit cost-based pricing. Examples include publicly funded long-term care for elderly and disabled persons, as seen in countries such as Spain, France, the United States and Australia (World Health Organization, 2021). By offering a tractable framework for analyzing and optimizing multi-tiered pricing schemes, this research contributes to the literature on provider payment design while also providing actionable insights for improving cost containment in mixed-provider systems.

Paper III – Blood Supply Allocation: Trade-Off Between Equity and Efficiency

This paper addresses a fundamental challenge in resource allocation: how to balance efficiency and equity considerations under hard constraints. I examine this trade-off in the critical context of blood supply allocation, where scarcity forces difficult choices between maximizing the number of patients treated and ensuring fair distribution of supply. A central constraint in this setting is biological compatibility—most notably ABO blood type compatibility—which limits feasible allocations and contributes to unequal access across patients with different blood types.

The motivation for this paper stems from the COVID-19 pandemic, when convalescent plasma (CP)—blood plasma from recovered patients containing neutralizing antibodies—was urgently deployed as an immune therapy for infected individuals.[1] The scarcity of plasma, coupled with the large number of patients requiring treatment at the peak of the pandemic, raised pressing questions about how to ensure both fair and efficient access to life-saving blood resources.

This paper builds on work by Kominers et al. (2020), who introduced a centralized mechanism for CP allocation and proposed an iterative pooling procedure that exploits ABO compatibility to enhance equitable access across blood types. While their analysis focuses on fairness in distribution, I extend the framework to examine the potential efficiency trade-offs introduced by such pooling. Specifically, I show that while allowing patients to receive plasma from any compatible type can promote equitable access, it may also reduce the total number of patients treated. To address this, I derive a dominance criterion that identifies when pooling improves or preserves efficiency relative to allocations that restrict patients to receiving plasma only from donors with the same blood type. I also demonstrate how this criterion can be embedded in iterative pairwise pooling procedures to ensure that each pooling step yields a weakly higher number of treated patients, thereby safeguarding efficiency while improving equity.

To assess the practical significance of the theoretical results, I conduct a simulation study using the CP supply and demand model developed by Kominers et al. (2020). The findings show that pooling

[1] Even today, CP remains one of the more viable treatment options, particularly in resource-limited settings where vaccines and antivirals are inaccessible (Hill et al., 2021; Plata, 2022; Ramachandran et al., 2021).

procedures that violate the proposed criterion lead to efficiency losses in 7.11% of simulated cases, resulting in fewer patients treated per unit time. On average, these inefficiencies reduce the number of treated patients by 0.60% to 1.03%, with the largest observed loss reaching 8.42%.

This paper contributes to the growing literature on the market design approach to medical resource allocation under compatibility constraints in three key ways. First, it derives a transparent and testable dominance criterion that characterizes when equity-promoting pooling of ABO-compatible blood types preserves efficiency. Second, it demonstrates—through simulations—that even small deviations from this criterion can lead to measurable efficiency losses, underscoring the importance of designing pooling procedures carefully to ensure that efforts to promote equity do not come at the cost of substantial efficiency losses. Third, it shows how this criterion can be operationalized within iterative pooling procedures, offering a practical tool for policymakers and blood banks to balance equity and efficiency in the design of blood supply allocation mechanisms.

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