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Centralized Versus Decentralized Pricing Controls for Dynamic Matching Platforms

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Online service platforms have transformed how customers and suppliers connect in real-time, using centralized dispatch and pricing systems. However, by acting as “central planners”, platforms risk undermining the workers’ flexibility endorsed by the gig economy. Hence, there has been significant scrutiny on the classification of gig workers as independent contractors and their freedom in decisions that directly influence their earnings, such as prices. To alleviate such concerns, several platforms in the ride-hailing industry have adopted or tested decentralized pricing schemes, where workers set prices flexibly. However, this approach presents a complex trade-off. On the one hand, platforms’ pricing systems enable an efficient matching process by balancing demand and supply. Individual suppliers’ pricing decisions may overlook market-wide effects on supply-demand equilibrium. On the other hand, suppliers possess private information about their preferences and costs that platforms cannot easily infer and use for price discrimination. Decentralized pricing can accommodate supplier-side heterogeneity, potentially increasing workers’ participation in the market.

In this paper, we study the above tradeoff between operational efficiency and supplier information under centralized versus decentralized pricing controls. We formulate a fluid model of dynamic two-sided matching markets and quantify the effects on social welfare of different degrees of centralization in pricing. The platform’s degree of centralization in pricing is expressed through the notion of a price menu, an interval of prices from which suppliers can choose. Our main technical contribution is to uncover the structure of stationary market equilibria under various levels of centralization and market characteristics and to analyze the resultant social welfare. We prove the existence of a unique equilibrium in centralized and decentralized platforms. For arbitrary price menus, we establish that any equilibrium is determined by three variables, which must be the roots of a fully-determined piecewise polynomial system.

Building on this analysis, we find that, within “impatient” markets (i.e., agents depart after one match attempt), decentralization is costly to social welfare compared with centralized pricing controls; the worst-case loss is a factor of 2 or 4 relative to revenue-maximal or welfare-maximal prices, respectively. By contrast, within “patient” markets (i.e., agents are involved in many match attempts), the decentralized equilibrium approaches the first-best outcome as agents’ departure rates converge to zero. Although a welfare-maximal price control consistently generates higher welfare than decentralization, we identify a semi-centralized pricing rule, where suppliers retain some flexibility in pricing, but outcomes close to the welfare maximum are achieved in most regimes. Our numerical study shows that other than the patience level, the degree of supply-demand balance and the specific objective used by a centralized platform to set prices critically affect the comparison between centralized and decentralized pricing. Through simulation-based experiments, we verify that our findings are robust to various model assumptions (e.g., distributions of valuations and costs).

A full version of this paper can be found at: <https://tinyurl.com/2azy2wna>.

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