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Algorithmic Governance of Peak-Hour Delivery Restrictions and Welfare in Dominant Platform Markets*

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This study examines algorithmic peak-hour delivery restrictions as a form of digital platform governance and evaluates their welfare implications. Motivated by recent practices in South Korea's highly concentrated food delivery platform market, we develop a stylized model in which a dominant digital platform chooses an endogenous delivery service radius to restrict delivery service areas during peak demand periods. The platform trades off congestion relief and operational performance against reductions in consumer choice and small business access. While algorithmic service area restrictions can improve delivery times and reduce order cancellations by alleviating congestion, they simultaneously shrink consumers' effective choice sets and contract restaurants' accessible markets. Because the platform internalizes the operational benefits of congestion relief but not the welfare losses associated with reduced choice and access, the privately optimal service radius is smaller than the welfare-maximizing radius in the model. Our findings highlight that platform control operates not only through prices but also through rule-based mechanisms that govern access. As a result, seemingly technical operational policies can generate welfare distortions by altering the feasible set of market interactions. We also suggest that performance-based regulation can improve welfare when it conditions the permissibility of access restrictions on demonstrated performance necessity.

Keyword: Algorithmic Governance, Consumer Choice, Korean Food Delivery Platforms, Platform Regulation, Service Area Restrictions

Ⅰ. Introduction

A notable shift in algorithmic governance has emerged in South Korea's digital food delivery platform market in recent years. Since the early 2020s, and increasingly during and after 2023, dominant platforms have implemented algorithmic rules that dynamically restrict delivery service areas during peak demand periods, such as dinner hours. While service coverage remains broad during off-peak periods, delivery availability is selectively curtailed at precisely the times

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when consumer demand is highest, reflecting the growing role of digital platforms in governing access, visibility, and market participation through non-price mechanisms. These practices create a fundamental trade-off. Restricting service areas may relieve congestion and improve operational performance, but it may also reduce consumer access and restaurant market reach.

Digital platforms increasingly rely on algorithmic rules rather than prices alone to govern access, participation, and market outcomes. Prior information systems research conceptualizes such practices as forms of algorithmic governance, in which control is exercised through embedded rules and automated decision systems (Kellogg et al., 2020; Möhlmann et al., 2021). Yet this literature has paid relatively limited attention to the welfare implications of algorithmically imposed access restrictions, especially when such restrictions operate as non-price controls in highly concentrated platform markets. In particular, less attention has been paid to how algorithmic rules shape the feasible set of market interactions by directly constraining access, and how such constraints affect welfare.

News reports document concrete cases in which platforms narrowed delivery service areas in response to peak-period congestion and rider shortages. For example, Coupang Eats reportedly reduced effective delivery radii in high-demand areas from several kilometers to as little as one kilometer, limiting the set of restaurants visible to consumers during peak hours (Lee, 2020). In addition, South Korea's Fair Trade Commission has scrutinized contractual clauses used by major platforms, including Baedal Minjok and Coupang Eats, that allowed platforms to restrict store visibility or delivery zones without prior notice to restaurant partners, indicating that delivery area restrictions have been a recurring source of dispute and regulatory concern (Kim, 2025). These developments suggest that delivery area restrictions are not merely operational details, but potentially consequential governance choices with broader welfare implications.

Platforms typically justify peak-hour service area restrictions as operational improvements aimed at enhancing delivery quality, reducing delays, and improving rider working conditions. From an operational standpoint, these claims are not implausible. By shortening delivery distances and limiting system load, platforms may reduce congestion in dispatch systems, improve order completion rates, and stabilize delivery times during demand spikes, as emphasized in the literature on platform congestion and capacity management (e.g., Cachon et al., 2017; Taylor, 2018). The central issue, however, is not whether such restrictions can improve operations, but whether the platform has incentives to impose them more aggressively than is socially desirable.

These operational changes have coincided with notable shifts in platform profitability and fee structures. During the same period in which delivery area restrictions expanded, major platforms reported sharp improvements in operating performance, while delivery fees charged to consumers and advertising or commission payments required from restaurants also increased (Jung, 2024; Park, 2024; Lee, 2026). This raises the possibility that service area restrictions may serve not only operational performance goals, but also revenue-related objectives under platform dominance. As such, the welfare consequences of these restrictions cannot be inferred from operational gains alone.

Crucially, the social costs of peak-hour service area restrictions extend beyond operational performance and beyond consumers alone. For consumers, restricting delivery areas directly reduces the number of restaurants available for ordering. Consumers who previously faced multiple alternatives may face a reduced set of available options. This represents more than a matter of inconvenience. A large body of welfare and discrete choice literature emphasizes that choice itself carries intrinsic value, and that reductions in available alternatives generate welfare losses even when prices and service quality remain unchanged (e.g., McFadden, 1977; Small and Rosen, 1981).

For small, independent restaurants, the impact is even more direct and structural. Delivery radius reductions mechanically contract the effective market size. Peak hours account for a disproportionate share of restaurant revenues, yet customer access is restricted precisely during these critical periods. At the same time, competition for visibility intensifies as more restaurants compete for a smaller pool of nearby consumers, often through paid advertising or higher commissions. Given the high fixed costs of managing in-house delivery and the oligopolistic structure of South Korea's delivery platform market, small restaurants have limited ability to respond. Switching platforms or bypassing dominant intermediaries is often infeasible. These effects imply that access restriction is not merely a consumer-side issue, but also a market access issue for complementors on the platform.

These market practices point to a structural asymmetry. Delivery platforms capture private benefits from congestion reduction, faster delivery times, and higher transaction completion rates. At the same time, the costs of reduced consumer choice and contracted restaurant market access are borne by consumers and small business owners. Because dominant platforms internalize operational gains but not the welfare losses associated with reduced consumer choice and contracted restaurant market access, they may have incentives to restrict service areas beyond socially optimal levels, a mechanism we formalize in the model below. In highly concentrated platform markets, competitive forces alone are unlikely to discipline such behavior (Rochet and Tirole, 2003; Armstrong, 2006). This makes a dominant-platform benchmark analytically useful for isolating the welfare distortion generated by centralized algorithmic control. Related concerns about dominant platforms' unilateral control over access and market outcomes have also featured prominently in recent antitrust and policy debates (e.g., Morton et al., 2019).

Against this background, this study addresses the following question. When a dominant delivery platform restricts its service area during peak hours, what degree of restriction is socially optimal once both congestion relief and consumer choice losses are taken into account, and how does this compare with the platform's privately optimal decision?

To address this question, we develop a stylized linear city model in which a monopolistic delivery platform chooses its peak-hour service area, represented by an endogenous delivery radius that limits restaurant availability. The model incorporates three key features. First, delivery times depend on both distance and congestion, and orders are canceled when delivery exceeds a threshold. Second, consumers derive explicit utility from having multiple restaurant options, allowing us to quantify the welfare cost of reduced choice. Third, consumer welfare is affected through changes in effective market access and transaction volume rather than prices alone. By focusing on access restriction rather than pricing, the model captures a non-price governance mechanism that is central to current platform practice but underexplored in existing theory.

This study makes three main contributions. First, it introduces service area restriction as a non-price control instrument that governs market access and participation in platform markets. Unlike pricing-based mechanisms, such restrictions limit consumer access and reduce the set of restaurants available to consumers, making them analytically distinct from the instruments emphasized in much of the existing congestion and platform literature.

Second, it conceptualizes these operational rules as a form of algorithmic governance that determines market access and participation through rule-based allocation, showing how centralized platform algorithms shape market outcomes not only through prices but also through access.

Third, it provides a unified welfare analysis of congestion relief and access loss. Using a standard discrete choice framework, we derive a tractable expression for the welfare loss from reduced consumer choice, incorporate it into the social welfare function, and show that because the platform internalizes congestion relief but not choice losses associated with reduced access, the privately optimal service radius is smaller than the socially optimal radius.

This welfare wedge further provides an efficiency rationale for performance-based regulation. Specifically, we show that welfare improves under a two-part rule that (i) sets a publicly announced delivery performance standard and (ii) requires the platform to demonstrate performance necessity before any service radius reduction is permitted. This approach permits access restrictions when they are genuinely required by congestion, without directly mandating service area sizes. This shifts the focus from pricing to access as the central mechanism of platform control.

The remainder of the paper proceeds as follows. Section 2 reviews the related literature. Section 3 presents the model. Section 4 analyzes the platform's optimization problem. Section 5 derives the socially optimal service area, and compares private and social optima and discusses regulatory design. Section 6 concludes.

Ⅱ. Literature Review

This study relates to two broad strands of literature that examine platform market power and non-price control, as well as choice, access, and welfare in digital markets. Recent work increasingly emphasizes that these dimensions are deeply intertwined, particularly in highly concentrated platform industries.

2.1 Platform Market Power, Congestion Management, and Non-Price Control

A foundational literature models platforms as intermediaries that internalize cross-group externalities while exercising control over access and participation (Armstrong, 2006; Rochet and Tirole, 2003), and related work shows how cross-network externalities can support dominance extension through tying in platform settings (Park et al., 2020). As digital markets have matured and concentrated, platforms increasingly rely on non-price instruments, including access rules, availability constraints, and algorithmic control, rather than prices alone, consistent with evidence that platform firms differ systematically in what they provide and how they leverage connectivity and innovation (e.g., Kim et al., 2024). Platform leadership can shape ecosystem outcomes not only through pricing but also through technological and architectural control (e.g., Lee et al., 2021).

This shift has been documented in both

theoretical and empirical studies. Belleflamme and Peitz (2021) argue that access design has become a core competitive instrument in platform markets. Related research links platform dominance to unilateral operational policies that are difficult to discipline through competition, particularly when users face high switching costs (Hagiu et al., 2022; Jullien and Sand-Zantman, 2021). Moreover, evidence shows that algorithmic decision-making alone can sustain anticompetitive outcomes even in the absence of explicit coordination or price fixing (Calvano et al., 2020), raising concerns that algorithmic decision-making and related non-price operational controls may generate persistent welfare distortions that standard price-based competition cannot easily correct.

Parallel to this literature, a substantial body of work examines congestion and capacity constraints in on-demand service platforms. Platforms face trade-offs between service quality, completion rates, and system stability during peak demand, and increasingly rely on quantity rationing and access restrictions rather than price adjustments to manage congestion (Bimpikis et al., 2019; Cachon et al., 2017; Taylor, 2018).

Our study contributes to this literature by modeling geographic service area restriction as a strategic non-price control chosen by a dominant platform. We show that while congestion management can be efficiency-enhancing, it creates incentives for excessive restriction when platforms do not internalize choice and access losses.

This perspective aligns closely with the information systems literature on algorithmic governance, which emphasizes how platform design choices and embedded rules shape access, participation, and economic outcomes beyond prices alone (Burtch et al., 2018; Kellogg et al., 2020; Möhlmann et al., 2021). These studies suggest that non-price operational controls increasingly function as governance mechanisms that shape market access rather than prices.

2.2 Choice, Access, and Welfare of Consumers and Small Businesses

A second strand of literature emphasizes that choice and access themselves are fundamental components of welfare. Discrete choice theory establishes that the size of the choice set directly affects consumer surplus, even holding prices and qualities constant (McFadden, 1977; Small and Rosen, 1981). Although this insight is well understood in theory, it has been less central in much of the platform literature.

Recent studies document that platforms actively shape effective choice sets through ranking, curation, and availability constraints, with important welfare consequences even in the absence of price changes (Nocke and Rey, 2024). Such practices can substantially reduce effective access and available options (e.g., Bourreau et al., 2017; Chiou and Tucker, 2013), and recent models formalize how intermediation and access restrictions generate first-order welfare effects (Nocke and Rey, 2024).

At the same time, a growing literature examines how platform policies affect small businesses and complementors. For example, Zhu and Liu (2018) show that Amazon's entry into complementors' product spaces reshaped seller performance through changes in competitive conditions rather than direct price effects. Platforms influence complementor outcomes not only through prices but also by governing access, visibility, and demand allocation, often in ways that disproportionately affect smaller firms (Cennamo et al., 2018; Kim et al., 2024). Prior research shows that platform policies can reshape complementors' effective market access by altering competitive exposure and visibility, even when aggregate platform demand remains high (Cennamo et al., 2018; Zhu and Liu, 2018).

In the context of food delivery platforms, existing research has focused primarily on pricing, commissions, and delivery speed. Far less attention has been paid to how service availability and geographic access shape welfare for consumers and restaurants. Our study fills this gap by explicitly modeling service area restriction as a reduction in both consumer choice and restaurant market access, and by quantifying the resulting welfare loss. This highlights that access and choice are not merely outcomes of platform design, but central channels through which platform governance affects welfare.

Ⅲ. Model

3.1 Environment, Delivery Technology, and Consumer Choice

Consider a monopolistic food delivery platform operating in a linear city [0, 1]. Consumers are uniformly distributed along the interval. Two restaurants, A and B, are located at the endpoints 0 and 1, respectively. The platform intermediates all transactions.

The linear-city structure provides a tractable benchmark for analyzing how service area restrictions affect market access and welfare. While it abstracts from richer heterogeneity in real markets, the key mechanism operates through endogenous truncation of the consumer choice set rather than the specific spatial structure, and therefore extends naturally to richer environments with greater heterogeneity.

The analysis focuses on peak hours. During this period, the platform chooses a delivery service radius $r \in [1/2, 1]$. A consumer located at x can order from restaurant A if $x \leq r$, and from restaurant B if $1-x \leq r$. The condition $r \geq 1/2$ ensures full market coverage, so that each consumer has access to at least one restaurant.

Menu prices are identical across restaurants and normalized to p. Production costs are normalized to zero.

Delivery time for an order with distance d is given by

$$T(d,r) = \tau(d) + H(r),$$

where $\tau'(d) > 0$ captures distance-related travel time, and $H'(r) > 0$ captures congestion in the platform's dispatch system. A larger service area increases routing complexity and congestion during peak demand.

There exists a delivery time threshold $\bar{T}$ such that if $T(d,r) > \bar{T}$, the consumer cancels the order and no transaction occurs, consistent with waiting-sensitive demand (Allon et al., 2011).

If an order is completed, a consumer located at x who orders from restaurant $j \in \{A, B\}$ obtains utility

$$U_j(x) = V - p - \alpha T(d_j(x), r) + \varepsilon_j,$$

where V is baseline valuation, $\alpha > 0$ measures disutility from delivery time, and ε_j is a restaurant-specific taste shock.

Taste shocks ε_A and ε_B are independently and identically distributed according to a Gumbel distribution with unit scale. This assumption implies that when both restaurants are available, consumers enjoy a positive choice value. Under the standard logit model with i.i.d. Gumbel taste shocks and symmetric deterministic utility components, the expected maximum utility increases by ln 2 when the number of available alternatives increases from one to two.[1] When only one restaurant is available, the incremental choice value from having an additional alternative disappears. This formulation captures the welfare value of choice in a reduced-form manner, and the associated welfare loss from access restriction would be larger in environments with a richer set of differentiated alternatives.

To clarify the scope and interpretation of the model, we note the following. The model adopts a stylized structure to isolate the core mechanism of service area restriction. In particular, the monopolistic platform should be interpreted as a reduced-form representation of strong market power rather than the literal absence of competition. In highly concentrated platform markets, even limited competition may not fully discipline platform

1) This ln 2 term should be interpreted as a normalized benchmark choice-value term under the symmetric two-restaurant setting.

behavior due to network effects and switching frictions. This interpretation is particularly relevant in highly concentrated platform markets such as the Korean food delivery industry, where a small number of dominant platforms can shape market access and participation.

In addition, rider supply is treated as exogenous to focus on the demand-side distortion arising from access restriction. Allowing for endogenous supply would introduce an additional adjustment margin, potentially mitigating congestion. However, the platform's incentive to restrict access in order to improve operational performance would remain. We return to these considerations in the discussion section.

3.2 Platform Payoffs, Transaction Volume, and Social Welfare

Consumers choose among available restaurants to maximize utility. Let $d^*(x,r)$ denote the delivery distance chosen by consumer x , conditional on availability. An order is completed if and only if

$$\tau\left(d^*(x,r)\right) + H(r) \leq \bar{T}.$$

Aggregate completed transaction volume during peak hours is therefore

$$Q(r) = \int_0^1 \mathbf{1}\{\tau(\, d^*(x,r)) + H(r) \leq \bar{T}\}\, dx.$$

Because reducing the service area lowers congestion, a decrease in r may increase transaction volume by preventing cancellations, despite reducing the choice set.

The platform earns a per-transaction margin $m(r) \geq 0$, which may depend on the service area through delivery fees, commissions, or operational costs. Platform profit during peak hours is

$$\Pi(r) = m(r)Q(r).$$

The platform chooses r to maximize Π(r), internalizing the effect of congestion on delivery times and order completion but not the welfare loss from reduced consumer choice.

We define social welfare, denoted by, $W(r)$, as the sum of consumer surplus net of delivery disutility and the intrinsic value of consumer choice. This welfare function serves as the objective of the social planner in Section V.

$$W(r) = \int_0^1 (V - p - \alpha T(\, d^*(x,r), r))$$
$$\cdot\, \mathbf{1}\{T(d^*(x,r), r) \leq \bar{T}\}\, dx + (2r - 1)\, ln\ 2\, \bar{s}(r).$$

where $\bar{s}(r)$ denotes the average completion probability among consumers who retain access to both restaurants.

This welfare measure is intentionally parsimonious. It captures completed-transaction surplus, delivery-time disutility, and the intrinsic value of consumer choice, but does not separately model seller-side payoff. Incorporating seller payoff based on accessible market reach or exposure would reinforce the access-related mechanism, while seller payoff based solely on realized transactions could partially offset it. The central point is therefore not that all seller-side effects necessarily strengthen the result, but that reduced choice and access create a welfare component that the platform does not fully internalize.

We assume that the access-expansion effect of a wider service radius dominates any reduction in completion probability due to congestion, so that the choice-value term $(2r-1)\,ln\;2\,\bar{s}(r)$ is strictly increasing in r over the interior of [1/2, 1]. This condition ensures that a marginal reduction in the service radius always generates a strictly positive welfare loss through reduced consumer choice, and is satisfied when congestion effects on completion probability are sufficiently mild relative to the direct gain in consumer access from expanding the service radius.

A social planner chooses r to maximize $W(r)$, fully internalizing both the congestion relief benefits of service area reduction and the welfare loss arising from reduced consumer choice.

Ⅳ. Platform Optimization

4.1 The Platform's Problem

During peak hours, the monopolistic platform chooses the delivery service radius $r \in [1/2, 1]$ to maximize peak-period profit. Let $Q(r)$ denote the measure of completed transactions, as defined in Section 3, and let $m(r) \geq 0$ denote the platform's per-transaction margin, which may depend on the service area through delivery fees, commissions, or operational costs.

The platform's optimization problem is

$$\max_{r \in [1/2, 1]} \Pi(r) = m(r)\,Q(r).$$

The platform takes consumer choice behavior and the congestion technology as given. Importantly, while the platform internalizes the effect of r on congestion, delivery times, and order completion, it does not internalize the welfare loss associated with reduced consumer choice and contracted restaurant market access.

Assuming an interior solution, the first-order condition is

$$\Pi'(r) = m'(r)Q(r) + m(r)Q'(r) = 0.$$

This condition characterizes the platform's privately optimal peak-hour service radius, denoted r^P

4.2 Comparative Statics and Interpretation

The first-order condition highlights two opposing forces. First, reducing the service area decreases congestion, lowers delivery times, and prevents order cancellations. This effect increases the volume of completed transactions, implying $Q'(r) \leq 0$ over ranges where congestion relief dominates the loss of availability.

Second, reducing the service area contracts the set of available restaurants for some consumers, but this effect enters the platform's problem only indirectly through its impact on completed transactions. The platform does not account for the direct utility loss from reduced consumer choice or the contraction of effective market access for restaurants.

As a result, whenever congestion relief is sufficiently strong, the platform has an incentive to reduce the service area even if such reductions substantially diminish consumer choice and restaurant exposure. Formally, because the platform's objective function depends on r only through $m(r)$ and $Q(r)$ any welfare effect that does not affect completed transactions or margins is ignored. The following proposition summarizes the platform's incentives.

Proposition 1

(Private Incentives for Service Area Restriction)

Suppose there exists a range of r over which congestion relief dominates availability loss, so that $Q'(r) < 0$. Then the platform optimally reduces the peak-hour service radius over that range. Moreover, the platform's privately optimal service radius r^P is weakly decreasing in the severity of congestion, as captured by the slope of the congestion function $H'(r)$.

Proof.

From the platform's first-order condition, a marginal reduction in r is profitable if and only if

$$m'(r)Q(r) + m(r)Q'(r) < 0.$$

To isolate the congestion channel, we consider local deviations holding per-transaction margins fixed, so that $m'(r) = 0$. Under this restriction, the profitability condition reduces to

$$Q'(r) < 0.$$

Reducing the service radius alleviates congestion and improves delivery performance. When congestion sensitivity is higher, that is, when $H'(r)$ is larger, a given reduction in r yields a greater improvement in delivery times and a larger reduction in cancellations.

Under mild regularity conditions on demand and cancellation behavior, higher congestion sensitivity magnifies the transaction-volume response to service area reductions. Consequently, the marginal effect of reducing r on completed transactions becomes more negative, implying that $Q'(r)$ is more negative. Higher congestion severity therefore strengthens the platform's incentive to restrict the service area, resulting in a weakly smaller privately optimal service radius r^P.

Proposition 1 formalizes the platform's operational logic. When congestion is severe, restricting service areas improves delivery performance and raises completed transactions, increasing profit. This incentive exists regardless of the magnitude of consumer choice loss or restaurant market contraction, as long as these effects do not reduce transaction volume sufficiently.

This observation is critical for the regulatory analysis that follows. The platform's first-order condition contains no term reflecting the direct welfare cost of reduced choice. In contrast, the social planner's problem explicitly incorporates this cost. The wedge between the platform's private optimum and the social optimum arises precisely from this missing term, which we analyze in the next section.

V. Social Planner and Regulatory Design

5.1 Social Planner's Problem

We consider a social planner who chooses the peak-hour delivery service area $r \in [1/2, 1]$ to maximize social welfare. Social welfare incorporates three components. First, it includes surplus from completed transactions net of delivery time disutility. Second, it captures the extensive-margin effect arising from order cancellations when delivery times exceed a threshold. Third, and critically, it incorporates the intrinsic welfare value of consumer choice and restaurant access.

Let $d^*(x,r)$ denote the delivery distance chosen by a consumer located at x, conditional on restaurant availability. An order is completed if delivery time satisfies

$$\tau(d^*(x,r)) + H(r) \le \bar{T}.$$

Using the social welfare function $W(r)$ defined in Section III, the social planner chooses the peak-hour service radius r to maximize welfare,

$$\max_{r \in [1/2,1]} W(r).$$

The first term in $W(r)$ captures congestion relief and order completion effects, which the platform also internalizes through transaction volume. The second term reflects the welfare value of consumer choice and restaurant access, which is not internalized by the platform.

Taking the derivative of the $W(r)$ with respect to r yields the social first-order condition

$$\frac{dW(r)}{dr} = \frac{d}{dr}\left[\int_0^1 (V - p - \alpha T(d^*(x,r),r)) \mathbf{1}\{T(d^*(x,r),r) \le \bar{T}\}\, dx\right] + 2\ln 2\,\bar{s}(r) + (2r-1)\ln 2\,\bar{s}'(r)$$

The first term captures the marginal welfare effect of congestion relief and reduced cancellations. The remaining terms capture the marginal welfare loss from shrinking consumer choice sets and effective restaurant access. These latter terms do not appear in the platform's first-order condition, generating a wedge between the private and social optima. This wedge constitutes the central mechanism underlying our main results.

5.2 Divergence Between Private and Social Optima and Regulatory Implications

Comparing the social first-order condition with the platform's first-order condition in Section 4 reveals a key difference. The platform's condition,

$$m'(r)Q(r) + m(r)Q'(r) = 0,$$

depends only on margins and completed transactions. By contrast, the social planner's condition includes the additional choice- loss term proportional to ln 2, which the platform does not internalize. This yields the central result.

Theorem 1

(Excessive Service Area Restriction)

Suppose there exists a range of r over which congestion relief is sufficiently strong so that $Q'(r) < 0$. Then the platform's privately optimal service radius r^P is weakly smaller than the socially optimal service radius r^S, i.e.,

$$r^P \le r^S.$$

Proof.

At any r such that $Q'(r) < 0$, a marginal reduction in r increases completed transactions through congestion relief, giving the platform an incentive to reduce the service radius to increase profits, as shown in Section 4. The social planner faces the same congestion- relief and cancellation benefits but, in addition, internalizes the marginal welfare loss from reduced consumer choice and restaurant access.

Specifically, shrinking the service radius reduces the measure of consumers who retain access to both restaurants and lowers the expected utility derived from choice. Under the standard logit model with symmetric alternatives and unit-scale Gumbel taste shocks, the expected utility gain from having two available options rather than one equals ln 2. As a result, the marginal welfare loss from reduced choice is given by

$$2\ln 2\,\bar{s}(r) + (2r-1)\ln 2\,\bar{s}'(r),$$

which is strictly positive under the assumption stated in Section III.

Because this choice-and-access loss does not enter the platform's objective function, the platform's first-order condition omits a strictly positive term that appears in the social planner's first-order condition. Under the maintained regularity condition that the relevant marginal objective functions satisfy a standard single-crossing property in the service radius, this additional marginal choice-and-access term shifts the planner's optimum weakly upward relative to the platform's private optimum. Consequently, the planner's condition is satisfied at a weakly larger service radius than the platform's, implying $r^P \le r^S$.

Theorem 1 formalizes the intuition that a dominant platform restricts service areas too aggressively during peak hours. The inefficiency arises not from congestion management per se, but from the platform's failure to internalize the welfare loss associated with reduced consumer choice and restaurant market access.

This wedge provides a foundation for regulatory design. Directly mandating service areas may not be necessary when performance-based rules are appropriately structured. Instead, regulation can target performance outcomes while restricting when service area reductions are permissible.

Proposition 2
(Access-Preserving Performance Regulation)
Consider a regulator who imposes the following two-part rule. First, the platform must satisfy a publicly announced delivery performance standard $E[T(r)] \le \hat{T}$. Second, any reduction in the peak-hour service radius relative to the prior period must be accompanied by a demonstrated performance necessity. The platform must show that maintaining the current radius (r_{current}) would violate the standard, that is $E[T(r_{\text{current}})] > \hat{T}$.

This rule permits service area reductions only when necessary to satisfy performance constraints and prevents further reductions once the standard is met.

Let r^P denote the platform's unregulated optimum and r^S the social optimum, with $r^P \le r^S$ by Theorem 1. Define $\tilde{r}$ as the largest service radius at which the performance standard is satisfied with equality so that $E[T(\tilde{r})] = \hat{T}$.

Suppose the regulator sets $\hat{T}$ such that $r^P < \tilde{r} \leq r^S$. Then under the two-part rule and the maintained verifiability and regularity conditions, the platform's regulated optimum satisfies $r^* = \tilde{r} > r^P$, and social welfare increases relative to the unregulated outcome.

Proof.

Since $E[T(r)]$ is strictly increasing in r because $H'(r) > 0$, the performance standard $E[T(r)] \leq \hat{T}$ is satisfied for all $r \leq \tilde{r}$. Without the justification requirement, the platform could freely reduce r below $\tilde{r}$, as doing so strictly improves the performance metric. The two-part rule eliminates this possibility. A reduction in the service radius is permitted only when the current radius violates the performance standard, that is when $E[T(r_{\text{current}})] > \hat{T}$. By construction, this condition never holds for any $r \leq \tilde{r}$. Therefore, once the service radius reaches $\tilde{r}$, further reductions are not admissible under the rule, and $\tilde{r}$ acts as a lower bound that the platform cannot cross through permissible adjustments.

The platform chooses r to maximize Π(r) subject to the admissibility implied by the rule. The unconstrained optimum r^P lies strictly below $\tilde{r}$ by assumption. Since r^P satisfies the interior first order condition, $\Pi'(r^P) = 0$ and is a local optimum, $\Pi'(r) < 0$ for all r in a right neighborhood of r^P. We assume that Π(r) has no local maximum in the interval $(r^P, 1]$, so that the platform's globally optimal feasible choice is the smallest admissible r.

By the assumption stated in Section III, the choice-value term $(2r-1)\ \ln 2\ s(r)$ is strictly increasing in r over [1/2, 1], and this term is not internalized by the platform. It follows that $W(r)$ is strictly increasing in r over the interval $[r^P, r^S]$. Since $r^* = \tilde{r} > r^P$ and $\tilde{r} \leq r^S$, it follows that $W(r^*) > W(r^P)$.

Theorem 1 and Proposition 2 imply that the primary regulatory concern is not delivery speed itself, but how performance considerations are used to justify reductions in choice and access induced by peak-hour restrictions. By focusing on performance outcomes rather than operational inputs, regulators can correct the inefficiency while maintaining platform adaptability.

Ⅵ. Discussion and Conclusion

This paper examines peak-hour delivery service area restrictions implemented by a dominant food delivery platform. Motivated by recent developments in South Korea's delivery market, we develop a parsimonious theoretical framework that incorporates congestion-dependent delivery times, order cancellation, and the intrinsic value of consumer choice. The analysis highlights a fundamental trade-off. Restricting service areas during peak demand can alleviate congestion and improve operational performance, but it simultaneously reduces consumer choice sets and contracts effective market access for small restaurants.

The central result is that a dominant platform's privately optimal service area is excessively narrow relative to the social optimum. This inefficiency does not arise from congestion management per se, which can be welfare-improving, but from the platform's failure to internalize the welfare loss associated with reduced consumer choice and restaurant access. In the platform's optimization problem, service area restrictions are evaluated only through their effects on completed transactions and margins. In contrast, the social planner internalizes an additional welfare component arising from the intrinsic value of choice, generating a systematic wedge between private and social incentives. This highlights that platform control operates not only through prices but also through non-price mechanisms that directly shape access and participation.

This wedge between private and social incentives has several implications for policy. First, it cautions against interpreting peak-hour service area restrictions purely as quality-improving operational adjustments. Even when such restrictions reduce delivery times and increase completion rates, they may impose substantial social costs on consumers and small business restaurants. Second, it suggests that laissez-faire outcomes are unlikely to be efficient in highly concentrated delivery platform markets, where competitive pressures are insufficient to discipline unilateral access restrictions.

Recent industry practices provide a useful real-world context for this mechanism. For example, recent reporting on Baedal Minjok's "Roadrunner" initiative documents that delivery-related operational rules, including geographic availability, are adjusted repeatedly even under normal demand conditions, rather than being triggered only by exceptional shocks (Hong, 2025). Importantly, these adjustments are described not solely as responses to acute congestion, but also as tools to manage rising delivery-related costs associated with longer distances. While Roadrunner encompasses broader changes to dispatch algorithms and rider assignment, the reported use of repeated access adjustments is consistent with the core logic of our model. When dominant platforms rely on non-price operational levers to manage costs and performance, service availability and effective access can be curtailed in ways that are privately optimal yet socially excessive.

Importantly, our analysis does not imply that service area restrictions should be categorically prohibited. Blanket bans risk eliminating legitimate congestion-management tools and may inadvertently degrade service quality. Instead, the model provides a justification for performance-based regulation. A two-part rule that combines a public performance standard with a demonstrated- necessity requirement can curb excessive access restriction while preserving platform flexibility. Under such a rule, service area reductions are permissible only when genuinely required to satisfy the performance standard, preventing the platform from invoking operational concerns as a justification for restrictions that primarily serve private interests. This approach is consistent with recent policy discussions that emphasize ex ante and performance-based regulation in digital platform markets where access and visibility are governed by dominant intermediaries (OECD, 2021; 2022). More broadly, our findings suggest that the central regulatory challenge is not improving operational performance per se, but governing how performance considerations are used to justify restrictions on access.

The framework also sheds light on the distributional consequences of peak-hour restrictions. Consumers bear welfare losses through reduced choice even when prices remain unchanged. Small restaurants face a contraction in effective market access precisely during peak revenue periods, and these losses may be amplified if platforms capture congestion relief gains through higher commissions or advertising fees. While transfers do not directly affect social welfare in our model, persistent erosion of restaurant rents may have longer-run implications for entry, variety, and market dynamism, reinforcing the importance of access considerations in platform regulation.

Beyond the welfare implications, our findings contribute to a deeper understanding of algorithmic governance in platform markets. In the context of food delivery platforms, service area restriction is not merely an operational parameter, but a rule-based mechanism embedded in platform algorithms that determines who can participate in the market and under what conditions. By adjusting service availability in real time, the platform effectively governs market access, visibility, and competitive exposure for both consumers and restaurants.

This perspective highlights that algorithmic governance operates through the design of decision rules that shape the feasible choice set, rather than through prices alone. As a result, seemingly technical operational policies can have first-order implications for allocation, market structure, and welfare. Our analysis shows that when such rules are optimized for platform objectives without fully internalizing access-related externalities, they may systematically distort market outcomes. In this sense, algorithmic governance operates as an allocation mechanism that determines the structure of market interactions.

Building on this framework, the model also generates testable empirical implications. Service areas are expected to contract during peak demand periods when congestion is high, reducing the effective choice set available to consumers. At the same time, improvements in delivery performance, such as shorter delivery times or lower cancellation rates, may coexist with reductions in overall welfare due to restricted access. These predictions can be directly mapped to observable platform behavior and evaluated using platform-level data on delivery distances, completion rates, and cancellation behavior, providing a direction for future empirical research.

Several limitations and extensions merit discussion. First, the model abstracts from competition between platforms. While South Korea's delivery market is highly concentrated, introducing limited multi-homing or asymmetric platform competition could yield additional insights into strategic interactions and regulatory scope. Second, we treat delivery area restrictions as a single scalar choice. In practice, platforms may implement more granular, algorithmic access rules that vary by neighborhood, restaurant, or real-time demand conditions. Extending the model to allow for differentiated access mechanisms would further enrich the analysis. Third, we do not endogenize rider supply. Allowing platforms to expand capacity through wages or incentives would introduce an additional margin of adjustment and clarify the trade-off between restricting access and investing in capacity. Fourth, the two-part regulatory rule proposed in Proposition 2 assumes that the regulator can verify the platform's reported delivery performance. In practice, E[T(r)] is privately observed by the platform, creating incentives for strategic misreporting. Effective implementation would therefore require independent monitoring of delivery times or third-party auditing mechanisms. Additionally, the regulator must set the performance threshold $\hat{T}$ such that the implied lower bound $\tilde{r}$ lies between r^P and r^S, yet neither quantity is directly observable. Calibrating $\hat{T}$ in practice would require regulators to rely on disclosed platform data, historical benchmarks, or regulatory experimentation. We leave the design of incentive-compatible monitoring and threshold-setting mechanisms to future work.

Despite these simplifications, the core insight is robust. When platforms use non-price operational controls to manage congestion and costs, consumer choice and small business access become central welfare variables. Ignoring these dimensions risks understating the social costs of seemingly technical platform policies.

Peak-hour delivery service area restrictions exemplify a broader challenge in platform governance. As digital platforms increasingly rely on algorithmic and operational levers rather than prices, traditional regulatory tools may miss important sources of welfare loss. By explicitly modeling choice and access, this paper provides a foundation for evaluating such policies and designing regulation that balances efficiency, flexibility, and fairness in platform markets. This suggests that access-based platform governance deserves greater attention in both academic research and regulatory practice, particularly in markets where algorithmic rules directly determine participation and allocation.

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