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Does Restricting Outsiders Always Lower Price and Benefit Insiders?

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Abstract

Policies that restrict outsiders are common. Some justifications include protecting insiders from high price and leaving more of the concerned products to insiders. Sometimes these policies fail to work because outsiders can get around the restrictions. In a model in which a policy of restricting outsiders is anticipated, we find that if the policy works, it only sometimes lowers the price. When the price does decrease, the product quality decreases too. Not every insider would benefit equally; those insiders who likely suffer are identified. While restricting outsiders may or may not reduce insiders' consumer surplus, outsiders and the producer are always worse off. They therefore would find ways to get around the restrictions. Evaluating these policies must (a) take into account the possibility that they might not work at all, (b) check their effects beyond just price if they do work.

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JEL Classifications: K25, K29, L25, L51, R38.

1. Introduction

Many policies restrict buyers who are considered "outsiders." Some countries restrict foreigners or foreign entities from buying real estates and other financial assets.[1] Some establishments (such as schools, dormitories, hospitals, armies, factories, and other kinds of workplaces) restrict outsiders from buying food in their cafeterias.[2]

These policies usually concern certain scarce resources, such as land and retail space. Policymakers usually justify these policies as: unrestricting outsiders raises prices and crowds out insiders. To ensure that enough is available for insiders and to protect them from high prices, policymakers have no choice but to restrict outsiders.[3] The logic goes as follows: if certain resources are scarce, then allowing outsiders to get their hands on the fruits of such resources leaves few for insiders at high prices. This logic has the following sequence:

$$\begin{aligned} &\textit{Someone produces} \Rightarrow \textit{Outsiders are restricted} \\ &\qquad\qquad \Rightarrow \textit{Products are cheaper and more available for insiders.} \end{aligned} \tag{I}$$

Economists would question whether the results are robust to the sequence. Their very first question is likely the following, "why would that producer fail to anticipate a restriction on who it can sell to?" Therefore, the kinds of policy scenarios we focus on have the following

[1]For instance, the Thailand Condominium Act of 1979 restricts foreigners from owning more than 49% of the floor space of a condo. Someone who is not a Swiss buying a property in Switzerland must have the right permit and license. Canada, Australia, and New Zealand all have certain restrictions for foreigners in buying properties. Different forms of such restrictions exist, including **a) Ex ante measures:** outright exclusion, extra tax, extra reporting/disclosure obligations, mortgage restrictions, etc.; **b) Ex post measures:** extra reporting/disclosure requirements, extra restrictions of the property rights, etc.

[2]For example, those cafeterias that are located inside Hong Kong industrial buildings are licensed differently from regular restaurants and are required by law to only serve workers of these factory buildings.

[3]Former Australian Prime Minister Kevin Rudd made a similar remark on August 21, 2013 during a discussion on the foreign ownership restriction of the agricultural land of Australia: "We often get criticized for trying to be protective. I actually look around the world and I see many, many countries being equally protective of their own core assets." Source: "FactCheck: do many other countries restrict foreign investment in agricultural land?" by Margaret McKenzie, *The Conversation*, September 6, 2013, URL: https://theconversation.com/factcheck-do-many-other-countries-restrict-foreign-investment-in-agricultural-land-17691.

sequence instead:

$$\begin{aligned} &\textit{Outsiders are restricted} \Rightarrow \textit{Someone produces} \\ &\qquad \Rightarrow \textit{Are the products still cheaper and more available} \\ &\qquad\quad \textit{for insiders? (What about other attributes?)} \end{aligned} \tag{II}$$

Three reasons make sequence (II) more appropriate to model policies that restrict outsiders than sequence (I). First, given that someone must produce the fruits of certain scarce resources that insiders and outsiders demand, producers must find out to whom they can sell to. Producers endogenously respond to what they anticipate so that what and how they produce can differ with and without outsider restrictions. Second, *unanticipated* restrictions can be politically infeasible and illegal. Once products have been produced using scarce resources as inputs, any *unanticipated* restrictions on who producers (or subsequent owners) can sell to harm their property rights and invite legal challenges. Third, theoretical studies on how restricting outsiders affects quality and price also offers models that follow our sequence.[4]

Does anticipation really matter for outsider restrictions? Take real estate policies as examples. An *unanticipated* foreign restriction imposed on existing housing stocks fits sequence (I) because housing stocks are already built before the unanticipated policy.[5] While such policies are observed across certain cities with red hot real estate markets, our study does not shed light on them.

In reality, developers and their buyers have every incentive to find out the possible policies they will face that affect their future selling. Suppose they *anticipate* a restriction; the way house developers build their housing stocks must reflect their anticipation. Modeling

[4]One study is Herguera, Kujal, and Petrakis (2000). Their question is put in a slightly different context. Rather than focusing on outsider-buyers, the outsider is a foreign seller who competes with an insider: the domestic seller. Without restriction, they both sell a vertically-differentiated good to domestic buyers. They compete by simultaneously setting quality in the first stage, then they simultaneously choose prices in the second stage. Herguera, Kujal, and Petrakis (2000) find that restricting outsiders (i.e., disallowing the foreign seller to sell to domestic buyers) affects the equilibrium quality and price chosen by firms. The combinations of price and quality available to domestic buyers are thus affected accordingly.

[5]For example, New Zealand's Overseas Investment Amendment Act 2018 bans some non-resident foreigners from buying existing houses. However, one may still argue that even existing houses involve "production" after they are built because owners continuously decide how much to invest in maintaining their houses. Therefore, applying our sequence in policies such as Overseas Investment Amendment Act 2018 on existing houses is not entirely inappropriate.

outsider restrictions using sequence (II) becomes applicable.

One such *anticipated* restriction is when it is a stipulated provision of the land sale. For instance, in Hong Kong a 2012 policy called "Hong Kong Property for Hong Kong People (HKPHKP)" stipulates in the land sale that the apartments built on two plots of land can only be sold to Hong Kong permanent residents in the next 30 years.[6] The worry of being legally challenged is probably a reason why a responsible official repeatedly reminded the general public that the outsider restriction applies only to the two plots of vacant land but not to existing housing stocks.[7] Developers produce housing stocks differently if no restriction is imposed, and their bidding prices can also differ.[8]

In a rather different context where retail space is a scarce resource, those who operate cafeterias in government buildings or schools must know whether or not they can serve outsiders. The way they run their food business likely adjusts accordingly.

Anecdotal evidence suggests that policies that restrict outsiders do not always work because the affected parties find ways to get around the restrictions. For instance, real estate brokers in Vancouver have advertised various obscure ways to evade a Canadian foreign buyer tax that requires foreign buyers of residential properties to pay 15% and later 20% extra tax on top of their transacted prices.[9] An investigation of the Ombudsman of the Hong Kong

[6]Similarly, Section 5.1 describes another Singaporean policy in which the government introduces executive condominiums (EC) and restricts initial sales to Singaporeans, and then restricts resales to foreigners until after the owners have lived there for 10 years. EC developers know they are building them. Therefore, the restrictions are anticipated.

[7]The then Hong Kong Secretary for Development, Mr. Paul Chan, reminded that "The measure is only applicable to flats constructed on residential sites subject to the HKPHKP pilot scheme but does not apply to existing housing stocks in the market or new housing supplies not subject to the pilot scheme." Source from https://www.info.gov.hk/gia/general/201406/11/P201406110675.htm

[8]Low bidding prices were expected, but the then Hong Kong Secretary for Development, Mr. Paul Chan, refused to make such a prediction. Instead, he stated that it "aims at giving priority to Hong Kong Permanent Residents to make use of our scarce residential land resources when a tight demand–supply situation occurs in the property market." Source from https://www.info.gov.hk/gia/general/201406/11/P201406110675.htm.

[9]The tax comes from Bill 28, *Miscellaneous Statues (Housing Priority Initiatives) Amendment Act*, 2016, 27 that was introduced in the B. C. Legislature on July 25, 2016. The rate increased from 15% to 20% on February 20, 2018. A Notice of Civil Claim filed to the Supreme Court of British Columbia dated September 18, 2017 shows the plaintiff, a non-Canadian, evaded the tax with the help of a defendant, a Canadian who assisted the plaintiff to buy a Vancouver property by agreeing to put his name on the title. Retrieved from https://assets.documentcloud.org/documents/4058607/Wu-v-Chu.pdf. The Globe and Mail reported that brokers and agents have advertised to prospective foreign buyers of ways to evade the tax, including setting up partnerships and buying through complicated contracting between Canadians and non-Canadians through an exclusive rent-to-own program. Source: "Skirting around B.C.'s tax on foreign buyers," by Xiao Xu, *The Globe and Mail*, URL: https://www.theglobeandmail.com/real-estate/bcs-foreign-buyertax-has-some-buyers-looking-for-aloophole/article36520663/.

Government reveals that factory canteens almost never restrict outsiders even though their license requires them to do so.[10] These cases raise the question of how costly it is to enforce policies that restrict outsiders. We seek an economic explanation of why the affected parties have incentives to undermine these policies.

We deliberately build the simplest possible model in which a producer would endogenously respond to an anticipated outsider restriction. The producer's potential customers consist of both insiders and outsiders. After knowing the restrictions faced by outsiders, the producer responds by choosing not only a selling price but also a level of product quality. The customers then decide whether to make a purchase. The outsider restriction, if any, is assumed to be fully enforceable. To address the concern that insiders can be "crowded out" by outsiders, we allow buying customers to impose negative externalities on one another.[11] We refer to such an effect as "crowding out."[12] The model helps identify the winners and losers of a policy to restrict outsiders, allowing us to explain why the affected parties find ways to get around outsider restrictions.

Findings. We find that restricting outsiders, if it works, does not always lower the price. Specifically, if customers do not crowd out one another, then restricting outsiders changes neither the price nor the quality; if they do crowd out one another, then restricting outsiders makes the producer lower the price and quality. Thus, crowding out is necessary for restricting outsiders to lower the price. When the price goes down, quality goes down as well but not by as much, resulting in a higher quality-per-dollar ratio. In this case, restricting outsiders can hurt insiders who sufficiently care about quality. The discriminatory effect on the different types of insiders makes it incorrect to claim that restricting outsiders always benefits insiders. We

[10]The Hong Kong law Cap. 132X Food Business Regulation restricts factory canteens from serving customers other than factory employees working in the same building. In May 2017, the Ombudsman issued an investigation report showing evidence that factory canteens usually served outsiders. The report states "the personal experiences of the investigation officers of the Office of The Ombudsman (the Office) reveal that factory canteens are patronized by people many times without having been asked whether they are factory employees." The report can be retrieved from https://ofomb.ombudsman.hk/abc/files/DI405_ES_E-11_5_2017.pdf. A similar investigation was performed in the U.S. to check whether cafeterias located inside Federal government buildings served outsiders, too. Section 5.2 offers further details.

[11]In the housing context, residents prefer less crowded places to live. In the cafeteria context, insiders may prefer less crowded cafeterias to enjoy food and short queues.

[12]The term "crowding out" has a specific meaning in macroeconomics. Throughout this paper, we use "crowding out effect" to refer to the situation that customers do not like the presence of other customers (such as customers do not like crowded places to live or crowded cafeterias).

derive conditions under which restricting outsiders decreases, rather than increases, insiders' consumer surplus. The model predicts that producers and outsiders always suffer from restricting outsiders; they therefore have incentives to find ways to get around these restrictions.

The public should be cautious when politicians attempt to please them by restricting outsiders. Depending on their taste and preferences, these policies can make them worse off. Sometimes, these policies do not work at all unless enough taxpayers' money funds the enforcement costs. Even when a policy works under reasonably low enforcement costs, evaluating the policy by checking its effects on price alone is inadequate.

2. Relation to the literature on policy anticipation

Beyond policies concerning real estate, studies have examined how anticipation would change the effects of public policies. Most profoundly stated in the Lucas critique (Lucas, 1976), a policy's effect must take into account the fact that actors would have rationally expected the possible policies that would affect them. Kydland and Prescott (1977) later formalize the insight in discussing the relative merits between rules and discretion in policy-making.

A policy's dependence on the market's expectation or anticipation is perhaps best illustrated by the monetary policy. It is by now a textbook example that any anticipated monetary policy a central bank makes it would not move the market; only unanticipated shocks would. Scholarly research on monetary policies, such as Taylor (1975, 1993), has since placed anticipation at a center in formulating monetary rules (see Holland (1985) for a non-technical review of the literature).

In a rather different context involving risk compensation, a literature pioneered by Peltzman (1975) suggest that individuals' reactions to a policy could negate the very purpose of that policy. The concept applies much broader than mandatory seat-belt rule that Peltzman (1975) studies. For instance, it applies to financial regulations as argued by Peltzman (1970). Financial institutions may anticipate that the treasury will likely bail them out in difficult times, they may behave less responsibly. Ng (2014) argues that bailout also gives incentives for non-financial firms to re-organize their production. The offsetting and undesirable behaviors

induced by policies come from anticipation.

This study is a particular application of the above two much bigger concepts in economic policies on policies related to real estate. While policymakers may want to enhance the well-being of insiders through restricting outsiders, the private developers may react to it if the restriction is anticipated and possibly negate the very purpose of that policy. One main message is that formulating policies concerning real estate would benefit much by asking if the policies are anticipated or unanticipated.

3. Model

A group of customers of mass 1 are either "insiders" (with mass $\alpha \in (0, 1)$) or "outsiders" (with mass $1 - \alpha$). Customers differ in their taste for quality denoted by θ, which is assumed to follow a uniform distribution: $\theta \sim U[0, 1]$.

Let m be the total mass of customers who are allowed to buy:

$$m = \begin{cases} \alpha < 1 & \text{if outsiders are restricted,} \\ \alpha + (1 - \alpha) = 1 & \text{if outsiders are unrestricted.} \end{cases} \tag{1}$$

Knowing whether outsiders are restricted, a producer picks a pair of price and quality (p, s) to maximize profit:

$$\max_{p,s} \ \pi = [p - c(s)]q - w, \tag{2}$$

where w is the "rent" that must be paid to someone (e.g., the government for a plot of land, or a landlord for a retail premise) to use scarce resources as inputs, q is the quantity demanded, and $c(s)$ is the per-unit cost that depends on quality s, which increases in quality at an increasing rate (i.e., $c'(s) > 0$, $c''(s) > 0$).

Observing the pair of price and quality, the unrestricted customers decide whether or not to buy a unit. Customer i's utility depends on her quality taste (θ_i), price (p), quality (s), and

the mass of buying customers (q) as follows:

$$u_i = \begin{cases} \theta_i s - p - tq & \text{if she buys a unit,} \\ 0 & \text{otherwise,} \end{cases} \tag{3}$$

where t denotes the strength of the crowding out effect: that customers create negative externalities among one another. Its strength takes one of two values:

$$t = \begin{cases} 0 & \text{without crowding out,} \\ \tau > 0 & \text{with crowding out.} \end{cases} \tag{4}$$

We compare the equilibrium pairs of price and quality when outsiders are restricted/unrestricted ($m \in \{\alpha, 1\}$) and with/without crowding out ($t \in \{\tau, 0\}$).

3.1 Remarks on model assumptions

3.1.1 Crowding out effect

The crowding out effect in the utility function represents an indirect way of modeling scarce resources, such as land, retail space, or some limited amount of productive inputs. While the functional form assumes a linear effect, non-linearity is possible: having a few other customers around is nice but too many becomes unpleasant. The linearity assumption makes the math tractable. We have nothing to say about whether the crowding out effect should be linear or not, which is ultimately an empirical question.

An implication of the crowding out effect is that it makes the mere presence of outsiders unpleasant to insiders. Therefore, our setting naturally favors restricting outsiders. Stripping away crowding out in the model takes away such a natural undesirability of restricting outsiders. But it also makes the model more trivial.

3.1.2 Taste distributions of consumers

Insiders and outsiders can follow different taste distributions.[13] We assume an equal taste distribution for two reasons. First, doing so ensures the results are *not* driven by assuming ad hoc differences between insiders and outsiders. Second, as a general resource allocation rule, the derived products from any scarce resources should go to those who value them the most. Restricting outsiders violates this rule but trivializes the math problem. Assuming an equal distribution among the two groups and introducing crowding out effect make it non-trivial to point out the right resource allocation.

It should be noted that uniform distribution is assumed to make the math more tractable. To a certain degree, the results presented in the following sections will stand if we perturbate the distribution in ways that do not change the marginal customers with and without outsider restrictions.[14]

3.1.3 Cost function of the producer

Given a quality, we assume a constant per-unit cost independent of production scale q. In reality, a cost curve can exhibit various shapes over quantity, such as U-shape. Changing the quality level also likely changes the shape. How quality and shape interact to affect cost depends on the product and the underlying technologies. Our assumption allows us to side-step the technical complications in dealing with such interactions. Thus, we can focus on the effect of restricting outsiders on the price and quality choices of the producer with and without the crowding out effect. Imagine a large market mechanically reduces the unit cost. This force alone, which

[13] Take real estate restrictions as an example. The kinds of real estate foreigners desire may differ from those of their domestic counterparts. One reason is that the kinds of renters they can find may differ from those of the locals. In *Li v. British Columbia, 2019 BCSC 1819*, mathematician Dr. Jens von Bergmann testified that foreign buyers are mainly concentrated on the high-end of the Vancouver real estate market. In contrast to the notion that foreigners are likely speculators, Dr. Von Bergmann testified that locals are more frequently involved in "flipping" houses than foreigners.

[14] We will derive marginal customers in section 3.2.1 with and without outsider restrictions. They are indifferent between buying and not buying and are characterized by $theta$ that must fall between 0 and 1. Suppose under the assumption of uniform distribution of taste, the marginal customers with and without outsider restrictions are between $\underline{\theta}$ and $\widetilde{\theta}$, where $0 < \underline{\theta} < \widetilde{\theta} < 1$. Suppose some probability density from a range of θ below $\underline{\theta}$ is reshuffled to another range of θ below $\underline{\theta}$, such a reshuffling upsets the uniform distribution assumption but would not alter the determination of the marginal customers. Our results remain robust to similar kinds of such reshuffling. It suggests that uniform distribution is not necessary for our results to hold. More general distributions, however, may not guarantee analytical solutions and may require numerical solutions instead.

sometimes exists in reality, can trivialize the analysis, making the model favor unrestricting outsiders.

From the modeling perspective, it ensures all our results are not driven by economies and dis-economies of scale. Adding the interactions back to the model may cost us the analytical solutions, although numerical solutions can still be easily obtained.

3.1.4 Enforcement of outsider restrictions

Outsider restrictions are assumed to be enforced without costs. However, in reality, enforcing any restrictions is costly, which can be a justification against restricting outsiders. Since our model does not include any enforcement costs, any analytical arguments for or against restricting outsiders are not due to enforcement costs.

One way to add enforcement cost is to introduce a government and impose the budget-balancing constraint that those insiders who eventually buy would equally share the enforcement cost. It is intuitive to think of a situation where the enforcement cost is huge, making it a huge burden for any insider-buyer such that no insider would prefer restricting outsiders.

3.1.5 Price and non-price discrimination by the producer

To avoid distraction, we assume that the producer does not engage in any forms of price and non-price discrimination. In reality, producers price discriminate in various ways (Armstrong, 1999; Armstrong and Vickers, 2001). For instance, presenting student (staff) cards assures discounts at college (workplace) cafeterias. Producers also sometimes engage in non-price discrimination (Ming and Ng, 2020), or prefer selling high quality varieties to foreign buyers due to lump-sum shipping costs, as predicated in the infamous Allen-Alchian theorem (Eid, Ng, and Chong, 2013).

Chao and Yu (2015) has a model within which the insiders are being subsidized by the tax revenue from taxing outsider-buyers. One can easily imagine that when the tax rate to outsider-buyers is extremely high, then no outsider will be willing to buy, making our case a special case nested within such a more general model.

3.1.6 Competition

There is no competition among producers. In reality, competition plays a significant role. Its absence allows us to focus on how a given producer reacts to a policy that restricts outsiders. Introducing competition requires us to assume a particular kind of competition among different producers. Moreover, introducing competition necessitates the quest for understanding how different types of firms self-select themselves into joining the competition. For instance, with or without restricting foreigners likely attracts different kinds of real estate developers.[15] These factors are all important policy concerns, but they are not modeled in this paper.

One complication of having multiple producers competing for a project is that we have to specify a particular government procurement mechanism or auction mechanism. With and without outsider restrictions, it is likely that the optimal mechanism would differ, leading to different types of firms attracted and ultimately winning the project.

3.2 Equilibrium analysis

3.2.1 Optimal choice of the customers

Given the pair of price and quality (p, s) and whether outsiders are restricted or unrestricted ($m = \alpha$ indicates the case when outsiders are restricted and $m = 1$ indicates the case when outsiders are unrestricted), the "marginal" customer type, $\overline{\theta}_m$, must satisfy $\overline{\theta}_m s - p - tq_m = 0$, where $q_m = \int_{\overline{\theta}_m}^{1} \mathrm{d}\theta_i = m(1 - \overline{\theta}_m)$ is the quantity demanded. It is straightforward to show that:

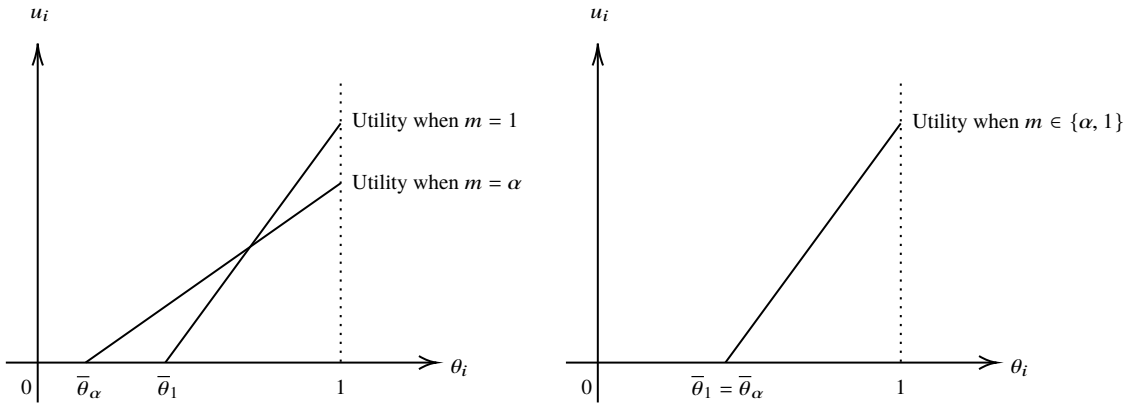
$$\overline{\theta}_m = \frac{p + mt}{s + mt}, \tag{5}$$

$$q_m = \frac{m(s - p)}{s + mt}. \tag{6}$$

Figure 1 visualizes insiders' utility in different scenarios. (a) and (b) respectively show the cases with crowding out ($t = \tau > 0$) and without crowding out ($t = 0$). In each case, insiders with types $\theta_i \in [\overline{\theta}_m, 1]$ buy a unit while those with types $\theta_i \in [0, \overline{\theta}_m)$ do not buy.

[15] In another context, the kinds of restaurateurs who bid for college cafeterias restricted from serving customers other than students and teachers likely differ from the kinds of restaurateurs who run regular restaurants facing no customer restrictions.

Figure 1: Insiders' utility when outsiders are restricted ($m = \alpha$) and when outsiders are unrestricted ($m = 1$)



Note: (a) shows the situation with crowding out ($t = \tau > 0$) and (b) shows the situation without crowding out ($t = 0$). The type of the marginal insider is $\overline{\theta}_m = \frac{p+mt}{s+mt}$ where $m = \alpha$ indicates the case when outsiders are restricted and $m = 1$ indicates the case when outsiders are not restricted. Insiders with types $\theta_i \in [\overline{\theta}_m, 1]$ buy a unit while those with types $\theta_i \in [0, \overline{\theta}_m)$ do not buy.

As Figure 1 shows, given a pair of price and quality (p, s) and with crowding out ($t = \tau > 0$), we have $\overline{\theta}_\alpha < \overline{\theta}_1$. To see this, $\overline{\theta}_1 - \overline{\theta}_\alpha = \frac{p+t}{s+t} - \frac{p+\alpha t}{s+\alpha t} = \frac{t(1-\alpha)(s-p)}{(s+t)(s+\alpha t}$. The utility function in (3) suggests that demand is non-negative when $s > p$ so that $\overline{\theta}_1 - \overline{\theta}_\alpha > 0$. Outsiders are only relevant when they are unrestricted (i.e., when $m = 1$). Their buying decision is identical to that of the insiders; those outsiders with types $\theta_i \in [\overline{\theta}_1, 1]$ buy a unit while those with types $\theta_i \in [0, \overline{\theta}_1)$ do not buy.

3.2.2 Optimal choice of the producer

The producer's profit maximization problem is:

$$\max_{p,s} \ \pi = [p - c(s)]\frac{m(s-p)}{s+mt} - w. \tag{7}$$

Lemma 1 characterizes the producer's optimal choices, denoted as (p^*, s^*). The Appendix shows all the proofs.

Lemma 1 *The producer's optimal choice* (p^*, s^*) *satisfies:*

$$p^* = \frac{s^* + c(s^*)}{2}, \tag{8}$$

$$c'(s^*) = \frac{p^* + mt}{s^* + mt}. \tag{9}$$

Lemma 1 allows us to see that quality is the fundamental choice of the producer. The optimal quality depends on the function of the per-unit cost ($c(s)$), whether outsiders are restricted (m), and the strength of the crowding out effect (t). Lemma 1 shows that for m to affect the optimal quality, t must be non-zero. In words, crowding out is essential for outsider restrictions to matter.

4. The effects of restricting outsiders

From the producer's profit maximization problem in (7), we can see $m = 1$ as mathematically equivalent to "unrestricting outsiders," while $m = \alpha < 1$ as "restricting outsiders." Therefore, parameter m is a handy scaling variable to examine the effects of restricting outsiders. To simplify the notations, we let $p^*_\alpha \equiv p^*(m = \alpha), p^*_1 \equiv p^*(m = 1)$, and $s^*_\alpha \equiv s^*(m = \alpha), s^*_1 \equiv s^*(m = 1)$.

4.1 On price and quality

To examine the effects of restricting outsiders on price and quality (i.e., whether $p^*_\alpha \gtrless p^*_1$ and $s^*_\alpha \gtrless s^*_1$), we check the signs of $\frac{\partial p^*}{\partial m}$ and $\frac{\partial s^*}{\partial m}$. With crowding out, these two partial derivatives are negative, allowing us to write down the following proposition.

Proposition 1 *Under uniform distribution of taste, without crowding out (i.e.,* $t = 0$*), restricting outsiders changes neither the price nor the quality. With crowding out (i.e.,* $t = \tau > 0$*), restricting outsiders lowers the price and the quality.*

Restricting outsiders does not lower the price unless a crowding out effect exists. The reason is that the producer's equilibrium price is ultimately tied to the product quality it offers

as in Lemma 1. The pricing decision is thus driven by the incentive of the producer to offer product quality.

One may relate Proposition 1 to the following intuition: to the extent that offering good quality brings little extra business when outsiders are restricted, the producer does not have as much incentive to offer quality than when outsiders are unrestricted. This intuition is not quite right absent a crowding out effect. The producer's incentive to offer quality, as in Spence (1975), is driven by marginal customers' taste for quality. Restricting outsiders means fewer potential customers when other things are held constant.

From a theoretical point of view, without crowding out, restricting outsiders does not change the marginal customer type because the mass of buying customers does not affect customer utility. Therefore, the optimal quality and pricing decisions of producers cannot be affected.[16] With crowding out, however, restricting outsiders changes the marginal customer type because the mass of buying customers that determines customer utility changes with the restriction. Consequently, the optimal pricing and quality decisions of the producer can be affected. Restricting outsiders mechanically reduces the number of buying customers, making the market "less crowded" and increases insiders' utility. This condition also makes the marginal customer is less sensitive to quality (i.e., $\overline{\theta}$ is smaller), reducing the incentive of the producer to offer quality. Therefore, the optimal quality and price decrease until another new equilibrium is reached. The comparative statics that provide Proposition 1 suggest that in the new equilibrium when $m = \alpha$, the equilibrium pair of (p, s) is lower than the original pair when $m = 1$.

Policy implication 1. If policymakers pitch a restriction of outsiders as a means to lower the price, the general public should ask for a proof of either a non-trivial crowding out effect, or a significant difference in the taste and preference between insiders and outsiders. Otherwise, restricting outsiders does *not* decrease the price. Even if doing so reduces the price, the general public should expect lower quality as a possible consequence. Thus, evaluating a policy of restricting outsiders only by examining its effect on price is inadequate.

[16] These can be seen in (5) and (6) when $t = 0$.

The intuition of the role of crowding out. A situation without crowding out resembles a case without a scale effect. Introducing crowding out brings back a scale effect in a sense that the larger the mass of buyers, the lower the utility enjoyed by each buyers for the same product. Since fixing a quality level, the unit production cost does not depend on the scale of production, without such a scale effect, restricting outsiders or not does not affect who the marginal customers are; thus, the producer's equilibrium choices of price and quality do not change. A scale effect brought by crowding out changes that. Fixing the marginal customer, restricting outsiders mechanically raises utility enjoyed by each insider-buyer who are buying when outsiders are not unrestricted. More insiders become buyers as a result, necessarily making the marginal customer having a weaker quality preference than that in the case of unrestricting outsiders. Quality is thus decreased to accommodate these marginal customers. Price also adjusts downwards as it follows the reduction of quality.

4.2 On quality-per-dollar ratio

Without crowding out, neither price nor quality changes; therefore, the quality-per-dollar ratio stays constant. With crowding out, how does restricting outsiders change the ratio? Does restricting outsiders decrease quality more than it does on price? The following proposition states that the opposite is true.

Proposition 2 *Under uniform distribution of taste, without crowding out (i.e., $t = 0$), restricting outsiders does not change the quality per-dollar ratio. With crowding out (i.e., $t = \tau > 0$), restricting outsiders increases the quality-per dollar ratio.*

The notion that restricting outsiders raises the "bang-for-the-buck" may sound great, but it is not the case for everyone. Typical vertical differentiation models with a pair of high- and low-quality varieties require the low-quality variety to offer a higher quality-per-dollar ratio for its equilibrium quantity demanded to be non-zero (Tirole, 1988).[17] When it is so, those who have a strong taste for quality buy the high-quality variety, whereas those who have a weak taste for quality go for the low-quality variety. The crowding out effect is absent in these

[17]The model of Eid, Ng, and Chong (2013) has also obtained this result in which horse-buyers who value quality more buys high-quality horses, whereas those who value quality less buys low-quality horses.

models. Suppose that restricting outsiders lowers the quality but raises the quality-per-dollar ratio. Those who desire quality will stil prefer the high-quality variety if it is available; but the high-quality variety is no longer available. Restricting outsiders hurts them. Those who do not have as strong a desire for quality benefit from the availability of a low-quality variety; they are the ones who benefit from restricting outsiders. Adding crowding out effect changes the exact cut-off of the "winners" and "losers" groups but not the general result. We therefore expect restricting outsiders, if it lowers the price, to exert a discriminatory impact on different types of insiders.

Policy implication 2. Restricting outsiders can exert a discriminatory impact on different types of insiders because such a restriction can raise the quality-per-dollar ratio. Certain insiders can benefit, others can get hurt as a result; the latter are likely those insiders who have a sufficiently strong taste for quality. Any insider facing policies of restricting outsiders must question whether these policies benefit herself.

4.3 On producer's profit

Restricting outsiders weakens the demands of the producer; its profit gross of rent must go down. Of course, the rent it pays may differ in different policy regimes.[18] The following proposition summarizes the result.

Proposition 3 *Under uniform distribution of taste and with or without crowding out, restricting outsiders always lowers the profit of the producer.*

Proposition 3 gives policy implications on compliance and enforcement costs.

Policy implication 3. Strictly following policies of restricting outsiders is never incentive-compatible for the producer. Therefore, the associated enforcement/monitoring costs can be substantial to make such policies work.

[18] We do not know how the rent varies without specifying the objective function of the owner of scarce inputs. For instance, the government who owns a land may not have a profit-maximizing objective when conceiving whether or not to allow foreigners to buy the apartments built on it. Some cafeterias in U.S. government buildings are contracted out by General Services Administration; its objectives are beyond profit-maximizing (United States General Accounting Office, 1978).

For real estates where transactions usually involve lawyers and formal legal procedures, enforcement costs can be low but unlikely zero.[19] For college cafeterias inside campuses that allow outsiders in, enforcement costs are likely huge. An empirical implication is that any restrictions of outsiders must meet with low compliance rates unless under heavy monitoring effort.

4.4 On the welfare of customers

4.4.1 Welfare of individual customers

Outsiders are worse off when they are excluded from the market. Meanwhile, the discriminatory impact on the different types of insiders implied by Proposition 2 makes the welfare effects on insiders less straightforward. Specifically, in equilibrium, a buying insider i's utility when $m \in \{\alpha, 1\}$ is:

$$u_i = \theta_i s_m^* - p_m^* - t\frac{m(s_m^* - p_m^*)}{s_m^* + mt} = \theta_i s_m^* - \frac{s_m^*(p_m^* + mt)}{s_m^* + mt} = s_m^*[\theta_i - c'(s_m^*)]. \tag{10}$$

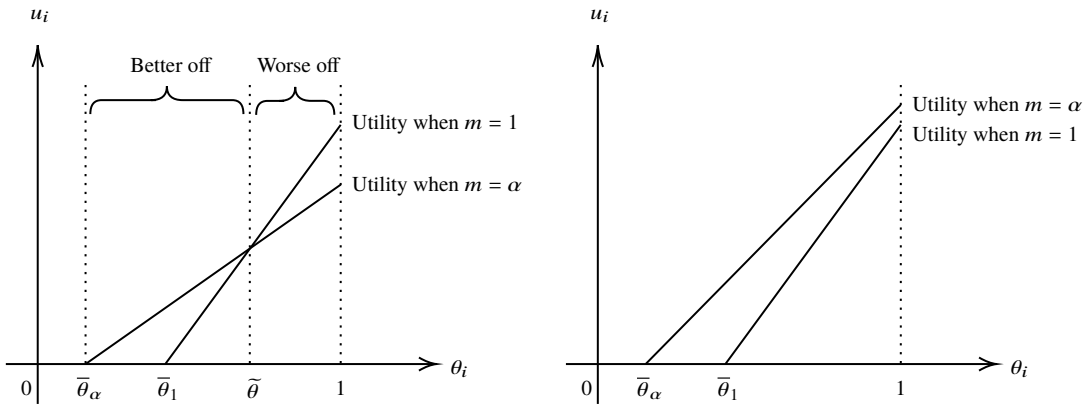
By Proposition 1, without crowding out, restricting outsiders does not affect price and quality. Therefore, restricting outsiders makes insiders neither better off nor worse off.

With crowding out, do individual insiders benefit from restricting outsiders? In this case, By Proposition 1, we have $s_\alpha^* < s_1^*$. Figure 2 visualizes the impact.[20] The utility function of insiders has a slope of s_m^* and an x-intercept of $c'(s_m^*)$ (i.e., the marginal customer type is $\overline{\theta}_m = c'(s_m^*)$). When $m = 1$, the utility function is steeper and the x-intercept is larger, relative to the case when $m = \alpha$. There are two possibilities: In Figure 2(a), the utility function when $m = \alpha$ is above that when $m = 1$ for $\theta_i \in [\overline{\theta}_\alpha, \widetilde{\theta})$, suggesting that restricting outsiders makes these insiders better off. The opposite happens for insiders with quality taste between $\theta_i \in (\widetilde{\theta}, 1]$; restricting outsiders makes these insiders worse off. In Figure 2(b), the utility function when

[19] Note that if domestic legal entities are unrestricted from buying real estates, then developers may have an incentive to help their foreign clients (likely through a law firm) set up domestic legal entities to get around any restrictions on foreigners or foreign entities. Other legitimate reasons exist for foreigners to hold overseas real estate using legal entities, such as limiting their personal liabilities and protecting their overseas assets from their own personal creditors. These other legitimate reasons make it difficult for policy enforcers to explain why certain people help their clients acquire real estate using legal entities.

[20] Note that since $c'(s) > 0$ by assumption, we have $c'(s_\alpha^*) < c'(s_1^*)$ so that in equilibrium, $\overline{\theta}_\alpha < \overline{\theta}_1$.

Figure 2: Restricting outsiders in the presence of crowding out: utility of insiders



Note: In (a), insiders with $\theta_i \in [\overline{\theta}_\alpha, \widetilde{\theta})$ are better off and those with $\theta_i \in (\widetilde{\theta}, 1]$ are worse off when $m = \alpha$. In (b), insiders with $\theta_i \in [\overline{\theta}_\alpha, 1]$ are better off when $m = \alpha$. In both cases, insiders with $\theta_i \in [0, \overline{\theta}_\alpha)$ are unaffected because they consume in neither regime.

$m = \alpha$ is strictly below that when $m = 1$; restricting outsiders makes every buying insider better off.[21] The following proposition sums up the results.

Proposition 4 *Under uniform distribution of taste, without crowding out (i.e., $t = 0$), restricting outsiders neither benefits nor hurts insiders. With crowding out (i.e., $t = \tau > 0$), restricting outsiders can benefit all insiders or can benefit some but hurt other insiders.*

4.4.2 Total welfare

Next, we examine the total welfare of customers by computing consumer surplus in regime $m \in \{\alpha, 1\}$ (denoted as CS_m). Given that customers buy when their types are above the threshold, we have:

$$CS_m = \begin{cases} \underbrace{\alpha \int_{\overline{\theta}_\alpha}^{1} u_i \mathrm{d}\theta_i}_{\text{Insiders' CS}} & \text{if outsiders are restricted } (m = \alpha), \\ \underbrace{\alpha \int_{\overline{\theta}_1}^{1} u_i \mathrm{d}\theta_i}_{\text{Insiders' CS}} + \underbrace{(1-\alpha) \int_{\overline{\theta}_1}^{1} u_i \mathrm{d}\theta_i}_{\text{Outsiders' CS}} & \text{if outsiders are unrestricted } (m = 1). \end{cases} \tag{11}$$

Obviously, restricting outsiders hurts outsiders with or without crowding out; they have

[21] In both cases, insiders with $\theta_i \in [0, \overline{\theta}_\alpha)$ are unaffected because they never consume.

an incentive to protest or sue against a restriction. This idea is consistent with the fact that in *Li v. British Columbia, 2019 BCSC 1819*, the foreign buyer tax was legally challenged by the plaintiff, a non-Canadian who was subject to the tax when buying a Vancouver property.

However, whether restricting outsiders increases the consumer surplus of insiders is ambiguous. Proposition 4 states that restricting outsiders can make some insiders better off and some other insiders worse off in the presence of crowding out; thus, overall, we cannot confirm whether $\int_{\theta_\alpha}^{1} u_i \mathrm{d}\theta_i \gtrless \int_{\theta_1}^{1} u_i \mathrm{d}\theta_i$. We sum up our discussion in the following proposition.

Proposition 5 *Under uniform distribution of taste, without crowding out (i.e., $t = 0$), restricting outsiders always decreases the consumer surplus of outsiders but does not change the consumer surplus of insiders. Overall, restricting outsiders decreases the total consumer surplus. With crowding out (i.e., $t = \tau > 0$), restricting outsiders always decreases the consumer surplus of outsiders and can increase or decrease the consumer surplus of insiders. Overall, restricting outsiders can increase or decrease the total consumer surplus.*

Policy implication 4. There is little reason for a particular insider to expect that policymakers can "protect" her by restricting outsiders. Outsiders can have an incentive to employ ways to get around the restrictions. They may also legally challenge any such policies.

5. Relevance to real world policies

5.1 Real estate

Policies to restrict outsiders from buying real estate are commonly perceived as means to improve housing affordability. What does our model imply and *not* imply in this context?

Our model conceptualizes two ways to sell a plot of land. First, sell it to a developer who can then sell the apartments built on such a land to anyone. Second, sell it to the *same* developer who can only sell the apartments to insiders but not outsiders. Some think the second way lowers the apartment price and makes insiders better able to afford housing than the first way. Our model calls for a second thought.

Two real world policies are relevant. First, in Hong Kong the 2012 policy called "Hong

Kong Property for Hong Kong People (HKPHKP)" stipulates in the land sale that the apartments built on it can only be sold to Hong Kong permanent residents in the next 30 years. Unlike other similar housing policies that also restrict outsiders, buyers under the HKPHKP policy face neither an income/wealth cap nor any other restrictions. Second, Singapore's executive condominiums (ECs) are subject to certain transferability restrictions in the first 10 years. Specifically, buyers must hold on to their properties for at least five years. After five years, they can sell their condominium to any other eligible Singaporeans but not outsiders. After 10 years, they can sell it to anyone.

Under these two policies, private developers have anticipated outsider restrictions before they build. It is also unlikely for developers and outsiders to get around these restrictions.[22] The population densities of the two cities suggest the crowding out effect is unlikely weak. The two cities have a highly competitive real estate brokerage industry, making it less likely for any renters to be only accessible to local but not foreigner owners.

An ideal empirical test of our model using these two policies requires the following counterfactual: the *same* developers build the apartments on the *same* plots of land *without* restrictions. The model predicts that relative to the counterfactual, the apartments actually built on the land subject to these two policies are of lower price and quality.

5.1.1 Related empirical evidence

Examining ECs in Singapore, Lee and Ooi (2018) offer a set of empirical patterns close to our ideal empirical test by comparing them with private condominiums (PCs). ECs and PCs differ fundamentally in at least two aspects: First, any Singaporeans and outsiders can buy PCs, but only certain Singaporeans are eligible for ECs. Specifically, one must earn less than an income cap to be an eligible buyer.[23] Second, PCs to owners can be either residences or investment vehicles, but ECs are unlikely to be merely investment vehicles because buyers must not own

[22] Singaporeans buying ECs must be screened by the Singaporean government. Source: Singapore Housing and Development Board: https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/new/eligibility/executive-condominiums Statutory declaration is required together with a lawyer's certificate for a Hong Kong permanent resident to buy an apartment on the land covered by HKPHKP. Source: Hong Kong Lands Department: https://www.landsd.gov.hk/en/hkpp/hkpp.htm

[23] Source: Singapore Housing and Development Board: https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/new/eligibility/executive-condominiums

other houses at the same time.[24] Despite these fundamental differences, Lee and Ooi (2018) manage to come up with convincing counterfactuals by using comparable PCs.

Their unit of analysis is a flat. Each EC flat transaction is matched with a comparable transaction by using propensity score matching to pair up the closest counterpart among the nearby (i.e., 2 km radius) PCs (in terms of a set of observable attributes) built in the same year. Their hedonic pricing model and the paired up PCs allow them to quantify the adjusted quality discount of ECs across years: 21% for brand new ECs, and after the lock-up period, the discount is approximately 8% in the sixth year and narrows to approximately 3% after 10 years when outsiders are unrestricted.

The restrictions on transferability explain the discount in the first 10 years. However, it cannot explain the 3% remaining discount when ECs and PCs have neither observable differences nor liquidity and transferability differences after 10 years.[25]

Our model offers one explanation of the remaining discount. In response to outsider restrictions, the private developers of ECs built them at a level of quality lower than they would have chosen had there been no such restrictions. The lower quality takes its toll even after a decade as reflected by a permanent discount relative to comparable PCs.

Substantiating our explanation is difficult as housing quality is inherently multidimensional and difficult to measure. Luckily, their dataset contains a quality measure called the Construction Quality Assessment System (CONQUAS) score, which comes from the Building and Construction Authority, a Singaporean regulatory agency that systematically assesses the quality of building projects since 1989. Consistent with our explanation, the CONQUAS scores of ECs in their sample are significantly lower than those of PCs with or without controlling for the observables.[26]

[24] In finance language, consumption and investment decisions can be separated for PC buyers, but they must be bundled together for EC buyers.

[25] They find that the sub-sample of old ECs have a larger permanent discount of 6% instead of 3% after any transfer restrictions expire.

[26] Following Lee and Ooi (2018), after removing the effects of such characteristics as Development size, Distance to the nearest subway station, Distance to central business district, presence of different amenities (Swimming pool, Barbecue pit, Gym, Mini-mart, Pavillion, Playground, Sauna, Clubhouse, Exercise area, Basketball court, Tennis court, Library, Lounge, and Game room), and year-by-neighborhood fixed-effects, we find using a t-test that the CONQUAS scores for ECs are significantly lower than those for PCs (p-value < 0.01). Appendix B shows further details.

5.1.2 Related anecdotal evidence

Miller, Sklarz, and Real (1988) document that the strengthening Japanese yen against the U.S. dollar and the booming Japanese economy in mid-1980s were followed by an influx of Japanese investors into the Hawaiian housing market. The change resembles the exact opposite of restricting outsiders: Japanese were "restricted" before, but some arguably exogeneous macroeconomic factors "lifted" their restrictions. Prices roared; homeowners and builders, analogous to the producers in our model, endogenously responded by "renovating their homes with the hope of realizing much higher prices. In some instances, entire houses were torn down and replaced by much larger and more luxurious ones, both by existing owners as well as speculative investor/builders who purchased these older and smaller homes." (Miller, Sklarz, and Real 1988, p.41). Crowding out effects are likely present in the incident, as written in a 1989 *Chicago Tribune* article: "many families are crowded two and three to a single-family apartment."[27] The then Mayor of Honolulu Frank Fasi declared on March 21, 1988 the need to restrict foreigners from buying residential homes.[28] Miller, Sklarz, and Real (1988) state that Mr. Fasi's proposal made national headlines all over the U.S., seemingly suggesting that politicians can gain popularity by restricting outsiders.

While their study does not offer direct empirical support due to the absence of a systematic quality measure of Hawaii houses, the observed responses of homeowners and builders are consistent with our model: that some producers respond to the "lifting of outsider restrictions" by adjusting housing quality upward.[29]

5.1.3 Other real estate studies of restricting outsiders

Apart from other legal issues, the economic question of whether the foreign buyer tax makes housing affordable is of paramount importance in *Li v. British Columbia, 2019 BCSC 1819*.

[27]Source: "Hawaii Leaders Resent Vexing Problems Caused by Japanese Land," by Paul Nussbaum, *Chicago Tribune*, October 15, 1989, URL: https://www.chicagotribune.com/news/ct-xpm-1989-10-15-8901220466-story.html.

[28]Source: "Curb Sought in Hawaii On Foreign Investment," *The New York Times*, March 24, 1988. The then governor of Hawaii Democrat John Waihee, however, did not take Republican Frank Fasi's advice.

[29]One may also argue that in Hawaii back in the mid-1980s, a typical Japanese investor could be substantially different from a typical local home buyer. Therefore, the assumption of equal distribution in our model between outsiders and insiders may be inapplicable.

Several expert witnesses are solicited to shed light on it. Our model cannot address the question of whether restricting outsiders reduces housing price in general because existing housing stocks likely dominate a housing market.

Somerville, Wang, and Yang (2020) offer a careful study using within-city variations of purchase restrictions over-time across four major Chinese cities. Their difference-in-differences is extremely credible because purchase restrictions are difficult to get around and houses within a city across different districts are comparable. Purchase restrictions are harsher for non-local than local residents, thereby restricting outsiders to a certain degree. Focusing on newly built houses, purchase restrictions reduce transaction volume, but prices do not seem to be significantly affected. We cannot tell if developers anticipated these restrictions beforehand. The complicated interactions between newly built and existing housing stocks make it difficult for our model to fit in their context.

Benson et al. (1997, 1999) study the effects of the exchange rate fluctuations between the Canadian and the U.S. dollars from 1984 to 1994 on the housing prices of Point Roberts and Bellingham in Washington, two districts adjacent to Vancouver where a substantial fraction of properties was bought and sold by Canadians. During these periods when the Canadian dollar significantly appreciated (depreciated), the general housing prices in the two regions went up (down).

Focusing beyond just a local housing market, Sá, Towbin, and Wieladek (2014), Sá and Wieladek (2015), and Sá (2016) identify a causal positive impact of capital inflows in OECD countries, the U.K., and the U.S. on the housing price indices there by using various foreign shocks as exogenous instruments. These results are consistent with the predictions of Chao and Yu (2015).

These interesting pieces of empirical evidence are consistent with the view reached by Justice Gregory T. W. Bowden in *Li v. British Columbia, 2019 BCSC 1819* that restricting outsiders helps lower housing prices. However, our model neither contradicts these pieces of evidence nor shed light on them.

5.1.4 The role of an anticipation of an outsider restriction on general housing price

Our model is relevant to a subset of the general housing market where either the developer or the owner have more room to respond to their own policy anticipation. An empirical implication would be that when more regulations are imposed on a housing market, for instance, permits are required for any renovations, then outsider restrictions, although anticipated, would not induce the kinds of responses our model predicts. We would more likely to see outsider restrictions being more effective in curbing the rising property prices. On the other hand, a housing market with less regulations will respond more quickly to any policy anticipation.

The empirical implication is that outsider restrictions become more effective at lowering the housing price in those housing markets with less regulations because developers and house owners would not be able to react as much to their policy anticipation. As far as we read, we are not aware of any such empirical tests yet.

5.2 Cafeteria in various establishments

Eating at school/workplace cafeterias is a routine for many. Lousy food, staff attitude, inflexible opening hours, and long queue are the quality concerns of some people. These cafeterias are run by private individuals/companies who know whether they can serve outsiders; thus, outsider restrictions, if any, are fully anticipated. To the extent that they maximize profit, our model gives a plausible explanation for these quality concerns. The model also explains why certain cafeterias do not restrict outsiders even if they should.

5.2.1 Quality concerns

Quality at school/workplace cafeterias is a huge topic. The economic literature investigates how doing a little nudging in these cafeterias makes people eat healthily.[30] The health policy literature examines how various interventions can improve workers/students' nutrition.[31] The media is also interested in workplace cafeterias, especially those in Federal buildings, and has

[30] See, for instance, Thaler, Sustein, and Balz (2013), Dayan, Bar-Hillel et al. (2011), and Rozin et al. (2011).
[31] See, for instance, Engbers et al. (2006) and Steenhuis et al. (2004).

once declared the food at the U.S. Supreme Court "unconstitutional."[32] However, these studies do not place further attention to cafeteria operators' incentives to implement necessary changes, the idea that our model focuses on.

A feature of many workplace/school cafeterias is that they are not supposed to serve outsiders. Our model cannot tell whether restricting outsiders is optimal because many other reasons (such as security) explain why restricting outsiders is necessary. Such reasons are outside of the scope of our model, which suggests that if quality is not as satisfactory in these cafeterias, then one reason can be their outsider restrictions coupled with the tendency for customers to feel less enjoyable in crowded cafeterias. Neither one alone can lead to low quality. In exchange, insiders usually enjoy low prices as pointed out in a *Washington Post* article: "No matter how much everybody criticizes their agency's cafeteria, they generally don't complain about the prices."[33]

An alternative competing theory that others may use to explain the unsatisfactory quality of their cafeteria is the lack of competition: students/workers have nowhere else to grab a quick bite. However, Spence (1975) and Alchian and Kessel (1962) have already debunk this myth: monopoly power does not necessarily translate to low quality.

5.2.2 Evidence of evasion

Proposition 3 of the model predicts that producers are worse off if they restrict outsiders. Therefore, they lack the incentive to comply. Can we observe non-compliance?

Cafeterias in U.S. Federal buildings are intended for Federal employees only, but some are found to serve outsiders, leading to complaints about unfair competition by a nearby regular restaurant.[34]

In Hong Kong, a 2017 investigation performed by the Hong Kong Ombudsman revealed

[32] One media article grades various cafeterias in Federal buildings as: F for Supreme Court Cafeteria; D for U.S. Department of Agriculture South Cafe and National Institutes of Health Clinical Center Cafeterias; C for The Cafe at State, U.S. Patent and Trademark Office Roundhouse Cafe, and Pentagon Dining Room. These grades are obviously bad. Source: "Well, fed: We try the food at U.S. government cafeterias," by Jane Black, *Washington Post*, July 14, 2010, URL: https://www.washingtonpost.com/wp-dyn/content/article/2010/07/13/AR2010071301472.html.

[33] Source: "When the Government Goes to Lunch," by Carole Sugaman, *Washington Post*, May 6, 1987.

[34] United States General Accounting Office (1978) investigates the James Forrestal Building cafeteria and finds that it attracts tourists and non-federal employees. Given that the operator has been "subsidized," a nearby private restaurant complained about unfair competition.

that factory canteens in Hong Kong, which are required by their licenses to restrict outsiders, almost never did so.[35] To actively attract outsiders, many canteens open emergency exits facing the street when such exits are supposed to be opened only during emergencies.

The investigation of the Ombudsman resulted in a sudden increase in the number of inspections. One can expect a substantial increase in enforcement costs, but we fail to find any published figures on the actual amount of increase. Nevertheless, a Hong Kong lawmaker explicitly detailed the sharp drop of the profit of canteens after the sudden tightening of the policy enforcement, a result consistent with Proposition 3.[36]

Hong Kong lawmakers also express worries that many cafeterias within police stations are frequented by outsiders. Apparently, some outsiders go into police stations only for food and are welcomed by operators. According to the documented discussion, the operators are "in breach of contract stipulations." Restricting outsiders is clearly an anticipated restriction as they are known to operators because they are given verbal and written warnings, but some operators continue to serve outsiders.[37]

Some travel websites praise several campus cafeterias of Japanese universities near tourist spots.[38] Their promotion results in many campus cafeterias becoming popular Facebook check-in locations, indirectly hinting costly enforcement and non-compliance of the policies of restricting outsiders.

[35]In May 2017, the Ombudsman issued an investigation report showing evidence that factory canteens usually serve outsiders. The report states "the personal experiences of the investigation officers of the Office of The Ombudsman (the Office) indicate that factory canteens are patronized many times by people who have never been asked whether they are factory employees." The report can be retrieved from https://ofomb.ombudsman.hk/abc/files/DI405_ES_E-11_5_2017.pdf.

[36]In lawmaker Tommy Cheung's question and the written reply by the Secretary for Food and Health, Professor Sophia Chan, in the Legislative Council on January 23, 2019, Mr. Cheung voiced out the substantially low profits of factory canteens after the tightening of the policy enforcement. Source: https://www.info.gov.hk/gia/general/201901/23/P2019012300389p.htm.

[37]Source: https://www.legco.gov.hk/yr97-98/english/counmtg/hansard/970820fe.htm.

[38]For instance, one travel website writes: "You do not have to show your ID or even look like a student. Even tourists or backpackers can enter and enjoy gakushoku, as it is commonly referred to." Source: "The Secret World of Japanese University Cafeterias," by Johnny, *Spoon and Tamago*, March 20, 2014, URL:http://www.spoon-tamago.com/2014/03/20/the-secret-world-of-japanese-university-cafeterias.

6. Concluding remarks

The effects of an economic policy usually depend on whether or not the policy is anticipated. We examine how an anticipated outsider restriction changes a producer's product choices. We find that the endogenous product choices induced by an anticipation can negate the notion that restricting outsiders lowers price and benefits insiders. When a policy of restricting outsiders is anticipated, a crowding out effect is necessary for the policy to lower price. Since quality can also vary, not all insiders would benefit equally; some may even get hurt. To help readers better understand the policy relevance, we sum up the theoretical results of the model in four policy implications. We argue that our model sheds some light on two common but rather different real world contexts.

Our model omits many relevant aspects of restricting outsiders (e.g., security, tax, health, and safety reasons). For instance, one possible extension of our model, motivated by Chao and Yu (2015), is to allow outsiders to buy from producers by paying a premium and the proceed can then be used to subsidize buying insiders to break even. Our current model is nested in such a general model as a special case when the premium becomes prohibitively high and deters all outsiders. This general model allows us to scrutinize Chao and Yu (2015)'s main advice about taxing foreigners to subsidize local home buyers.

We briefly list a few issues for future work. First, we do not define exactly who are the outsiders. They can depend on look, citizenship, gender, age, race, etc. Putting the insider-outsider dichotomy in a particular context may deepen our understanding of the potentially discriminatory issues. For instance, we may assume that outsiders impose a larger crowding out effect than insiders when they are visually distinctive. Second, when insiders and outsiders can be different, the model may bring new insights. Third, price and non-price discrimination are common and may influence the effects of restricting outsiders on insiders. Last, multiple producers compete with one another, and this competition may change the way restricting outsiders affect insiders.

A. Proofs

Proof of Lemma 1. The first order conditions for the profit maximization problem in (7) are:

$$\frac{\partial \pi}{\partial p} = \frac{m}{s+mt}\{(s-p)-[p-c(s)]\} = 0, \tag{A.1}$$

$$\frac{\partial \pi}{\partial s} = \frac{m}{s+mt}\left\{-c'(s)(s-p)+[p-c(s)]\frac{p+mt}{s+mt}\right\} = 0. \tag{A.2}$$

Simplifying these two equations gives $p^* = \frac{s^*+c(s^*)}{2}$, and $c'(s^*) = \frac{p^*+mt}{s^*+mt}$. □

Proof of Proposition 1. To find the sign of $\frac{\partial p^*}{\partial m}$ and $\frac{\partial s^*}{\partial m}$, we totally differentiate (A.1) and (A.2) with respect to m to obtain the following system of equations:

$$\begin{bmatrix} \frac{\partial^2\pi}{\partial p^2} & \frac{\partial^2\pi}{\partial p\partial s} \\ \frac{\partial^2\pi}{\partial p\partial s} & \frac{\partial^2\pi}{\partial s^2} \end{bmatrix} \begin{bmatrix} \frac{\partial p^*}{\partial m} \\ \frac{\partial s^*}{\partial m} \end{bmatrix} = \begin{bmatrix} -\frac{\partial^2\pi}{\partial p\partial m} \\ -\frac{\partial^2\pi}{\partial s\partial m} \end{bmatrix}. \tag{A.3}$$

Let H denote the Hessian matrix. By Cramer's rule:

$$\frac{\partial p^*}{\partial m} = \frac{\begin{vmatrix} -\frac{\partial^2\pi}{\partial p\partial m} & \frac{\partial^2\pi}{\partial p\partial s} \\ -\frac{\partial^2\pi}{\partial s\partial m} & \frac{\partial^2\pi}{\partial s^2} \end{vmatrix}}{|H|} = \frac{-\frac{\partial^2\pi}{\partial p\partial m}\frac{\partial^2\pi}{\partial s^2} + \frac{\partial^2\pi}{\partial s\partial m}\frac{\partial^2\pi}{\partial p\partial s}}{|H|}, \tag{A.4}$$

$$\frac{\partial s^*}{\partial m} = \frac{\begin{vmatrix} \frac{\partial^2\pi}{\partial p^2} & -\frac{\partial^2\pi}{\partial p\partial m} \\ \frac{\partial^2\pi}{\partial p\partial s} & -\frac{\partial^2\pi}{\partial s\partial m} \end{vmatrix}}{|H|} = \frac{-\frac{\partial^2\pi}{\partial p^2}\frac{\partial^2\pi}{\partial s\partial m} + \frac{\partial^2\pi}{\partial p\partial s}\frac{\partial^2\pi}{\partial p\partial m}}{|H|}. \tag{A.5}$$

Observe that at (p^*, s^*), $\frac{\partial^2\pi}{\partial p\partial m} = 0$, $\frac{\partial^2\pi}{\partial s\partial m} = \frac{mt[p^*-c(s^*)](s^*-p^*)}{(s^*+mt)^3} \geq 0$, and $\frac{\partial^2\pi}{\partial p\partial s} = \frac{m[1+c'(s^*)]}{s^*+mt} > 0$. By the second order condition, $\frac{\partial^2\pi}{\partial p^2} < 0$ and $|H| > 0$. Therefore:

$$\frac{\partial p^*}{\partial m} = \frac{\frac{\partial^2\pi}{\partial s\partial m}\frac{\partial^2\pi}{\partial p\partial s}}{|H|} = \frac{\frac{mt[p^*-c(s^*)](s^*-p^*)}{(s^*+mt)^3} \times \frac{m[1+c'(s^*)]}{s^*+mt}}{|H|}, \tag{A.6}$$

$$\frac{\partial s^*}{\partial m} = \frac{-\frac{\partial^2\pi}{\partial p^2}\frac{\partial^2\pi}{\partial s\partial m}}{|H|} = \frac{-\frac{\partial^2\pi}{\partial p^2} \times \frac{mt[p^*-c(s^*)](s^*-p^*)}{(s^*+mt)^3}}{|H|}. \tag{A.7}$$

With crowding out (i.e., $t = \tau > 0$), $\frac{\partial p^*}{\partial m} > 0$ and $\frac{\partial s^*}{\partial m} > 0$. That is, $p^*_\alpha < p^*_1$ and $s^*_\alpha < s^*_1$, indicating that restricting outsiders lowers the producer's equilibrium price and quality. Without crowding out (i.e., $t = 0$), $\frac{\partial p^*}{\partial m} = 0$ and $\frac{\partial s^*}{\partial m} = 0$. That is, $p^*_\alpha = p^*_1$ and $s^*_\alpha = s^*_1$, suggesting that restricting outsiders does not affect the producer's equilibrium price and quality. □

Proof of Proposition 2. Let $r^* = s^*/p^*$ be the quality-per-dollar ratio in equilibrium. When $t = 0$: Proposition 1 suggests that $p^*_\alpha = p^*_1$ and $s^*_\alpha = s^*_1$ so that $r^*_\alpha = r^*_1$.

When $t = \tau > 0$: Differentiating r^* with respect to m, we have $\frac{\partial r^*}{\partial m} = \frac{p^* \frac{\partial s^*}{\partial m} - s^* \frac{\partial p^*}{\partial m}}{(p^*)^2}$. By Lemma 1, $p^* = \frac{s^* + c(s^*)}{2}$ so that $\frac{\partial p^*}{\partial m} = \frac{1}{2}\left[\frac{\partial s^*}{\partial m} + c'(s^*)\frac{\partial s^*}{\partial m}\right]$. Therefore, we can rewrite $\frac{\partial r^*}{\partial m}$ as:

$$\frac{\partial r^*}{\partial m} = \frac{\frac{s^*+c(s^*)}{2} - s^*\left\{\frac{1}{2}\left[1 + c'(s^*)\right]\right\}}{(p^*)^2}\frac{\partial s^*}{\partial m} = \frac{c(s^*) - s^* c'(s^*)}{2(p^*)^2}\frac{\partial s^*}{\partial m}. \tag{A.8}$$

By Lemma 1 again, we have $c'(s^*) = \frac{p^* + mt}{s^* + mt} = \frac{\frac{s^*+c(s^*)}{2} + mt}{s^* + mt}$. Therefore:

$$c(s^*) - s^* c'(s^*) = c(s^*) - s^*\left[\frac{\frac{s^*+c(s^*)}{2} + mt}{s^* + mt}\right] = \frac{[c(s^*) - s^*](s + 2mt)}{2(s^* + mt)}. \tag{A.9}$$

Non-negative quantity demanded implies $p^* < s^*$. By Lemma 1, we have $\frac{s^*+c(s^*)}{2} < s^*$ or $s^* > c(s^*)$. Therefore, $c(s^*) - s^* c'(s^*) < 0$ and thus $\frac{\partial r^*}{\partial m} < 0$. That is, $r^*_\alpha > r^*_1$, i.e., restricting outsiders raises the quality-per-dollar ratio. □

Proof of Proposition 3. Fixing w and given (p, s), the difference between the producer's profit when outsiders are welcomed (denoted as π_1) and that when outsiders are restricted (denoted as π_α) is:

$$\begin{aligned}\pi_1(p, s) - \pi_\alpha(p, s) &= \left\{[p - c(s)]\frac{s - p}{s + t} - w\right\} - \left\{[p - c(s)]\frac{\alpha(s - p)}{s + \alpha t} - w\right\} \\ &= [p - c(s)]\frac{(s - p)s(1 - \alpha)}{(s + t)(s + \alpha t)},\end{aligned} \tag{A.10}$$

which is positive for all $t \geq 0$. Therefore, $\pi_1(p, s) > \pi_\alpha(p, s)$ for all (p, s), including (p^*_α, s^*_α). Moreover, by revealed preference, the optimal profit when $m = 1$ at (p^*_1, s^*_1) must be larger than that at (p^*_α, s^*_α), i.e., $\pi_1(p^*_1, s^*_1) > \pi_1(p^*_\alpha, s^*_\alpha)$. Taken together:

$$\pi_1(p^*_1, s^*_1) > \pi_1(p^*_\alpha, s^*_\alpha) > \pi_\alpha(p^*_\alpha, s^*_\alpha). \tag{A.11}$$

That is, the producer's equilibrium profit is always higher when outsiders are unrestricted; this observation is true regardless of whether there is a crowding out effect. □

Proof of Proposition 4. Note that given $c(s)$ and t, the shape of the utility function when $m = 1$ does not change. In the case of Figure 2(a), it must be true that the consumer with $\theta_i = 1$ has a higher utility when $m = 1$ than when $m = \alpha$, i.e.:

$$s^*_\alpha[1 - c'(s^*_\alpha)] < s^*_1[1 - c'(s^*_1)]. \tag{A.12}$$

If the values of α (mass of insiders) and τ (extent of crowding out), and the shape of the cost function $c(s)$ is such that the above condition holds, then at least some insiders are better off

when outsiders are restricted. □

Proof of Proposition 5. Here we show that in the presence of crowding out, restricting outsiders can increase or decrease the consumer surplus of insiders. Let $A_m = \int_{\overline{\theta}_m}^{1} u_i \mathrm{d}\theta_i$ denote the area under the utility function when $m = \{\alpha, 1\}$. It is the area of a triangle with base $1 - \overline{\theta}_m = 1 - c'(s_m^*)$ and height $s_m^*[1 - c'(s_m^*)]$. By simple geometry, we have:

$$A_m = \frac{s_m^*[1 - c'(s_m^*)]^2}{2}. \tag{A.13}$$

Considering that $s_\alpha^* < s_1^*$ and $1 - c'(s_\alpha^*) > 1 - c'(s_1^*)$, we do not know whether $A_\alpha \gtrless A_1$, that is, we cannot confirm whether the consumer surplus of insiders is higher when outsiders are welcomed. □

B. Further details for footnote 26

We use the data of Lee and Ooi (2018) to do the following exercise.[39] We first run the following regression using their matched sample of Executive condominiums (ECs) and Private condominiums (PCs):

$$CONQUAS_{ikt} = \alpha + \beta\, Controls_{ik} + \tau_k + \varphi_t + \tau_k \times \varphi_t + \varepsilon_{ikt}, \tag{B.1}$$

where i, k, and t are respectively indexes of a condominium unit, a neighborhood, and year, $CONQUAS_{ikt}$ represents the CONQUAS score of the unit,[40] $Controls_{ik}$ is a vector of physical attributes of the unit and locational characteristics of the neighborhood (including Development size, Distance to the nearest subway station, Distance to central business district, presence of different amenities (Swimming pool, Barbecue pit, Gym, Mini-mart, Pavillion, Playground, Sauna, Clubhouse, Exercise area, Basketball court, Tennis court, Library, Lounge, and Game room)), τ_k and φ_t are respectively the neighborhood and year fixed-effects, and ε_{ikt} is the residual.

We then obtain the residuals from the regression and perform a t-test to compare the residuals of ECs and those of PCs. Table A summarizes the results. These results seem to suggest that the CONQUAS scores for ECs are lower than those for PCs.

[39] We downloaded the data from https://www.journals.uchicago.edu/doi/abs/10.1086/698747.

[40] Specifically, this score is compiled by the Singaporean Building and Construction Authority (BCA) which independently evaluates the quality of new buildings throughout their construction. The CONQUAS scores are publicly available at the BCA website.

Table A: Comparing the CONQUAS scores of the Executive and Private condominiums

Condominiums	Observation	Mean
Executive condominiums	11,600	−0.541
Private condominiums	10,046	0.625
	Difference	−1.166
	p-value	0.000

Note: This table shows the *t*-test results comparing the residuals of the CONQUAS scores of the Executive and Private condominiums. The residuals are obtained by regressing the CONQUAS scores on a vector of physical attributes of the unit and locational characteristics of the neighborhood (including Development size, Distance to the nearest subway station, Distance to central business district, presence of different amenities (Swimming pool, Barbecue pit, Gym, Mini-mart, Pavillion, Playground, Sauna, Clubhouse, Exercise area, Basketball court, Tennis court, Library, Lounge, and Game room)), and year-by-neighborhood fixed-effects.

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