Enforcement polices with corruption at the ticket and the license stage

Amy Farmer∗
University of Arkansas

Fabio Mendez†
Loyola University Maryland

Andrew Samuel‡
Loyola University Maryland

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Abstract

Many economic activities are regulated both ex-ante (through licenses) and ex-post (through tickets, fines, or tort law). For example, doctors are required to possess a license, but even after obtaining a license they may be penalized for violating legal or medical standards of care. At either of these stages, bribery may occur. That is, an agent may pay a bribe to receive a “fake” license (that is, even when they have not met the requirements for a license), and those who possess a license (real or fake) may pay a bribe to avoid any penalties for any subsequent wrongs committed. Although there is a vast literature on bribery, none of these papers study the interaction between bribery at the license stage and bribery at the ticket stage. This paper develops a model to study the interaction between these two forms of corruption. Our main finding is that bribery at the license stage can make regulation through licenses useless, in the sense that with bribery the level of compliance is the laissez faire level. Whereas, bribery at the ticket stage does not completely eliminate the value of regulation. Further, we also study the extent to which offering higher wages can be used to deter bribery. We find that an increase in the wage of the official in charge of issuing fines lowers the probability of bribery at the license stage. However, it also increases the size of the bribe at the ticket stage.

∗Department of Economics, University of Arkansas, Fayetteville, AR 72701. Email: AFarmer@walton.uark.edu.
†Department of Economics, Loyola University Maryland, 4501 N. Charles Street, Baltimore, MD 21210. Email: fabiomendezmae@gmail.com
‡Department of Economics, Loyola University Maryland, 4501 N. Charles Street, Baltimore, MD 21210. Phone: 410-617-2357. Email: asamuel@loyola.edu.
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1 Introduction

In order to enforce government regulations on economic activities, public authorities often rely on a combination of permits and tickets. Permits refer to the licenses and compliance certificates that businesses are required to obtain before they can operate legally, while the term “tickets” embodies the penalties established for those who operate without the permit or without the legal requirements. Shavell (1993) notes that tickets are a form of ex-post regulation (i.e. after the harmful act has been committed), while licenses are a form of ex-ante regulation. Examples of economic activities regulated in this manner abound in everyday life: Restaurants are required to obtain a public safety certification and are penalized if they serve food without such a certificate, timber companies are required to obtain a permit before they can exploit a forest and are prosecuted if they extract lumber without permission, trucking companies are required to obtain special licenses for their drivers and are fined whenever their drivers are caught driving without it, etc.

A regulator may choose to regulate a market through a license for three reasons. First, if the harm from non-compliance is direct (i.e. affects consumers directly), then a license is used to signal quality to consumers (Leland 1979, Esther Gal-Or 1983). For example, doctors are licensed by professional organizations to signal that they have completed the requisite training. Second, if the harm from non-compliance is third-party, licensing is used to restrict production only to those firms that have complied (e.g. permits for firms that install abatement technology). Third, Amir and Burr (2015) argue in a Cournot framework that licenses can be used to restrict entry into an oligopolistic market with entry costs (the Mankiw and Whinston (1986) “business stealing” reason for restricting entry.)

All of the above arguments for using licensing to regulate markets, however, do not explicitly consider how the license is enforced, that is, how the social planner will be able to restrict entry only to those firms that have obtained a license. Indeed, Leland (1979) explicitly states that he does not consider issues of enforcement, and Amir and Burr (2015) also abstract from this issue.

In reality, licensing (ex-ante regulation) is often effective only if it used in conjunction with some form of ticket stage (ex-post) regulation. For example, consider the well-known example of licensing drivers. In the absence of any police, who are authorized to fine unlicensed drivers, few drivers would choose to obtain licenses. Thus, permits and tickets are often needed in conjunction in order to form an effective regulatory system that steers economic activity toward optimal levels from a public policy perspective.

The success of the system of licensing and ticketing, however, can often weakened by corrupt practices that appear at either of these two regulatory stages. That is, license

\[1\] Torts and liability rules are in some sense also a part of the ex-post enforcement mechanism, however, we do not study this issue here.
officials can accept a bribe in order to issue permits to firms not entitled to receive them (Amir and Burr 2015). However, ticket stage officials may also accept bribes in exchange for not fining firms who are operating without a license.

There is a rich literature that answers that task (see Svensson (2005) and Polinsky and Shavell (2001) for useful literature reviews). Unfortunately, the conclusions drawn from that literature are derived from a naive analysis in which corruption at the “permit stage” is assumed to be independent from corruption at the “ticket stage”. Choi and Thum (2005), for example, only study the effects of corruption using a model where individuals pay a bribe at the permit-stage in order to obtain a license. Mookherjee and Png (1995) study corruption in a model where individuals pay a bribe at the ticket-stage in order to reduce the penalties associated with violating mandated regulations. Similarly, many others like Polinsky and Shavell (2001), Samuel (2009), and several others have studied the economic effects of bribery at the ticket stage without considering how it may interact with bribery at the licensing stage.

Once it is recognized that effective regulation requires both licensing and ticketing, it is clear that these two forms of bribery also need to be studied together. Thus, this paper departs from the prior literature to study how regulatory systems are affected by the interaction of bribery at both the permit stage the ticket stage. Specifically, we develop a game theoretic model firms that join the formal sector are faced with costly, but welfare improving, regulations. Firms that join the informal sector are not subject to any form of licensing (ex-ante regulation). Licensing in our model serves one of two purposes. In the first case, compliance with the regulation improves the firm’s product so that consumers are willing to pay more for its products. In the absence of full information licensing by a credible independent institution can help resolve the asymmetric information. The second role of licensing occurs when it used by the regulator to limit production to only those firms the install some abatement technology that mitigates a third-party harm. For example in many industries, licenses or permits are often only given to firms that install pollution control devices.

To enforce these regulations, the government implements a system of both licenses and tickets. At either (or both) of these stages officials may be corruptible. That is, licensing officials may accept a bribe in exchange for granting a permit to a non-compliant firm. Or ticket stage officials may accept a bribe in exchange for not sanction a firm that is operating without a license (which may be either a firm in the informal sector, or a non-compliant formal sector firm that has paid a bribe to receive a license.)

We use this model to study the following questions. First, how does bribery affect enforcement. Second, is bribery at these two stages complementary or are they substitutes?

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2This role of licensing is relevant for e.g. in the case of professional licensing where consumers are willing to pay more for the services of doctors or cab-drivers who are licensed professionals.
Third, with limited funds (if only one of these two types of bribery can be sanctioned, should bribery be sanctioned at the permit stage or the ticket stage? Fourth, how does bribery at either of these two stages affect the size of the informal sector. That is, is one of them more or less likely to encourage the informal sector. Finally, we also examine whether it may be possible to achieve an efficient outcome by eliminating either the licensing stage or the ticket stage of regulation altogether.

Our first set of results are concerning the effectiveness of licenses in the presence of corruptible license officials at both the license and the ticket stage. We find that when licensing is implemented to resolve imperfect information, then the presence of corruptible licensing officials completely negates the value of licenses. Next we introduce inspectors who verify whether firms who are operating in the formal sector are operating without a license. We find that if inspectors cannot distinguish between real and fake licenses, then again licensing is useless and does not improve welfare. If inspectors can distinguish between real and fake licenses, and this information can be credibly conveyed to consumers, then licensing can improve compliance. This is the only case in which licenses improve compliance when license officials are corrupt.

Our second set of results examine the effectiveness of uses wages (of licensing and ticket officials) to deter corruption and improve enforcement, a long standing debate in the literature. Our main finding here is that an increase in the license official’s wage may increase or decrease the size of the formal sector and the level of compliance. However, an increase in the ticket officials remuneration always increases the size of the formal sector and compliance. Thus, changes in the wages of the license and ticket official do not have the same effect on compliance.

The remainder of the paper is organized as follows: Section 2 presents the main theoretical model and describes the decisions of the individual entrepreneurs who must choose whether to follow the mandated regulations and whether to join the unofficial economy. Section 3 expands the analysis to consider the effects of extortion. Finally and Section 4 concludes.

2 Model

We first consider the role of licensing in the absence of any bribery and in the presence of direct harms to consumers. Firms in this model economy can choose to comply or not comply with some regulation at cost $\lambda > 0$. We use the term comply here very broadly to denote investment in human capital (for doctors, dentists), safety measures (for taxicab companies and other industrial products). Consumers in this economy value products produced by compliant firms, or equivalently are willing to pay more for higher quality products. Specifically, a consumer is willing to pay $\pi_h$ to compliant firms and $\pi_l$ to non-compliant firms, where we assume that $\pi_h - \lambda > \pi_l \geq 0$. This last assumption ensures that compliance is
efficient. Under this assumption, if consumers are fully informed about firm decisions, then all firms choose to comply with the regulation, and the efficient outcome is achieved.

We now introduce imperfectly informed consumers who do not observe the firm’s choices. Consumers, therefore, cannot condition their payments based on the firm’s quality choice. This results a classic “lemons problem” where consumers pay $\pi_l$ to both types of firms, therefore, all firms are non-compliant.

Within the context of imperfectly informed consumers, we now introduce an independent, incorruptible, licensing agency who employs licensing officials who costlessly observe the agencies type. These licensing officials are paid a wage of $w$. For example, the American Medical Association can easily verify that someone claiming to be a doctor has passed the medical boards, whereas patients on their cannot easily verify such information. The agency reports this information to consumers by issuing a costless license to compliant firms. Since the agency is honest, this information is trustworthy, and consumers can once again distinguish between compliant and non-compliant firms, therefore, the first-best outcome will be achieved.

So far, the role of licensing is very similar to that found in Leland (1979). However, our model can be easily altered to include the case where licenses are used to limit negative externalities. Specifically, suppose that compliance and non-compliance both result in a private benefit of $\pi$ to the firm, but that non-compliant firms generate a negative externality $h > \lambda$. In this case, in the absence of any regulation, all firms would be non-compliant. If licensing officials were incorruptible and could fully enforce the license, then they could ensure that only firms that have chosen to comply are allowed to enter the market. However, as we have seen enforcement in this case usually involves ticket stage enforcement, since there are no market incentives to encourage firms to comply. (would need ticket stage enforcement, otherwise, licensing has no bite).

3 Bribery

We now introduce two extensions to the above framework. First, we allow firms to choose to either join the formal or informal sector. If they join in the informal sector their scale of operation is smaller, but they are not subjected to any licensing requirements or quality standards. Intuitively, one can think of a “quack” who practices medicine in a small village. We assume that the gains from being in the informal sector is denoted by $\gamma \geq 0$. The second, extension is that the licensing official (henceforth, “official”) is corruptible and may accept a bribe in exchange for granting a non-compliant firm a “fake” license. Initially, we shall assume that consumers cannot distinguish between fake or real licenses, but later, we shall relax this assumption.

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3The cost of the license could be positive but implicitly included in the compliance cost $\lambda$. 
The timing of this extended game is characterized below, with the extensive form presented in Figure 1 (in the Appendix).

1. Firms choose to either enter the formal sector or the informal sector. Firms that enter the informal sector receive a benefit of $\gamma$, and the game ends.\footnote{4}

2. Firms that enter the formal sector encounter and choose whether to bribe the license official or whether to comply.

3. The official either rejects the bribe or accepts the bribe. If the bribe is rejected the firm receives a payoff of 0. If the bribe is accepted the firm is receives $\pi - b$. Where $\pi$ is the consumer’s willingness to pay. Consumers remain uninformed in that they cannot determine whether a licensed firm has a real or a fake license. Thus, their willingness to pay cannot be conditioned on the firm’s choice of compliance.

4. The game ends and all payoffs are received.

Implicitly, Stage 2 assumes that the contracts between the official and the firm are fully enforceable. That is, when the firm is granted a licensing it does not renege by not investing $\lambda$. Similarly, it is assumed that the bribe contract can be enforced. Finally, a key distinction between the formal and the informal sector is that to operate in the formal sector requires a license (either fake or real), and further once a firm enters the formal sector it cannot leave it for the informal sector.

Analyzing the equilibrium of this game is rather straightforward. First consider the sub-game conditional on choosing to enter the formal sector. The official receives a payoff of $w + b$ if she accepts the bribe, and $w$ if it is rejected. Thus, any bribe $b > 0$ will be sufficient to ensure that it is accepted. Hence in equilibrium the firm offers a small positive bribe $b = \epsilon$ (where $\epsilon$ denotes a small positive value) which is accepted. Recall that consumers do not know whether the licensed firm has a fake or a real license, therefore, any price $\pi$ must be identical for both compliant or non-compliant (bribe paying) firms. Since the payment is identical, the bribe $b$ also satisfies, $\pi - b > \pi - \lambda$ or $b < \lambda$. Thus, conditional on entering the formal sector, all firms choose to bribe, and receive $\pi_l$, the value of a non-compliant product. Effectively, the corruptibility of officials now makes it impossible to distinguish between the two types of firms, and reintroduces the “lemons problem”.

The equilibrium of this game, however, will depend on whether firms choose to join the formal sector or the informal sector. We characterize this in the following Lemma.

\footnote{4We assume that the decision to formal/informal sector first because the scale of operation for these two sectors is very different. Further we assume that one cannot easily switch from one to the other once this decision is made.}
Lemma 1 Let the gains from the informal sector be $\gamma \sim F[0, \gamma_{max}]$, then the size of the formal sector is, $\overline{\gamma} = \pi_l - b$, and the size of the informal sector $(\gamma_{max} - \overline{\gamma})$. All firms with $\gamma \leq \overline{\gamma}$ choose the formal sector and pay a bribe, while all firms with $\gamma > \overline{\gamma}$ choose the informal sector (and do not bribe).

The previous result shows that if license officials are corrupt, then licenses does not encourage compliance. Further, in this the equilibrium outcome will in effect be the laissez faire equilibrium (i.e. the equilibrium without any regulation).

3.1 Bribery at the license stage with “naive” inspectors

We now introduce a (second) ticket stage law enforcer, who we refer to as an “inspector”. The role of the inspector is to verify whether firms in the formal sector possess a license, but they are “naive” because they cannot distinguish between a genuine license or a fake license that was obtained through bribery. The inspector chooses to either inspect or not inspect a firm, where inspection is costly and costs $c > 0$. Analyzing this equilibrium is also straightforward (using backward induction). The dominant strategy for all inspectors is to choose to not inspect (since inspection is costly). Since inspection does not reveal whether the firm has complied and received a license or not, consumers cannot condition their prices according to the firm’s type. Consequently, all firms choose to not comply and pay the license official a bribe of $b = \epsilon$. Thus, in equilibrium, conditional on entering the formal sector, no firms comply, all pay a bribe or 0 (plus epsilon) and receive fake license. Thus, their payoff is $\pi_l$. We characterize this in the following Lemma.

**Lemma 2** If inspectors cannot distinguish between real and fake licenses (and consequently cannot punish license official for issuing fake licenses), then all firms with $\gamma < \pi_l$ choose the formal sector, pay a bribe $b^* = 0$, and receive a fake license. All firms with $\gamma > \pi_l$ choose to enter the informal sector.

Lemma 2 shows that if inspectors are naive in that they cannot distinguish between real and fake licenses, then once again licensing is useless. Further, in this case inspectors do not add anything to enforcement and the equilibrium with naive inspectors is identical to the equilibrium identified in Lemma 1.

3.2 Bribery at the license stage with “sophisticated” inspectors

We now assume that the ticket stage law enforcer can distinguish between fake and real licenses. An inspector who discovers that a firm has a fake license receives a reward of $r$ and the firm looses all its payoff, and the official who granted it a fake license looses his wage of $w$ (but the official gets to keep the bribe received $b$). An inspector who inspects a compliant firm does not receive a reward. (This is a standard inspection game.)
Further, we assume that if an inspection occurs, then this information is revealed to consumers. Thus, if a compliant firm is inspected, consumers know that it has a genuine license and will be willing to pay $\pi_h$ for its product. However, if firms are not inspected then consumers do not know whether the license is fake or real, therefore, they cannot condition any prices according to whether the firm is compliant or not. Consequently, if no inspection occurs, firms can only receive at best $\pi_l$. The timing of this game tree is represented in Figure 2 below.

**Lemma 3** Let $p$ be the probability with which a firm (along with a license official) in the formal sector chooses to comply (and $(1-p)$ be the probability with which they exchange a bribe.) Also, let $q$ be the probability with which an inspector inspects. The equilibrium mixed strategies $(p^*, q^*)$ are given by,

$$p^* = \frac{r - c}{r},$$

and

$$q^* = \frac{\lambda}{\pi_h + w},$$

and the equilibrium bribe is,

$$b^* = \frac{\lambda}{\pi_h + w}.$$  

**Proof.** In equilibrium all players must be indifferent. The firm offers the license official a bribe that makes the official indifferent between accepting and rejecting the bribe. That is,

$$qw + (1 - q)w = bq + (1 - q)(w + b),$$

or

$$b = qw$$

We assume that if the official is indifferent then she accepts the bribe always. Thus, the equilibrium beliefs of the other players (conditional on this bribe being paid in equilibrium) is that the official always accepts the bribe. Similarly, the inspector chooses a probability of inspection $q$ that makes the firm indifferent between complying and bribing the license official. Thus, $q^*$ satisfies,

$$q(-b) + (1 - q)(\pi_l - b) = q(\pi_h - \lambda) + (1 - q)(\pi_l - \lambda),$$

which when evaluated at $b = qw$ yields,

$$q^* = \frac{\lambda}{\pi_h + w}.$$
Finally, the firm chooses a probability of complying $p$ that makes the inspector indifferent between inspecting and not inspecting. Thus, $p^*$ satisfies,

$$p(-c) + (1 - p)(r - c) = 0,$$

which yields,

$$p^* = \frac{r - c}{r}.$$

It is easy to see that both $q^* \in (0, 1)$ and $p^* \in (0, 1)$, so we have a non-degenerate mixed strategy equilibrium. Finally, substituting the equilibrium $q^*$ into the bribe, it follows that the equilibrium bribe $b$ is,

$$b^* = \frac{\lambda}{\pi_h + w} w < \lambda.$$

$\blacksquare$

Under our assumption that the distribution of gains from the informal sector is $\gamma$, we have the following equilibrium,

**Proposition 1** In equilibrium, the size of the formal sector is given by,

$$\gamma = p^* q^* \pi_h + (1 - q^*) \pi_l - p^* \lambda - (1 - p^*) b.$$

**Proposition 2** If inspectors are “naive” (Lemma 2), changes in the inspectors reward, the wages, and the costs of inspection have no impact on the size of the formal sector; or the likely hood of compliance or bribery.

If inspectors are sophisticated (Lemma 3), the following comparative static results are true,

1. An increase in the wage $w$ (of the licensing official) reduces the frequency with which an inspection occurs at the ticket stage. It also raises the size of the license bribe $b$, but will have no impact the decision to bribe at the license stage.

2. An increase in $w$ may increase or decrease the size of the formal sector, as well as compliance.

3. An increase in $r$ always increases (decreases) the size of the formal (informal) sector.

4. An increase in in $r$ (inspector’s reward) lowers the probability of bribery at the license stage.

**Proof.** Result [1.] [4.] above are easy to deduce from the equilibrium specified in Proposition 1. Turning to [2.],

$$\frac{d\gamma}{dr} = c \frac{\lambda w}{r^2 \pi_h + w} > 0.$$
Finally, turning to [3.]

$$\frac{d\gamma}{dw} = \frac{dq^*}{dw} [\pi_h - \pi_l - \frac{c}{r} (\pi_h + w)] - \frac{c}{r} \frac{\lambda}{\pi_h + w}.$$  

Since $\frac{dq^*}{dw} < 0$, the right hand side of the previous expression may be positive or negative.  

The first observation worth noting in these comparative static results is that changes in the wage of the license inspector have a very different impact on compliance (the formal sector) when compared with changes in the inspector’s reward $r$. Increasing the reward $r$ lowers the probability of bribery at the license stage because fake licenses are now less attractive (since the inspector’s reward for detecting them is higher). Thus firm’s comply more often and do not pay bribes for licenses as often. Second, note that an increase in $r$ always increases the size of the formal sector, but an increase in $w$ may raise or lower the size of the formal sector. Thus, a budget constrained regulator who wants to raise compliance will have to make careful choices in determining whether to spend the money to incentivize ticket stage inspectors or license stage officials. Finally, it is worth noting that when $c$ is small or $r$ large, the size of the formal sector will always be decreasing in $w$.  

The relationship between compliance and the size of the formal (informal sector) is important to our model. Specifically, in many formal treatments of regulation and bribery the compliance is equivalent to entering the formal sector, whereas in our model firms can be non-compliant but remain in the formal sector because they have paid a bribe to receive a license. Thus, compliance and the size of the formal sector are not equivalent. This implies that although compliance may increase when $r$ is raised, it only rises among those formal sector firms. Since the size of the formal sector is also larger when $r$ is raised, overall compliance will be higher.  

The previous set up assumed that if the inspector finds that a firm in the formal sector is operating without a license, both the firm and the license official are punished. In some instances, the license official need not be punished (perhaps it is too difficult to trace who the official is). In that case, the bribe $b$ must satisfy $w = w + (1 - q)b$. Clearly any positive bribe $b$ will be sufficient. Thus, in this case the bribe $b$ is no longer a function of $q$. Hence $q^* = \frac{\lambda}{\pi_h}$.  

### 3.2.1 Sophisticated inspectors without credible communication

It is also possible that inspectors are sophisticated but cannot credibly reveal (to consumers) when they have inspected a compliant firm. For example, with restaurant inspections, failures of compliance can lead to citations (tickets) that are posted on the city health department website (this is the case above). Whereas, a cab driver who receives a ticket, usually does not have this information available to consumers. In the previous section we assumed that information regarding the results of inspections were made available to consumers. If
this is not the case, then the equilibrium probability of inspection and detection is,

\[ q^* = \frac{\lambda}{\pi_l + w}, \]

while the probability of compliance \( p \) (conditional on choosing the formal sector) remains the same. It should be noted here that we may have degenerate mixed strategies. That is, since \( \pi_l \) is not necessarily greater than \( \lambda \), it follows that the probability of inspection may be 1, in which case firms always comply. Finally, the size of the formal sector is,

\[ \bar{\gamma} = p^*q^*\pi_l + (1 - q^*)\pi_l - p^*\lambda - (1 - p^*)b, \]

where \( q^* \) is given by the new equilibrium probability of inspection.

4 Bribery at both stages

We now allow for the possibility that the ticket stage inspector is also corruptible and make accept a bribe in exchange for not punishing the firm. Specifically, we assume that after inspecting a non-compliant firm the inspector does not reveal that he has found the firm non-compliant. We assume that the firm and the inspector “Nash bargain” over this ticket stage bribe, which we denote by \( B \). In this case, the smallest bribe that the inspector will be \( r \), while the largest bribe that the firm will be willing to accept is \( \pi_l \). Assuming Nash bargaining with equal bargaining power yields

\[ B = \frac{1}{2}(\pi_l + r). \]

Note that we assume that the license official cannot bribe the inspector in order to avoid loosing wages \( w \). [This adds a further complication which needs to be addressed.] Under this assumption, the inspector chooses a probability of inspection, such that

\[ q(\pi_l - \frac{r}{2} - b) + (1 - q)(\pi_l - b) = q(\pi_h - \lambda) + (1 - q)(\pi_l - \lambda). \]

Note that the license official’s bribe \( b \) is still chosen such that the official is indifferent between accepting and rejecting the bribe. Thus, \( b = qw \). Using the previous equation, it follows that the equilibrium \( q_B^* \) simplifies to,

\[ q_B^* = \frac{\lambda}{\pi_h - \frac{\pi_l - r}{2} + w}. \]

Mookherjee and Png (1995) consider a model of bribery which occurs only at the ticket stage. In light of their results it is worth comparing our findings with theirs. Similar to
their results we find that \( q_B^* > q^* \), that is, with ticket stage bribery the ticket stage inspector inspects more often because the bribe is larger than the reward and so the incentive to inspect is stronger (similar to Mookherjee and Png and most other results in the literature). However, in contrast to Mookherjee and Png, an increase in \( r \) increases compliance (ceteris paribus) and monitoring (ceteris paribus), so the effect on equilibrium monitoring is ambiguous. Here an increase in \( r \) increases compliance (so same as their paper), but an increase in \( r \) lowers \( q_B^* \) unambiguously. Further, although raising \( r \) increases compliance, the size of the formal sector decreases. So although there are more firms complying (within the formal sector), there are fewer formal sector firms.

5 Conclusion

Despite the fact that many economic activities are regulated ex-ante (with licenses) and ex-post (with tickets) the economic understanding of such regulatory frameworks is surprisingly incomplete. That is, there is a literature that studies the role of licenses as means to regulate economic activity (Leland 1979, Amir and Burr 2015), and a literature that studies the effectiveness of tickets as tools to monitor compliance (Becker 1968, Shavell 1993). However, neither of these literatures has produced a comprehensive, analytical framework in which permits and tickets are employed simultaneously. Relatedly, there is a vast literature that studies bribery at the license stage (Amir and Burr 2015, Choi and Thum 2005), and a separate literature that studies bribery at the ticket stage (Mookherjee and Png 1995, Polinsky and Shavell 2001, Samuel 2009). However, neither of these literatures study how bribery at the ticket stage interacts with bribery at the license stage and vice-versa. Consequently, neither of these strands of the literature provide a complete understanding of how regulations affect economic activity or how they should be enforced.

This paper departs from that trend and studies a regulatory framework that is composed of both permits and tickets. We allow corruption to occur at both the license and the ticket stage. We find that an increase in the wage of a license official may increase or decrease the level of compliance, but an increase in the inspector’s wage always increases compliance. We also find that increase in the license officials wage has no impact on the likelihood of bribery at either the license or the ticket stage. But, an increase in the inspector’s wage reduces the likelihood of bribery at the license stage.

Our model also allows us to study the interplay between the formal and the informal sector. Specifically, recall that in our model agents who choose not to join the formal sector (and obtain either a real license or a fake license through bribery) can choose to produce in the informal sector. Thus, our model allows us to study the interaction between bribery at either the ticket stage or the license stage and the size of the formal/informal sector. We find that an increase in the license officials wage may increase or decrease the size of the
formal sector, but an increase in the ticket officials wage always decreases the size of the formal sector. Thus, in contrast to Choi and Thum (2005) we find that the informal sector is not necessarily complementary to the formal sector in the presence of bribery.\footnote{Choi and Thum’s claim that, in the presence of bribery, the informal sector complements enforcement in the formal sector is mis-leading. It is not the informal sector itself, but rather the ex-post enforcement of the informal sector that creates the complementarity. Indeed, in the absence of this ex-post enforcement (which is assumed), the informal sector completely crowds out the formal sector (i.e. they are substitutes) and the level of compliance would be the laissez faire level.}

Finally, we use the model to evaluate the relative usefulness of using tickets versus licenses to regulate economic activity. We find that if bribes can be paid in exchange for a license, then licensing becomes completely useless (in most cases) and compliance is in some cases equivalent to the laissez faire outcome. In contrast, bribes paid in exchange for avoiding penalties at the ticket stage do not completely negate the value of tickets and fines (or ex-post enforcement in general). Thus, while corruption at the license stage essentially eliminates the usefulness of ex-ante enforcement (i.e. licenses), corruption at the ticket stage does not eliminate the value of ex-post enforcement. Our model therefore suggests that in the presence of bribery it may be more effective to focus on regulating economic activity ex-post (with tickets), rather than ex-ante (with licenses).

References


6 Appendix
Figure 1: Bribery with only licenses, consumer decisions not shown
Figure 2: The figure shows the sub-game, conditional on choosing the formal sector. Consumer decisions not shown.