Development and the Interaction of Enforcement Institutions *

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Abstract

How do markets and institutions interact? How does development influence this interaction? In this paper we examine how formal and informal contract enforcing institutions interact in a competitive market where consumers do not observe quality before purchase. Firm level incentives for high quality can be achieved with an informal enforcement mechanism, *reputation*, the efficacy of which is enhanced by consumers investing in "connectedness," or with a formal mechanism, *legal enforcement*, the effectiveness of which can be reduced by means of bribes. Higher levels of development (proxied by the lower frequency of bad productivity shocks) are associated with a lower efficacy of informal enforcement, and – up to a certain threshold – better performance of formal institutions as well as lower incentive compatible market prices, and higher consumer welfare. In addition, the theory predicts that any market characteristic that causes prices to be lower is associated with better performing judicial institutions.

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1 Introduction

It is well recognized that informational and contracting constraints increase the difficulty of "doing business" in developing countries. Mookherjee (1999) argues that "these diverse problems of information and trust encountered in running a business in different markets, industries and countries stem from a common problem of moral hazard, based on unobservability of certain dimensions of "effort"...".

At the same time, there is ample evidence of various informal resolutions to these problems. For example Allen, Qian and Qian (2005) show that in China the informal sector is growing faster than the formal sector due to relationship based contract enforcement. McMillan and Woodruff in a series of papers (1999, 2000) show that in Vietnam and other transition economies relational contracting and repeat transactions were successful in the absence of well functioning legal institutions.

The problem is that in most countries these two types of institutions **co-exist**, and the "institutional mix" that we observe is not necessarily one extreme or the other. Indeed, as Dixit (2004) suggests, formal and informal modes of governance are two conceptually pure extremes that are unlikely to be seen in reality so that the study of the interface between them is an important and open question. In the literature there are two different views of the relationship between formal and informal enforcement mechanisms: the "substitutability"[1] view, that informal mechanisms substitute for formal mechanisms and informal enforcement mechanisms emerge when formal mechanisms work poorly, while when formal mechanisms work well, they crowd out the relatively inefficient informal institutions (e.g. Kranton and Swamy (1999) show that setting up of civil courts in Colonial India led to the breakdown of relational contracting between moneylenders and farmers in rural India). Other examples from the literature can be found in Dixit (2004) which provides a nice overview.[2] The competing view of the relationship is the "complementarity" view that formal contracts and legal enforcement can limit the gains from short term opportunistic behaviour, thus increasing the value of relational contracting. However, while there is an *acknowledgement* in the literature that the relationship

[1] This notion of substitutability is not the one we use in the paper. We are interested in how the *performance* of each mechanism is affected by the other, not by the more common notion of the two mechanism being substitutes in demand.

[2] Greif (1993, 1994, 1997) and Greif *et al.* (1994) discuss informal contract enforcement in the Medieval Age. See also Ostrom (1990), Ellickson (1991), Kandori (1992), Besley *et al.* (1994), Ellison (1994), Battigalli and Maggi (2004). Finally, see Esfahani (1991) for a discussion on informal enforcement mechanisms in developing countries, and Greif (2004), and MacLeod (2006) for the discussions on different modes of governance.

may go in either direction, to the best of our knowledge there is no model that tries to analyze this question in a precise way.

In this paper we take a first step at filling this gap by developing a theory of institutional interaction where *both* formal and informal institutions co-exist and where the performance of both is endogenous. The theory aims to predict an equilibrium institutional (performance) mix as a function of the level of development.

In India for example, most real estate transactions take place knowing that the legal system cannot help to redress grievances, but at the same time the dysfunctional legal system is important because recourse to the court by either party means effectively an embargo on the sale of the property. The use of informal methods of contract enforcement is pervasive in this environment: it takes the form of using networks of informed consumers and brokers who have a "good" reputation. The market for brokers is unregulated and very competitive at the entry point. However there are brokers who develop a reputation for protecting their clients from unscrupulous buyers or sellers: moreover these brokers are known mainly through word of mouth and having the right connections. Brokers known in one area do not usually have the same advantage in another location: Indeed they only have local knowledge though they may have networks with brokers in other areas. In this market, there is a lot of cheating going on, there are no warranties and no "brand" names for brokers. There is a high degree of asymmetric information arising from the fact that sellers quite often have forged documents (unreliability of the government departments that look after housing) or that some buyers create hold up problems due to the time lag between signing the documents and actual payment. Moreover the informal mechanism is word of mouth and the formal one is the use of courts. This is the type of market we are interested in. It is no coincidence that judicial corruption in the real estate sector in India is notorious: this can be directly linked to the market prices of real estate.[3] The essence of our paper is to show possible causality through the market price in this setting: the functioning of the informal enforcement method (word of mouth and developing connections) depends on how (badly) the judicial system functions. The worse it functions the more are

[3]There is a famous case of a Chief Justice of the Supreme Court of India (Y.K Sabharwal) who took over cases relating to demolition of commercial properties in residential areas. The Municipal Corporation of Delhi (another governmental body known to be corrupt) started the "sealing"' drive whereby many small shops in residential areas were demolished. After several Public Interest Litigations the case was taken over by Mr Sabharwal. Later on it emerged that his two sons were involved in a real estate firm that profited enormously from the demolition through increasing the demand for malls.

the incentives to build the informal mechanism. At the same time the functioning of the judicial system depends on how the informal mechanism works. Our results suggest that if the informal mechanisms worked so well that conditional on going to court, the gains from bribing were sufficiently low then perhaps there is less scope for corruption as well.[4] This result is in sharp contrast to the existing literature which *assumes* that the interaction is one way – formal institutions affect the working of informal institutions (e.g. see Kali (1999) and Sobel(2006)) but not the other way round.

The study of institutional interaction derives increased significance from the view, now pervasive in the literature, that "institutions" are key to the process of development.[5] As Acemoglu *et al.* (2005) observe, a fundamental issue that this literature must address is that of how institutions are determined. Our paper contributes to this second literature by exploring the reverse causation: how can the level of development of a country or sector determine the level of incentive compatible market prices and the institutional mix for a fixed level of quality. Our measure of the level of development is *the probability of high quality task completion* taken from Kremer (1993). The level of development would be lower with unskilled labour, with poor infrastructure, unreliable government agencies etc.

In our example of the Indian real estate market, it is perhaps not surprising that the nature of the formal-informal interactions is different in the real estate market since the scope for asymmetry of information is very high and there are no warranties as compared to other markets for durable goods. Other such markets might be for example health services: in developing countries the level of regulation on entry is quite low so that these markets happen to be quite competitive at the entry point and are characterized by volatility in the sense of firms entering and exiting the industry quite rapidly. Again word of mouth is very important in these markets, there are no warranties and virtually no one ever tries recourse to courts in developing countries, an indicator of how poorly they function, while e.g in the USA the problem is of excessive litigation.

In line with this view of the markets we are interested in, our setting is a competitive economy where firms produce a good of variable quality, and consumers can observe quality only after they have bought the good. Bad quality occurs ei-

[4]The informal mechanism will of course reduce the necessity of going to court at all, but this is not the issue we address.

[5]See Acemoglu *et al.* (2005) for a review of the relationship between institutions and growth, and the discussions on contract enforcing institutions in Mookherjee (1999).

ther because of an exogenous, unobservable bad productivity shock,[6] or because firms did not put in the effort required to produce high quality, so that a one-sided asymmetric information problem arises. In our leading example of the Indian real estate market the development parameter measures the scope of ex-post opportunistic behavior which arises e.g. because of the unreliability of legal documents on the seller's side or because of hold up problems due to unreliable information about the buyer's credit worthiness. Thus, effort is unobserved and unverifiable while quality is unobserved at the time of purchase and is verifiable.

In such an environment, building upon the reputation model of Allen (1984),[7] and more recently, Hörner (2002), we study two institutions that enforce contracts: a "formal" enforcement mechanism, *legal enforcement*, and an "informal" mechanism, based on *reputation*. While the formal mechanism is centralized and can administer high penalties to cheating firms, it can be corrupted by firms bribing officers in the judicial system to avoid compensating consumers. On the other hand, corruption is less of a problem in the informal mechanism, as it relies on networks of uninterested consumers connecting with one another to provide truthful information about cheating firms. However, punishment is also less effective because the highest imposable penalty consists of not buying from cheating firms. In this setting we study how the performance of the institutions affect one another, and the market price and how productivity shocks affect the interaction between these two institutions.

A novel feature of our approach is the co-existence of the two institutions in a market environment with large numbers of firms and consumers. Unlike bilateral exchange models studied in the literature on "relational" vs. "formal" contracts[8], it is the (collective) actions of price taking agents at the micro level that determine how these institutions function and interact. Also, we do not assume that the use of the informal mechanism necessarily implies that agents are "outside" the market: hence, the institutional interaction does not depend on scale effects on the formal institution arising from the participation of agents in the informal one.[9]

[6]Shocks can be interpreted differently depending on the context, examples are physical shocks (e.g. electricity shortages, transportation difficulties, unskilled labor), socio-political (e.g. crime and corruption), or stemming from policy uncertainty. In fact, a growing body of literature documents how policy uncertainty is a serious concern for businesses in developing countries. See, for instance, Hallward-Driemeier and Stewart (2004), World Bank (2005), and The Economist Intelligence Unit (2005).

[7]See also Klein and Leffler (1981), Shapiro (1983) and Kranton (2003).

[8]For example, Sobel (2006).

[9]This feature is in contrast to Kranton (1996) or Kali (1999), which assume that the use of one institution precludes the use of the other. Both papers are based on scale effects, and show how the numbers of people using reciprocal exchange or the monetary market exchange can affect the

Institutional interaction happens instead through the *equilibrium price of goods*, as both consumers' connectedness decisions, and firms' bribing decisions influence and are influenced by equilibrium prices.

Our results only partly confirm the common belief that formal and informal institutions substitute each other in this competitive market setting. On the one hand, consistent with the view that informal enforcement arrangements arise when formal institutions work poorly, we find that *poorly functioning legal institutions, by increasing the price of high quality goods, provide consumers higher incentives to build informal enforcement networks.* On the other hand, however, we find that *well-performing informal enforcement networks, by lowering the price of goods, improve legal efficiency, as firms have less incentives to bribe.* This last result, although less intuitive, is consistent with the analyses of Putnam *et al.* (1993) and Knack and Keefer (1997), who find a positive relationship between social capital (interpreted, however, as *trust*), institutional quality, and economic performance. Consistently with the literature showing how product specialization is affected by the lack of well functioning legal systems (for example Levchenko (2004), Nunn (2007))[10] – we generate an analogous result where market price is higher conditional on the same product quality when legal systems do not function well.

To conclude, we study how the equilibrium institutional mix is affected by the reliability of the economic environment, measured by the frequency of bad productivity shocks. In the model, shocks prevent firms from delivering a high quality good, and, *ceteris paribus* (that is, by holding the effectiveness of the alternative institution constant), when the frequency of bad productivity shocks decreases (i.e., the production process becomes more reliable) firms bribe less, and consumers connect less with one another. Nonetheless, when we let institutions interact through prices, firms' bribing may *a priori* not decrease anymore under more reliable production processes, as bribing relates positively to the price of goods, which has an ambiguous behavior. In accordance with common wisdom, however, we demonstrate that up to a certain threshold the strong effect of improved reliability on production costs lowers equilibrium prices. Therefore – up to a certain reliability threshold – improvements in the reliability of the economic environment are associated with a decrease in the use of informal enforcement, lower prices, less bribing and higher

functioning of each institution. Similarly, Li (1999) shows how self governance (reputation based informal mechanism) is a diminishing returns system optimal on a small scale compared to the formal legal system, which is an increasing returns system.

[10]Tabellini (2007) uses another parameter *trust and respect* (which substitutes for legal enforcement) as the independent variable to explain specialization in contract intensive sectors.

consumer welfare.

Overall, our analysis demonstrates the relevance of fundamental market characteristics (captured in our model as the price) as potential channels of institutional interaction. One striking implication of our model is that *ceteris paribus* more concentrated markets are associated with worse functioning legal institutions and better informal institutions (via higher market prices). The analysis also extends to specific sectors of the economy where verifiability is an issue, and explains the differential performance of formal and informal contract enforcement across sectors.

The paper is organized as follows. Section 2 presents the basic model assuming *exogenous* institutions. Section 3 endogenizes connectedness and legal efficiency, and Section 4 concludes.

2 Contract Enforcement under Imperfect Institutions

The model is closely related to Allen (1984) and Hörner (2002) when institutions are exogenous. The economy consists of overlapping generations of consumers, each of measure one, and of firms producing a homogenous good of variable quality. Consumers live for two periods. In the first period (young consumers) they choose whether to buy the good in the market or not. In the second period the only role of old consumers is to provide information to young consumers. In what follows we focus only on young consumers.[11] At each period firms can choose to provide high or low effort. If they choose low effort they produce a low quality good which is costless, while if they put in high effort they produce a high quality good with marginal costs c. Firms are also subject to an exogenous "bad" productivity shock that happens with probability $1-\vartheta$, in which case the good becomes of low quality. Our uncertainty variable $1-\vartheta$ captures in a simple way production uncertainty faced by firms, such as problems related to infrastructure, regulation uncertainty, or the prevalence of an unreliable labor force, which reduce the probability of high quality task completion. As in Kremer (1993) we say that countries (sectors) with a higher parameter ϑ are more developed.

Quality is unobservable to consumers until after they have bought the good, and consumers cannot observe if low quality is due to a bad productivity shock, or due to the firm's decision to produce low quality. Shocks are persistent[12], and when

[11] Our model captures the situation in a market where purchases are rare: e.g. surgery or buying a house.

[12] See the next section for a discussion of this assumption.

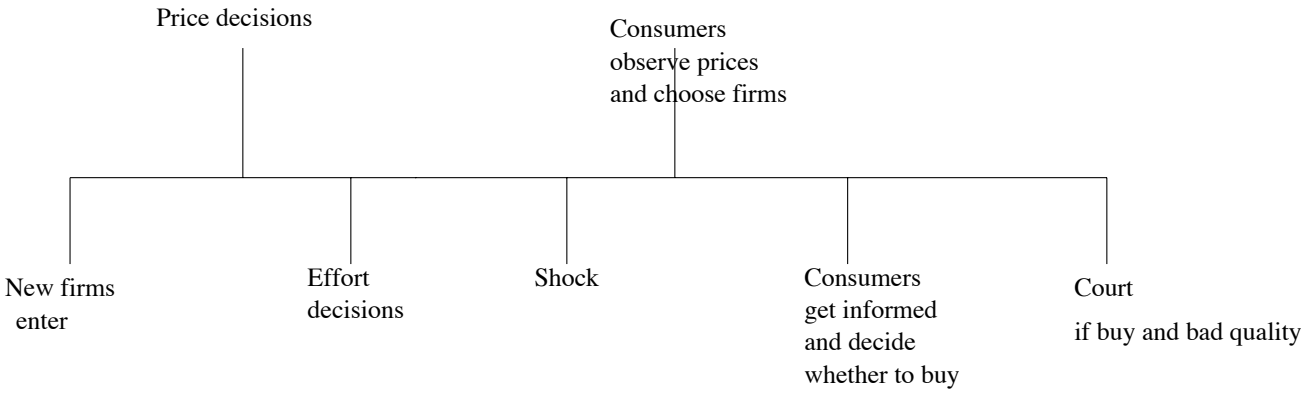

Figure 1: Timing of the stage game.

a firm has faced a bad productivity shock it stops producing high quality forever: hence, consumers face both moral hazard and adverse selection problems. To avoid repetitions, we will call firms that have always produced good quality in the past "good" firms, and firms that have produced bad quality at least once "bad" firms.

Consumers need to buy one unit of the good each period, and derive utility $U(p) = \overline{U} - p$ from high quality, and utility $0 - p$ from low quality. The maximum price consumers are willing to pay for high quality is thus $\overline{p} = \overline{U}$, while consumers are not willing to spend money on low quality. However, consumers who decide not to buy from a firm have to give up on purchasing the good. Notice that consumers do not know why a given firm did not produce good quality in the past.

Figure 1 shows the timing of the stage game: Notice that the figure does not show the incompleteness of information in the stage game, which occurs as consumers do not observe quality before the purchase, but only the price. In each period there are N_t new firms entering the market and investing a sunk cost of T units in building capacity. The sunk cost allows them to produce up to one unit of output per period (i.e. we normalize everything by the total demand), and the number N_t of firms that enter the market in each period is such that entrants face zero expected profits.[13] Next, all firms choose prices and then effort levels simultaneously, after which shocks are realized and firms produce either high or low quality. Effort is not observed (and is not verifiable) nor is the quality at the time of purchase (though it is verifiable).

[13]We depart therefore from conventional models of reputation (see, among others, Klein and Leffler, 1982, Shapiro, 1983, Allen, 1984, and Kranton, 2003): as in Hörner (2002), we introduce *shocks*.

Consumers observe prices, go randomly to a firm posting a price[14] at which they wish to buy the good, get informed about the firm's history, and decide whether to buy the good or not. Notice that in the model consumers have no possibility to stay with a firm since each firm-young consumer pair meets only once. Finally, after all transactions have occurred, each firm faces an exogenous probability of closure $(1-\delta)$.[15]

In each period t, N_t firms enter. Of these, the expected number of firms that survive is δN_t. In the steady state therefore the stock of firms $S_{t+1} = S_t = S$. This happens if the expected number of entering firms in every period is equal to the expected number exiting: $N = S(1-\delta)$. Hence the steady state stock of all firms in any period is $S = N/(1-\delta)$. In the same way the expected number of good firms in any period t is given by $\frac{N}{1-\delta\theta}$. The expected market share for each good firm is then $\frac{1-\delta\theta}{N}$: this is based on the random matching of consumers and firms.[16] To ensure zero profits with free entry, the expected profits of firms must equal T. Since expected profits depend on the expected market share of good firms, which is a function of N by the random matching assumption, this equation fixes N.

An *equilibrium* is a sequence of prices and quality choices, along with consumers buying decisions, an firm entry decisions such that consumers maximize utility given the firms strategies, new firms decide whether to enter or not, and all firms in the market choose prices and quality to maximize profits given the consumers strategies (see the Appendix for a formal discussion). Although the model leads to multiple equilibria, in what follows we restrict attention to symmetric *perfect Bayesian equilibria with Markov strategies* that maximize consumers' payoff.[17] The choice of looking at strategies maximizing consumers' payoff is based on the desire to find the

[14]This implies in particular, that if we treat the mass of consumers as a single consumer who demands one unit, then he is indifferent between all firms posting the lowest incentive compatible price. Hence he employs a mixed strategy of choosing among them with an equal probability. Alternatively, treating consumers as a continuum this means an equal market share among all firms posting the lowest incentive compatible price.

[15]Hence firms do not voluntarily choose to exit the market. This assumption can be justified if the fixed costs of setting up an alternative business are very high. This assumption is made for tractability but it is easy to make the probability of closure higher for good firms than for bad firms. This would make the market share for good firms a function of Q as well in the steady state.

[16]Notice that while consumers are a continuum, the number of firms is finite. Hence though each firm has the capacity to produce "1 unit" this unit is equivalent to producing enough to satisfy all the market demand. If both were finite and there were $M < S$ consumers, each firm could produce M units with sunk costs of T because it is possible that one firm gets all the consumers but in expected terms would be able to sell only $\frac{M}{S}$ units. This is equivalent to our focus on expected market share.

[17]See the next section for a justification of this assumption.

best equilibrium outcome for consumers for a given level of reliability. Consumers' best reaction is to stop buying from *any* firm delivering low quality, since - given a high effort equilibrium and persistent shocks - firms that produce low quality today will always produce low quality.

We then consider two institutions that can induce firms to produce high quality: *reputation* and *legal enforcement*. Reputation works through the interaction of consumers and firms in the market, while legal enforcement works through the reimbursement of consumers who go to court after having experienced bad quality. We denote by φ_j the probability that firm j has to reimburse consumers if it delivers low quality, and by $\Phi = \int \varphi_j dj$ the average level of legal efficiency in society (we assume therefore that *ex-post* quality could be verifiable by uncorrupt courts). Similarly, we denote by q_i the probability that consumer i is informed about the firm she is trading with, and refer to the average level of information in society $Q = \int q_i di$ as *connectedness*, because consumers need to "connect" to other (old) consumers to be informed about bad firms. In this section we assume q_i and φ_j to be exogenous and equal across people and firms, so that $q_i = Q, \varphi_j = \Phi$. Finally, we consider a situation where $\overline{U}$ is sufficiently high so that consumers always prefer firms producing high quality. The expected utility of consumer i in each period is thus equal to:

$$U_i = \frac{1-\delta}{1-\delta\vartheta}\left\{\vartheta\overline{U} - (1-\Phi(1-\vartheta))p\right\} - \frac{\delta(1-\vartheta)}{1-\delta\vartheta}(1-q_i)(1-\Phi)p \qquad (1)$$

Equation (1) reads as follows. The variable p is the price of the good, and $\frac{1-\delta}{1-\delta\vartheta}$ is the share of good firms in the economy. Good firms have then a bad shock in the current period with probability $1-\vartheta$, in which case the consumer gets utility $0-(1-\Phi)p$ as she will be reimbursed with probability Φ. Therefore, conditional on meeting a good firm, each consumer has a utility equal to $\vartheta(\overline{U}-p) - (1-\vartheta)(1-\Phi)p = \vartheta\overline{U} - (1-\Phi(1-\vartheta))p$. Similarly, consumer i meets a bad firm with probability $\frac{\delta(1-\vartheta)}{1-\delta\vartheta}$. If she is informed (which happens with probability q_i), she does not buy from that firm and gets utility $U=0$, while if she is uninformed (which happens with probability $1-q_i$), she buys at price p and is reimbursed with probability $(1-\Phi)$.

Notice that consumers' welfare is maximized when p is minimized, and that price competition between firms guarantees that the equilibrium price is the lowest stationary price that is compatible with high quality. We now derive the lowest

incentive compatible price under which firms deliver high quality. Given a price p, the expected payoff of a good firm j from always putting in high effort is:

$$V_j^H = (1 - \varphi_j(1-\vartheta))px_H - c \cdot x_H + \frac{\delta}{R}\left\{\vartheta V_j^H + (1-\vartheta)V_j^B\right\} \tag{2}$$

where $x_H = (1-\delta)/N$ represents the share of consumers per firm; the first term in (2) comprises the likelihood that even if firms produce high quality, they may suffer a bad shock with probability $1-\vartheta$, in which case they have to reimburse consumers with probability φ_j; $1/R$ is the discount rate; the second term in (2) is the continuation value (which depends on whether firms faced a good or bad shock); and $V_j^B = R(1-\varphi_j)px_L/(R-\delta)$ represents the discounted profits of a bad firm facing judicial efficiency φ_j, where $x_L = (1-Q)x_H$ represents the share of *uninformed* consumers that buy from bad firms.[18]

On the other hand, if firm j shirks, it faces an expected payoff equal to $V_j^L = (1-\varphi_j)px_H + (\delta/R)V_j^B$, as in the first period all consumers will be uninformed – so that the firm will be able to capture a high market share – but subsequently, even if it did not face a bad shock, the firm will be seen by consumers as a bad one. In order to sustain high quality we must have that $V_j^H \geq V_j^L$. Thus, as $q_i = Q$ and $\varphi_j = \Phi$ are equal across agents and firms, high quality equilibria are sustainable only if:

$$p(\vartheta, \Phi, Q) \geq \frac{Rx_H}{\delta(1-\Phi)(x_H - x_L) + R\Phi x_H}\frac{c}{\vartheta} \tag{3}$$

We call inequality (3) the *No Milking Condition* (see Shapiro, 1983, and Allen, 1984), and the lowest price that satisfies condition (3) the *No Milking Price* $p^{NM}(\vartheta, \Phi, Q)$. The no milking condition shows that sustaining high effort requires a "carrot and stick" strategy: in order to be able to reward firms for high effort, price must be above marginal costs (the carrot); on the other hand, consumers must also punish shirking firms by boycotting them (the stick). Notice that the no milking price p^{NM} has two components: the *marginal cost* component c/ϑ, and the *markup* component (represented by the first fraction in (3)). The markup is required to sustain high quality when legal enforcement is less than perfect, and decreases with the efficiency

[18] Equation (2) implicitly assumes that informed consumers stop buying from a bad firm independent from winning or losing in court, as in a high quality equilibrium firms deliver bad quality only if they have been hit by a bad shock.

of either institution:[19]

PROPOSITION 1 *p^{NM} is the lowest stationary price that can be achieved as the outcome of a Perfect Bayesian equilibrium where no firm shirks. Moreover, $\partial p^{NM}/\partial Q < 0$, and $\partial p^{NM}/\partial \Phi < 0$.*

In the Appendix we describe strategies and beliefs that support the high quality equilibrium with firms pricing at p^{NM}. Notice that p^{NM} is the most plausible stationary outcome, as competition between firms and free entry ensure that stationary equilibria with prices higher than p^{NM} are not chosen. Moreover, if firms were to price lower than p^{NM} consumers' beliefs are that they are buying low quality. Thus, any firm that prices lower than p^{NM} will get no market share , so that there are no stationary separating equilibria in our model.

Observe that in reputational equilibria (i.e., $\Phi < 1$) firms overinvest in capacity. This is because firms need to price above marginal costs to have the incentives to produce high quality, but because of the free entry of firms, all firms' profits translate into excess capacity ($x_H < 1$). Notice, also, that at high levels of institutional efficiency Φ, Q, firms' participation constraint can be violated, as firms cannot recover their sunk costs even under full capacity production $x_H = 1$. Therefore, if Φ, Q are too high, consumers and firms need to coordinate on a price *above* p^{NM}. However, we do not discuss this case (see Esfahani, 1991).

Discussion of the Modeling Assumptions

Our repeat purchase mechanism model is set up to capture in a simple way the impact of legal enforcement and consumer connectedness on the incentive compatible price. We need both moral hazard and adverse selection in the model. We need moral hazard because we want to capture the differential effect of the level of development ϑ on firms' incentives to put in high effort. But we also need adverse selection (i.e., shock persistence), since without shock persistence the past would not provide information about the present, and no consumer would have private incentives to get informed. We can interpret a persistent shock as e.g. a huge loss of reputation

[19] Also observe that $\lim_{\Phi \to 1} p^{NM} = \frac{c}{\vartheta}$, while $\lim_{Q \to 1} p^{NM} > \frac{c}{\vartheta}$. Therefore, abstracting from the costs of setting up either institution, and from the firms' participation constraint, our model suggests that legal enforcement can in principle achieve higher consumer welfare.

that causes the firm to be unable to get informed consumers as customers for a very long time, so that it has no incentives to put in high effort.

Free entry, sunk costs, and an exogenous survival rate, ensures a competitive, stationary equilibrium with a *constant share of bad and good firms*. Finally, random matching between surviving firms and consumers ensures that the (stationary) punishment for bad quality only comes from the lower market share faced by bad firms. This captures the features of a market (e.g. surgeries, real estate) where purchases are made rarely so that the role of old consumers is only to provide information to new consumers.

In our model we allow consumers to make use of both formal and informal institutions: there is no explicit cost to going to courts. We do this because our focus is on the *performance* of institutions and on how the interaction influences the performance of each. Allowing consumers to choose should then imply that the use of the formal mechanism only occurs when the performance is sufficiently high to compensate for the costs. There are no externalities in our model that occur because of more people using one mechanism or the other: scale effects are ruled out. Kranton (1996), Kali (1999), and Li (1999) are all models based on scale effects.

A possible objection to our model arises from the assumption we make that firms cannot use any other strategy except bribing judicial officials. For example, firms could possibly make out of court settlements with consumers to prevent loss of reputation. Alternatively, firms might offer warranties. First of all, while this may be a realistic depiction in developed countries, it is rare to see warranties in markets of the type we are interested in: real estate, health services etc. Secondly, notice that this can happen only if the firm produced bad quality as consumers go to court conditional on bad quality. In this case the firm faces a loss of reputation in any case, given the persistence of shocks and equilibrium strategies, regardless of making out of court settlements or not. At this point reputation cannot be salvaged. Hence it is a dominant strategy for the firm to try to bribe and for consumers to go to court anyway (given zero costs). The persistence of shocks rules out any benefits from warranties or out of court settlements. To the extent that warranties or out of court settlements exist, should they be considered formal or informal? Our view is that they should be considered informal *if they do not rely on courts for enforcement*. In this event, firms care about honoring their warranties or out of court settlements for the same reason that they care about high quality: influencing their market share. We can then expect that both informal mechanisms influence the incentives

to bribe. Of course there can be a number of informal and formal mechanisms to solve the same problem. The basic point we make remains the same: the interaction is important, even if viewed rather as how the performance of informal institutions viewed collectively influences the functioning of formal institutions and vice versa.

The informal mechanism in our model is characterized by truthful revelation of information through connections to an informal consumer network of old consumers. As information is obtained in a *decentralized* manner, its verifiability is a minor issue, because consumers have no incentives to lie (Dixit (2003) considers instead the case of an information intermediary who can be bribed by both sides of the market). Finally, note that although our informal network is consumer based, the same analysis would hold for producer's networks in the context of intra-industry trade (Kali (1999) and Pyle (2005) provide evidence of such relational contracts between firms).

The equilibrium we focus on is a pooling (in prices) stationary equilibrium. There are no separating equilibria in this model: if a firm tries to post higher prices than p^{NM}, others can profit by offering lower prices since consumers behave as in a Bertrand game conditional on seeing an incentive compatible price. If a firm posts lower prices then maybe there could be different beliefs off the equilibrium path that lead to high quality being offered credibly with non-stationary equilibria e.g. if building market share through lower prices would lead to higher profits later on (see Horner (2002) Kranton (2003)). Since our focus is on the role of institutions we ignore non stationary equilibria for tractability of the model. No doubt having non stationary equilibria would create interesting dynamics on the evolution of institutions on top of the simple comparitive statics results of our paper. Second, there might be equilibria where consumers do not use the trigger strategy we assume or where firms collude on a higher price: these seem less plausible in our setting where repeated interaction does not occur between a firm-consumer pair but rather a series of firm-consumer pairs each of whom meet only once.

3 Reputation and Legal enforcement as Endogenous Institutions

We now let consumers invest in their own connectedness to old consumers to increase the probability with which they are informed about the firm they are trading with. Similarly, we let firms choose how much to bribe court officials to decrease the

probability of having to reimburse consumers. To be sure, a more general model would conceivably allow for consumers and firms influencing both variables Q and Φ. Nevertheless, what we want to capture here is the fact that consumers have a comparative advantage in investing in connectedness, while firms have an advantage in bribing.

We begin by describing the consumers' maximization problem. Let $m_c(i)$ denote consumer i's investment in her own connectedness. Then individual connectedness is equal to $q(m_c(i))$, where $q' > 0$, $q'' < 0$, and to exclude corner solutions we assume that q satisfies the Inada conditions $q'(0) = \infty$, $q'(\infty) = 0$.[20] In deciding how much to invest, consumers take the price p^{NM}, average connectedness Q, and judicial efficiency Φ as given, so that for constant values of ϑ, Q, Φ the consumers' maximization problem is:

$$\max_{\{m_{c,t}\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \frac{1}{R^t} \left\{ U(\vartheta, \Phi, q(m_{c,t}), p^{NM}) - m_{c,t} \right\} \tag{4}$$

Notice that each consumer faces the same maximization problem (4). Thus, *ex post* $q_i = Q$, and we can use the first order conditions of the maximization problem to characterize the average level of connectedness Q:

PROPOSITION 2 *For each (ϑ, Φ) there exists a unique level of connectedness Q resulting from the consumers' maximization problem (4). Moreover, $\partial Q/\partial \vartheta < 0$, $\partial Q/\partial \Phi < 0$, and $\partial Q/\partial p^{NM} > 0$.*

Intuitively, consumers invest in connectedness to be informed about bad firms in the market, and as ϑ increases, the share of bad firms decreases. Moreoever, the gain of an extra unit of information per firm is decreasing with the price (which also decreases with ϑ), while the marginal cost is constant. Thus, as reliability ϑ increases consumers invest less in connectedness, both because of the direct effect on the share of bad firms, and of the indirect effect on the equilibrium price p^{NM}. The same logic holds for judicial efficiency Φ, which captures the net benefits of going to court. Observe that consumers do not internalize the effect of their actions on the

[20] In a previous version we considered the case where q_i also depends on *average* investment $M_c = \int_0^1 m_c(i)di$, capturing the idea that individual connectedness increases proportionally more if other consumers also invest in their own connectedness. This adds significant algebraic burden while conveying similar results.

equilibrium price, and therefore *under-invest* in connectedness.

We now turn to firm behaviour. Firms can decrease the probability of having to reimburse consumers by bribing courts. We presume that bribing has decreasing returns, so that $\varphi'(m_f) < 0$, $\varphi''(m_f) > 0$, and we also assume that $\varphi(m_f)$ satisfies the Inada conditions, i.e. $\varphi'(0) = -\infty$, $\varphi'(\infty) = 0$. For constant values of ϑ, Φ, Q, the maximization problem of a firm that delivered low quality can then be expressed as follows:

$$\max_{m_f}(1 - \varphi(m_f))p^{NM}x - m_f x \tag{5}$$

Notice that firms bribe the court *after* a case has been brought against them, so that $x = x^{L,H}$. Using the first order condition of (5), we can characterize judicial efficiency Φ as follows:

PROPOSITION 3 *Let $\varphi(m_f)$ satisfy $\varphi''/|\varphi'| > 1/c$. Then for each (ϑ, Q) there exists a unique level of judicial efficiency Φ resulting from the firms' maximization problem (5). Moreover, $\partial\Phi/\partial\vartheta > 0$, $\partial\Phi/\partial Q > 0$, and $\partial\Phi/\partial p^{NM} < 0$.*

Observe that in the firms' maximization problem (5), reliability ϑ and connectedness Q only enter through the market price p^{NM}. Changes in judicial efficiency Φ depend therefore on how p^{NM} varies with ϑ and Q, as when p^{NM} decreases, bad firms have lower incentives to bribe because gains are lower. Bribing, however, also has an indirect effect because it increases the equilibrium price p^{NM}, and hence firms' profits: it is to rule out this perverse effect through Φ that Proposition 3 requires the condition on $\varphi(m_f)$.[21]. Note that firms as well do not internalize the effect of their actions on the market price: in this sense, they also bribe less than what would be optimal for them.

Observe also that for both consumers and firms *all the institutional interaction happens through the market price p^{NM}*, as Q and Φ do not enter directly each side's maximization problem. In fact, any factor lowering the market price – such as lower production costs or, in a model of monopolistic competition, higher competition among firms – would affect in a similar way formal and informal institutions. The result is therefore worth mentioning independently:

[21] A similar effect also acts on consumers' investment decisions in connectedness $q(m_{c,t})$, but for consumers the indirect effect has the "right" sign

PROPOSITION 4 *Everything else being equal, a decrease in the market price p^{NM} reduces firms' bribing (increases Φ), and lowers consumers connectedness, Q.*

Under asymmetric information, the incentive compatible price is therefore key in determining equilibrium levels of bribing and connectedness. If the market price remains high, consumers have high incentives to connect because they suffer high losses when they meet a bad performing firm, and firms find it more profitable to bribe. The result of Proposition 4 is also consistent with the observed empirical relationship between competition and corruption (see Ades and di Tella, 1999), although it provides a complementary explanation through the market price. Our paper, however, pushes the analysis further by looking in addition at how institutions affect one another via the market price, and at how development – measured by a reliability parameter – affects the overall institutional mix.

This institutional interaction is presented in Figure 2, which shows the consumers' and firms' reaction functions $Q_C(\Phi), Q_F(\Phi)$. Note that the reaction functions are monotonic and opposite in slope, hence the equilibrium is unique. Moreover, an increase in reliability ϑ shifts both consumers' and firms' reaction functions downwards, so that connectedness Q unambiguously decreases with reliability ϑ. In contrast, the effect of changes in reliability ϑ on judicial efficiency Φ remains *a priori* ambiguous, as whether judicial efficiency Φ increases or decreases with ϑ depends on whether the firms' reaction curve Q_F is more or less elastic than the consumers' reaction curve Q_C. At low levels of reliability, however, Q_F is more elastic than Q_C, so that bribing also decreases with ϑ:

PROPOSITION 5

1. *Equilibrium connectedness always decreases with the reliability of the production process.*

2. *There exists a threshold $\overline{\vartheta}$ such that judicial efficiency improves with reliability ϑ for $\vartheta < \overline{\vartheta}$.*

The intuition behind Proposition 5 shows the relevance of the market price p^{NM} in determining the institutional interaction. When reliability ϑ increases, there is a first, direct effect lowering connectedness Q via lower marginal costs and an increase in the share of good firms. As this direct effect is the only exogenous driver of the

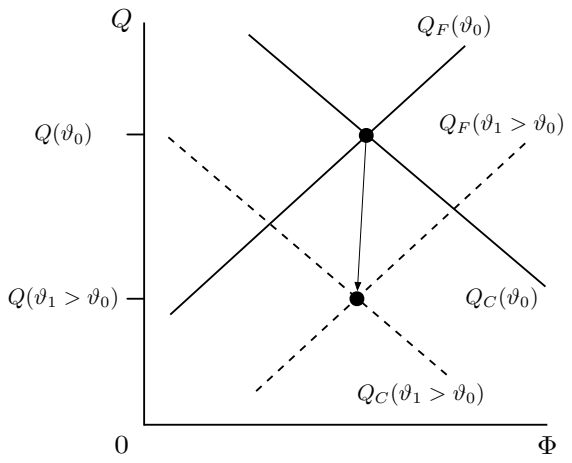

Figure 2: Equilibrium levels of connectedness and of judicial efficiency.

change in institutional mix, connectedness Q unambiguously decreases with higher reliability ϑ. On the other hand, reliability does not affect directly judicial efficiency. Therefore, how judicial efficiency reacts to increases in reliability depends only on the behavior of the equilibrium price p^{NM}, on which two opposing forces act: lower marginal costs c/ϑ that decrease p^{NM}, and lower connectedness Q that increases it. As marginal costs behave as $\sim 1/\vartheta$, at low levels of reliability they dominate the behavior of p^{NM}, and judicial efficiency Φ improves with ϑ. Instead, at higher levels of reliability both effects become of similar magnitude, and the behavior of p^{NM} and Φ becomes ambiguous (see Figure 3).

4 Conclusions

This paper contributes to the literature on the endogenous determination of institutions by endogenizing their mutual interaction in a competitive setting, and by demonstrating a new channel – the market price – through which development can affect institutions. Results are only partly consistent with the common belief that formal and informal institutions substitute one another: when legal enforcement works poorly, consumers invest more in connecting with other consumers to enhance contract enforcement via the reputation mechanism; on the other hand, however, better informal enforcement *improves* legal enforcement because it reduces firms' incentives to bribe. Along the development path, the model demonstrates – up to

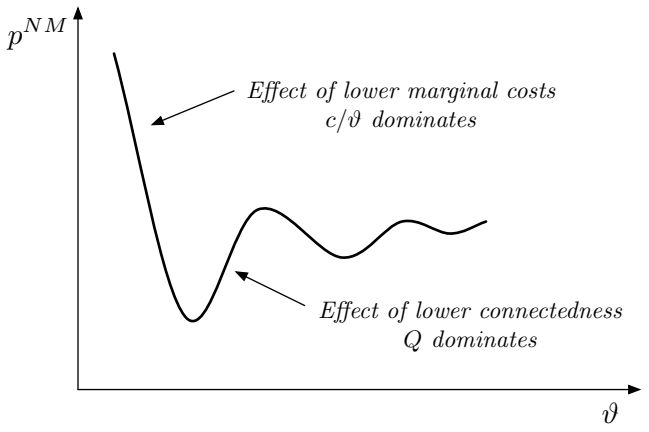

Figure 3: EquilibriumPrice

a certain threshold – a decrease in bribing and in the use of informal enforcement, and explains it via improvements in the reliability of the economic environment.

In the Indian real estate market there is huge scope for opportunistic behavior by brokers, relative to other markets for durable goods. In this market the salient mechanisms are the two we discussed in the paper: word-of-mouth built reputation and the legal system. It is characterized by a high degree of corruption both in the use of the legal system (and limited use of it) as well as of the government agencies that deal with real estate: Indeed in Delhi, the government agency responsible for overseeing registrations of properties (the Delhi Development Authority) is also involved with direct sales and is notorious for its high fraction of corrupt officials. This suggests that the results of our stylized model might be borne out by a well designed empirical study of this sector compared with other sectors or with the same sector in more developed countries.A natural extension of the model would let institutions affect reliability, thus providing a simultaneous determination of the institutional mix, and economic growth. We leave both of these extensions to future work.

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Appendix

The stage game is as follows. At period t there are N^t firms that simultaneously post prices $P^t = (p_j^t)_{j\in[0,N^t]}$, and then decide whether to produce the high or the low quality good, so that $g_j^t = (H, L)$ for good firms, and $g_j^t = L$ for bad firms. Consumers $i \in [0, 1]$ observe the vector of prices P^t in the market, go to a firm j, and decide whether to buy ($a_i^t = B_j$) or not to buy ($a_i^t = NB_j$). We assume that once consumers have bought the good they can observe the quality perfectly. Thus the stage payoff to consumers at the end of the period is equal to $\overline{U} - p_j^t$ if they bought the good and the quality is good, 0 if they did not buy any good, while if quality is bad they get $-p_j^t$. On the other hand, the payoff to firm j is equal to $(p_j^t - c) \cdot x_j^t$ if it produces the high quality good and x_j^t consumers bought it, and to $p_j^t \cdot x_j^t$ if it produces the bad quality good. Payoffs to firms and consumers in the game as a whole correspond to the discounted sum of payoffs in each period. The game is repeated over an infinite horizon, so that a *history* h^t at period t is a sequence of quality and price vectors $(G^0, P^0); \ldots; (G^{t-1}, P^{t-1})$, where $G^t = (g_j^t, x_j^t)_{j\in[0,N^t]}$, and of consumer actions $(a_i^0); \ldots; (a_i^{t-1})$. Finally, consumers' information sets at time t are defined by all price combinations $\Pi^t = (p_j \in [0, \bar{p}])_{j\in[0,N^t]}$ for each possible history h^t, which for simplicity we refer to a consumer's information set as (P, h^t).

Proof of Proposition 1

Without loss of generality we only consider the case where $Q = 1$. The Markov strategies and beliefs that achieve p^{NM} as the outcome of a perfect Bayesian equilibrium are the following:

Firms' Strategy. New firms enter as long as expected profits net of sunk costs are positive. Bad firms always produce bad quality and price at p^{NM}. Good firms have the following strategy:

1. *If* $p_j^t \geq p^{NM}$*, put in high effort.*
2. *If* $p_j^t < p^{NM}$ *put in low effort.*
3. *Set* $p_j^t = p^{NM}$*, regardless of history.*

Consumers' Strategy

1. *Do not buy if* $\max\ p_j^t < p^{NM}$.
2. *Match randomly among firms posting a price equal to* $\min\left(p_j^t | p_j^t \geq p^{NM}\right)$.
3. *If a firm has produced bad quality in* $t-1$*, do not buy.*

Consumers' Beliefs:

1. *If* $p_j^t < p^{NM}$ *then the firm has produced bad quality with probability one.*

2. *If $p_j^t \geq p^{NM}$ then the firm has put in high effort and the probability of getting good quality is ϑ, as long as the previous history did not have bad quality.*

3. *If a firm has produced bad quality in period $t-1$ then it will always produce bad quality.*

It is easy to prove that this strategy profile represents a Nash equilibrium. Notice that firms never face a non-trivial information set, since, given the consumers' strategies, incomplete information about other firms' types does not influence payoffs. Hence, the only imperfect information comes from the simultaneous price game, and it is sufficient to look for subgame perfection in firms' strategies. Consider any subgame off the equilibrium path where prices of some firms are lower or higher than p^{NM} regardless of quality history, or where consumers do not follow their equilibrium strategies. Given consumers strategies in the continuation game, the best response is obviously to price at p^{NM} and put in high effort as long as there is no bad shock. Moreover, if consumers buy at a price lower then p^{NM} they believe that they will get bad quality, and this belief is consistent with firms strategies. Given the permanence of shocks and equilibrium strategies of firms, if a firm produces bad quality once the best response is never to buy from this firm again. Finally, assume that that there exist a stationary price $\tilde{p} < p^{NM}$ under which firms put high effort. The no milking condition (3) ensures that, given other firms strategies and consumer's strategies, a firm charging $\tilde{p}$ would strictly prefer to cheat in every period.
End of Proof.

Proof of Proposition 2
Since $q(m_c)$ satisfies the Inada conditions the solution of the maximization problem lies in $m_{c,t} \in (0, \infty)$, and we can use the first order conditions of the maximization problem to characterize the optimal investment $m^*_{c,t}$. Notice that utility is maximized when $m_{c,t}$ maximizes the per period utility. Notice, also, that each consumer faces the same first order conditions, and that in equilibrium $Q \equiv q_i$, so that connectedness is characterized by the following first order condition:

$$G \equiv \frac{\delta(1-\vartheta)}{1-\delta\vartheta}(1-\Phi) \cdot p(\vartheta, \Phi, q(m_c))q'(m_c) = 1 \tag{6}$$

where $p = p^{NM}$. By the implicit function theorem the following then holds:

$$\begin{aligned}
\frac{\partial G}{\partial m_c} &= \frac{\delta(1-\vartheta)}{1-\delta\vartheta}(1-\Phi)\cdot\left\{\frac{\partial p}{\partial q}\left(\frac{dq}{dm_c}\right)^2 + p\frac{d^2q}{dm_c^2}\right\} < 0 \qquad (7)\\
\frac{\partial G}{\partial \Phi} &= \frac{dq}{dm_c}\frac{\delta(1-\vartheta)}{1-\delta\vartheta}\left\{-p + (1-\Phi)\frac{\partial p}{\partial \Phi}\right\} < 0\\
\frac{\partial G}{\partial \vartheta} &= -\frac{\delta(1-\Phi)}{1-\delta\vartheta}\frac{dq}{dm_c}\frac{1-2\delta\vartheta+\delta\vartheta^2}{\vartheta(1-\delta\vartheta)}p < 0
\end{aligned}$$

where $1-2\delta\vartheta+\delta\vartheta^2$ is minimized for $\vartheta = 1$, so that $\partial G/\partial\vartheta < 0$. By the implicit function theorem we then have that $\partial m_c/\partial\Phi = -G_\Phi/G_{m_c} < 0$, and that $\partial m_c/\partial\vartheta = -G_\vartheta/G_{m_c} < 0$. The fact that $\partial G/\partial m_c < 0$ ensures that there is a unique equilibrium. Recall that $\frac{\partial q}{\partial m_c} = q' > 0$. Hence, $\frac{\partial q}{\partial \Phi} = q'\frac{\partial m_c}{\partial \Phi} = -q'G_\Phi/G_{m_c} < 0$, and $\partial q/\partial\vartheta = -q'G_\vartheta/G_{m_c} < 0$.

It is obvious from expression (4) that $\partial Q/\partial p^{NM} > 0$.

End of Proof.

Proof of Proposition 3

The firms' first order conditions are equal to: $-\varphi'(m_f) = 1/p^{NM}$. The aggregate firms' implicit function is therefore equal to:

$$F \equiv \Phi'(m_f) + \frac{\delta(1-\Phi)Q + R\Phi}{R}\frac{\vartheta}{c} = 0 \qquad (8)$$

Under the Inada conditions there exists then a unique solution $m_f \in (0,\infty)$ to equation (8). The partial derivatives are then equal to:

$$\begin{aligned}
\frac{\partial F}{\partial Q} &= \frac{\delta\vartheta(1-\Phi)}{Rc} > 0 \qquad (9)\\
\frac{\partial F}{\partial \vartheta} &= \frac{\delta(1-\Phi)Q + R\Phi}{Rc} > 0\\
\frac{\partial F}{\partial m_f} &= \Phi''(m_f) + \Phi'(m_f)\frac{\vartheta(R-\delta Q)}{Rc} > \Phi'' - \frac{|\Phi'|}{c} > 0
\end{aligned}$$

where the last inequality holds for $\Phi''/|\Phi'| > 1/c$. Using the implicit function theorem we then have that $\partial\Phi/\partial Q = -\Phi' F_Q/F_{m_f} > 0$, and that $\partial\Phi/\partial\vartheta = -\Phi' F_\vartheta/F_{m_f} > 0$.

It is obvious from expression (4) that $\partial\Phi/\partial p^{NM} < 0$.

End of Proof.

Proof of Proposition 5

The partial derivative of the consumers' reaction function Q_C is as follows:

$$\frac{\partial Q_C}{\partial \vartheta} = -\frac{1-\delta\vartheta(2-\vartheta)}{\vartheta(1-\vartheta)(1-\delta\vartheta)} \frac{1}{\frac{\delta(1-\Phi)}{\delta(1-\Phi)Q+R\Phi} + |q''| / (q')^2} \tag{10}$$

where $\partial p^{NM}/\partial Q = -p^{NM}\delta(1-\Phi)/(\delta(1-\Phi)Q + R\Phi)$. Rewriting judicial efficiency as $\Phi_F(Q_F(\Phi,\vartheta),\vartheta)$, notice that $\Phi_F(Q_F(\Phi,\vartheta),\vartheta) - \Phi = 0$. Thus, using the implicit function theorem we have that $\partial Q_F/\partial\vartheta = -(\partial\Phi_F/\partial\vartheta)/(\partial\Phi_F/\partial Q_F)$, which implies that:

$$\frac{\partial Q_F}{\partial \vartheta} = -\frac{\delta(1-\Phi)Q + R\Phi}{\delta\vartheta(1-\Phi)} \tag{11}$$

In equilibrium we also have that $Q_F(\Phi^*,\vartheta) = Q_C(\Phi^*,\vartheta)$. Define therefore $D \equiv Q_F(\Phi^*,\vartheta) - Q_C(\Phi^*,\vartheta)$: as in equilibrium $D = 0$, we can use the Implicit Function Theorem again to compute $d\Phi^*/d\vartheta$ as follows:

$$\frac{d\Phi^*}{d\vartheta} = -\frac{\frac{\partial Q_F}{\partial\vartheta} - \frac{\partial Q_C}{\partial\vartheta}}{\frac{\partial Q_F}{\partial\Phi} - \frac{\partial Q_C}{\partial\Phi}} \tag{12}$$

Since $\frac{\partial Q_F}{\partial\Phi} > 0$ and $\frac{\partial Q_C}{\partial\Phi} < 0$, the denominator is always positive. Hence the sign of (12) depends on the numerator. Since $\partial Q_F/\partial\vartheta = -(\partial\Phi_F/\partial\vartheta)/(\partial\Phi_F/\partial Q_F) < 0$, $\partial Q_C/\partial\vartheta < 0$, the sign of $d\Phi^*/d\vartheta$ depends on whether $|\partial Q_F/\partial\vartheta| \gtrless |\partial Q_C/\partial\vartheta|$. Hence, judicial efficiency increases if and only if:

$$\frac{1}{\delta(1-\Phi)} > \frac{1-\delta\vartheta(2-\vartheta)}{(1-\vartheta)(1-\delta\vartheta)} \frac{1}{\delta(1-\Phi) + C\xi} \tag{13}$$

where $C = \delta(1-\Phi)Q + R\Phi$, and $\xi = |q''| / (q')^2$. For $\vartheta \to 0$ the inequality (13) is always satisfied, while for $\vartheta = 1$ the inequality is never satisfied, so that there exists a threshold $\overline{\vartheta}$ below which judicial efficiency increases with ϑ. Finally, Figure 2 shows that when ϑ increases, connectedness Q decreases.

End of Proof.