

ON CORRUPTION AND INSTITUTIONS IN DECENTRALISED ECONOMIES

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ABSTRACT. This paper studies opportunistic behaviour in a model of decentralised economic exchange and inadequate institutional framework of formal contract enforcement. It is shown that (i) when the number of cheating traders is sufficiently large, inadequate institutions (e.g., due to insufficient legal provisions and/or ineffective enforcement of existing laws) result in a loss of decentralised trading contracts which suggests yet another explanation of the output fall puzzle of the recent transition experience; (ii) while being necessary for the attainment of a Pareto optimal outcome, an adequate institutional framework may not be sufficient if traders *perceive* it as inadequate; and (iii) in the presence of adequate institutional framework, even if enforcers are corrupt contractual breach is deterred when enforcers enjoy strong bargaining power. The results suggest that institutions of formal contract enforcement have a first order effect on the success of liberalisation in the economy with a high level of corruption.

KEYWORDS: Formal contract enforcement, corruption, transition economies.

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'We are being asked to solve complex equations in multiple unknowns without so much as a multiplication table to guide us.'
Veniamin Iakovlev, Chairman of the Higher Commercial Court of the Russian Federation.¹

1 Introduction

This paper puts forward a simple framework for analysing the impact of institutions on the implementation of reforms in the formerly planned economies of Eastern Europe. The institution under study is formal contract enforcement which is widely regarded as an important ingredient of well-functioning markets. In the model I construct, an economic exchange is subject to opportunistic behaviour and may be undertaken in one of two sectors, labelled as 'state' and 'market'. The two sectors differ in their trading potential as well as the effectiveness of contract enforcement. Trade in the state sector is less efficient than in the market (when measured in terms of an achievable trade surplus), but the state contract enforcement is more effective in curtailing opportunistic behaviour. In contrast, the market sector is able to deliver a higher trade surplus, but due to the less effective deterrence of opportunistic behaviour, the higher trade surplus may fail to materialise.

The simple model presented here advances our understanding of salient facts about transition. Firstly, the analysis suggests that adequate institutional framework—specifically, effective contract enforcement which ensures a sufficiently high probability of punishment for contractual breach—is conducive to achieving a Pareto optimal outcome. Alternatively, inadequate formal enforcement of contracts is shown to lead to a loss of decentralised trading contracts, thus suggesting yet another explanation of the output fall puzzle observed in the initial years of post-communist transition, an explanation which emphasises informational and legal factors rather than technological ones (Blanchard and Kremer 1997, Roland and Verdier 1999). Secondly, and perhaps surprisingly, good enforcement *per se* may not be sufficient: agents' perceptions of the inadequacy of the legal system may force the reforming economy into an inferior outcome even when the level of enforcement is relatively high.

The stylised setting in this paper identifies two possible scenarios in which the perception of the inadequacy of the legal system will determine the equilibrium outcome. In the first scenario, the enforcement technology may exhibit a negative enforcement externality: the higher the proportion of non-complying agents the more difficult it is to detect non-

¹*Izvestiia*, July 3 1993, *cit op* Gustafson (1999, p. 151).

compliance. In such a case, the perception of a legal void leads to the highest level of undeterred opportunistic behaviour in the economy which, if combined with a large number of opportunists, forces honest agents to avoid the market altogether. The higher the enforcement externality, the higher the level of enforcement required to achieve a Pareto optimal outcome. For a sufficiently high enforcement externality, the perception of legal inadequacy has the most damaging effect: even the highest level of enforcement will not suffice to achieve a Pareto optimal outcome, because the fixed resources devoted to enforcement are spread too thinly for the number of non-complying agents. The enforcement externality scenario is analysed under the assumption of an exogenously fixed market contract price. An alternative scenario arises when the price is endogenously determined by the demand for market contracts in the presence of a large number of cheating contractual partners.

In this alternative scenario, asymmetric information regarding the type of a contractual partner (honest or opportunistic supplier) affects the market contract price. When one party to the contract, the buyer, believes that opportunistic behaviour in the market is rampant, the market contract price at which the buyer is willing to trade may be too low to cover the honest suppliers' cost of honouring the contract. With honest suppliers' being driven out of contracting, the market falls apart because of the buyers' certainty to be dealing with breaching suppliers. In this scenario, the celebrated lemons problem (Akerlof 1970) presents itself once again. The policy implication here is therefore evident: some of the government's reform effort in transition should be directed towards both improving the adequacy as well as the perception of adequacy of the legal system to support markets.²

Finally, observers of the transition experience agree that wide-spread, and in some cases endemic, corruption played a critical role when reform efforts in Eastern Europe were deemed unsatisfactory.³ I therefore supplement the analysis of contract enforcement in a decentralised setting with a study of corruption. The findings of this study suggest that, other things equal, a Pareto optimal outcome is more difficult to achieve when some enforcers are corruptible. In such a case, the strong enforcement of contracts must be complemented with a high enough number of honest enforcers, for the good equilibrium to exist.

²The positive correlation between the degree of success in liberalisation and a degree of adequacy of the legal framework in the Eastern European transition economies is well-documented (e.g., Rubin (1998), Gray and Hendley (1997), Borish and Noel (1996), and De Melo, Denizer, and Gelb (1996)).

³This is the grabbing-hand paradigm of the state involvement in economic activity, so coined in Frye and Shleifer (1997) and advanced in Djankov, La Porta, Lopez de Silanes, and Shleifer (2000).

The analysis also uncovers the following surprising but intuitive result: when all enforcers are corrupt and enjoy a strong bargaining power, but the enforcement institution itself is relatively effective in terms of a sufficiently high probability of breach detection, the Pareto optimal outcome exists as a unique equilibrium. In such a case, the opportunistic behaviour of suppliers is deterred because it is cheaper to honour the contract than engage in a bribing game with a corrupt enforcer. The analysis therefore suggests that strong institutions (e.g. adequate legal framework for a smooth functioning of markets) have an even greater importance in the economy with a high corruption level.⁴

The rest of the paper is organised as follows. The next section provides a discussion of the relevant literature. Section 3 introduces the model and discusses its assumptions. The analysis of the model is contained in section 4. The analysis of the benchmark case (with fixed market contract price) in subsection 4.1 is followed by the study of endogenous enforcement technology in subsection 4.2 and corruptibility of enforcers in subsection 4.3. The implications of endogenously determined market contract price are analysed in subsection 4.4. Concluding discussion is supplied in section 5, while Appendix contains all the proofs.

2 Relation to the literature

2.1 Models of centralised versus decentralised economic activity

Within the transition economics literature,⁵ two studies directly compare the functioning of centralised and decentralised economies: Roland and Verdier (1999) and Blanchard and Kremer (1997). Both are motivated by the puzzle of continuous output fall in the aftermath of liberalisation.⁶ In Blanchard and Kremer (1997), productive chains under the cen-

⁴This analysis is also of relevance to the debate about public versus private ownership. The ‘economy’ in the model could be interpreted as a sector of the economy (e.g., health or education), with a part of the sector operating in the ‘planned’ (or directed) regime and the other part operating in a free market regime. The model proposed here could therefore be useful for understanding the role of law enforcement or regulation in combatting fraud and opportunism in the provision of health care, education, and pensions.

⁵See Roland (2000) for a comprehensive summary of theoretical and applied research in the field of transition economics over the last decade.

⁶In the initial years of reforms in the Eastern European economies, the persistent and significant decline in their total output did not agree with the mainstream economics view according to which removal of state controls on prices moves the economy to a more efficient economic mode.

tralised regime possess strong technological complementarities, with each state enterprise contributing to and drawing from the production of several other enterprises. The process of inter-enterprise exchange of inputs is however characterised by inefficient bargaining (take-it-or-leave-it offers) and this causes the disruption of productive chains following price liberalisation: as the price of inputs rises the enterprise increasingly prefers to trade off a positive probability of production disruption against a lower offer of the price. Roland and Verdier (1999) offer an alternative explanation of the production lock-in and consequent output decline following liberalisation. They argue that in the context of investment specificity centralised economic activity is more potent, as compared to a decentralised regime, to cope with depreciation of capital which however may be used suboptimally. If there are search costs to finding more efficient partners, then decentralisation will lead to a break down in renewing depreciated assets and ultimately to an output fall.

The model proposed in this paper and its focus are different. The main building block of the analysis here is imperfect enforcement of contracts (rather than the degree of lock-in) and its implication for a change of the economic regime. I show that decentralisation of economic activity which goes hand-in-hand with inadequate institutions of contract enforcement increases the temptation of opportunistic agents to break their promises, and this in turn deters honest agents from pursuing beneficial market transactions. Thus the present work emphasises informational and legal rather than technological explanations for the output decline.

2.2 Opportunism and contractual breach in matching models

The framework developed in this paper involves one-to-one economy-wide contracting and thus relates to studies of opportunistic behaviour and contractual breach in matching models (Diamond and Maskin 1979, Ramey and Watson 1996). These models employ a repeated setting and additionally assume search frictions, both of which I explicitly rule out for a sharper focus on the problem of enforcement (see 2.4 below for further discussion of reasons for ruling out repeated interaction). In these models, opportunistic behaviour typically arises due to the agent's desire to pursue more profitable outside options. Assuming that contractual parties are covered by well designed breach penalties, this pursuit may be harmful for third parties because one-to-one contracting prevents other agents from contracting with a given agent once (s)he found a contractual partner, as in Diamond and Maskin

(1979). In such a case, discouraging search effort becomes desirable. Alternatively, the pursuit of more profitable outside options may be harmful because it dramatically reduces or nullifies the value of assets specific to a given contractual relationship. If additionally the incentive to invest in relation-specific assets is associated with high returns, then the policy of deterring opportunism involves reducing the market (search) frictions sufficiently, as suggested by Ramey and Watson (1996). Bearing in mind these insights, one might plausibly conjecture that an introduction of the search frictions in the present setting will exacerbate the problem of ineffective enforcement, as non-opportunistic agents will find market transactions even dearer in the presence of search costs.

2.3 Formal contract enforcement: breach remedies

The assumptions regarding contractual breach, which are utilised in the present work, draw on the insights from the literature on formal enforcement and efficient breach remedies.⁷ This literature notes that contracts provide economic agents with the opportunity to make commitments when economic interaction may be subject to opportunistic behaviour. In order to make commitments credible, breach remedies are specified either by contractual parties at the time of signing the contract, or otherwise by the courts. An observation that contractual compliance may not necessarily be socially desirable (e.g., when the ex post resolved uncertainties make the contractual value to one or both parties negative) calls for a design of efficient breach remedies. Breach remedies typically used in economic analysis are: *specific performance*, or court compelled performance; *expectation damages*, a payment that makes the victim of breach as well off as performance would have; and *reliance damages*, a payment that makes the victim as well off as if there had been no contract (Edlin 1998). The efficiency of a given breach remedy is shown, however, to depend on the specific contractual setting, particularly so when parties make relation-specific investments and contracts are incomplete.⁸ In the setting relevant to the model that is put forward in section 3, namely a unilateral relation specific investment (and assuming that contract renegotiation is possible), the existing literature suggests that both specific performance and expectation damages provide efficient investment incentives in a fixed price contract

⁷E.g., Shavell (1980, 1984, 1998), Posner (1998), and Edlin (1998).

⁸On incomplete contracts see Moore (1992), Hart and Moore (1999), and Maskin and Tirole (1999).

with a monotonic sharing rule (Edlin and Reichelstein 1996).⁹

In the model below it is assumed that the contract breach is remedied by specific performance under the centralised regime, while it is remedied by reliance damages under the decentralised regime. Two considerations justify this choice of a remedy for a given regime. Firstly, it is intuitive to expect that a regime with a high degree of centralisation would rely on commands in enforcement of contracts, as well as in undertaking the economic activity. The available evidence confirms this intuition: in a comparative analysis of use of different breach remedies in the Western (Anglo-American) market economies and the centrally planned Soviet system, Kroll (1987) suggests that specific performance was used relatively more often in the enforcement of centrally planned delivery contracts. Secondly, the choice of reliance measure as breach remedy for the decentralised setting is due in part to its tractability (it is simply ‘your money back’ measure), and in part due to the specific context of a transition economy that we have in mind here. In transition, it may be difficult for enforcers to form an unbiased estimate of the value of the contract to the victim, and thus it may be difficult to implement the expectation damages measure.

2.4 Informal contract enforcement

Since the study by Macaulay (1963), it has been noted that parties in a (contractual) relationship often substitute formal penalties for opportunistic behaviour with informal ones. A supplier who cheats his customers by delivering substandard quality today will lose future trade as the word gets out about his dishonesty (Klein and Leffler 1981). Reputation, or one’s concern for the future, is therefore the obvious channel of informal contract enforcement, and by definition requires repeated interaction and some sharing of information. Studies of reputational mechanisms in diverse settings¹⁰ suggest that both repeated interaction and information sharing requirements are crucial for the effectiveness of informal

⁹However, in a setting of bilateral relation specific investments and positive switching costs, the issue of efficiency of these two breach remedies depends on additional assumptions (Edlin and Reichelstein 1996) or may even become irrelevant (MacLeod and Malcomson 1993).

¹⁰These include infinitely repeated games with observable actions (Fudenberg 1992), varying opponents (Fudenberg and Tirole 1991, Ch. 5), and randomly matched opponents when the extent of information transmission varies (Kandori 1992, Ghosh and Ray 1996, Watson 1999); also communities with social or business norms (Ellickson 1991, Bernstein 1992, Greif 1993).

mechanisms.¹¹ Interestingly, the results of recent empirical evaluation of informal contract enforcement mechanisms in Eastern Europe and Vietnam suggest that the two requirements play an ever greater role in situations where formal enforcement does not exist (McMillan and Woodruff (1999a, 1999b)) or is inadequate (McMillan and Woodruff (2000) and Johnson, McMillan, and Woodruff (2000)).

Due to the focus on formal contract enforcement, the present setting (one-shot game in a large population) explicitly rules out reputational mechanisms to deter opportunistic behaviour. However, the results presented in sections 4.2 and 4.4 suggest that reliance on a reputational mechanism such as trust to support cooperation when formal enforcement mechanisms are ineffective may be problematic: if the prior belief of economic agents is the high probability of opportunism, then lack of formal institutions combined with lack of trust will force the economy into a bad equilibrium.¹² Because other informal mechanisms (such as loss of future business, prior information gathering in social and business networks, or community sanctions), which rely more on the repeated nature of interaction, may mitigate the problem of lack of trust, it is desirable to evaluate this prediction in an extended model allowing for repetition of the one-shot game. The analysis of the one-shot game presented here is nevertheless valuable for the following two reasons. Firstly it highlights the importance of the formal mechanism which, as some argue (Pistor 1996, Greif and Kandel 1995), is necessary for the effectiveness of informal mechanisms in transition economies.¹³ And secondly, the present model provides a useful starting point for theoretical evaluation of the relative importance of formal enforcement.

3 Model

There are two equally sized large populations of risk-neutral players: buyers and sellers. In a one shot game, a buyer and a seller negotiate a contract $(z, p(z))$ whereby the seller

¹¹In contrast, Rosenthal (1979) demonstrates that cooperation is impossible to sustain in the steady state (except for one value of the discount factor) when there is effectively no information sharing.

¹²The process of belief formation may take the form of collective reputations as in Tirole (1996).

¹³This may be so because the out-of-court settlements implicitly rely on the existence of legal standards which allow the parties to calculate and agree upon the likely outcome of litigation (Pistor 1996, p. 61), or due to extreme political and economic uncertainties that prevent economic agents from establishing a reputation-based sanctioning system (Greif and Kandel 1995, Pistor 1996, p. 57).

agrees to deliver one unit of a product embodying a specified value of a quality parameter, $z \geq 0$, and the buyer agrees to pay the price $p(z) \geq 0$ up front.¹⁴ The net value that the buyer obtains from the product is given by $U = z - p(z)$. Provision of quality costs $c(z) \geq 0$ to the seller who gains $V = p(z) - c(z)$ if the contract is agreed. Three levels of quality are considered: high ($z = \bar{z}$), mediocre ($z = \underline{z}$), and low ($z = 0$), with $\bar{z} > \underline{z} > 0$. The corresponding costs and prices are: $c(\bar{z}) = \bar{c}$, $c(\underline{z}) = \underline{c}$, $c(0) = 0$, with $\bar{c} > \underline{c} > 0$; and $p(\bar{z}) = \bar{p}$, $p(\underline{z}) = \underline{p}$, $p(0) = 0$. Also, $\bar{z} > \bar{c}$ and $\underline{z} > \underline{c}$, so that signing a contract for quality $z > 0$ is worthwhile ex ante. Each player can only sign one contract. The outside options of buyers and sellers are normalised to zero.

All buyers are homogeneous.¹⁵ The population of sellers contains two types: opportunistic in proportion $\gamma \in (0, 1)$ and honest in proportion $1 - \gamma$. The seller's type is his private information. An honest seller never fails to honour the contract (say, due to a large 'psychic' cost of breaking promises), while an opportunist chooses whether to abide by the contract depending on the extent of contract enforcement. A contract is breached if the seller fails to deliver the contracted quality.

The economy is divided into two (productive) sectors: the market (or decentralised) sector of size $\mu \in (0, 1)$, and the state (or centralised) sector of size $1 - \mu$. The assignment of a seller to a sector is random, while buyers can choose the sector in which to trade. The two sectors (subscripted m and s) are distinguished by the following two factors. Firstly, the levels of quality contractible in each sector are $z_m = \{\bar{z}, 0\}$ and $z_s = \{\underline{z}, 0\}$. The assumption captures the idea that the sellers operating in the state sector cannot beat the market sellers in the level of contractible product quality (for $z > 0$) due to, say additional costs of bureaucratic procedures on writing contracts in the state sector (or other deficiencies imposed by centralised information processing). Furthermore, $\bar{z} - \bar{c} > \underline{z} - \underline{c}$, so that (ignoring the problem of enforcement) a total trading surplus from a market contract is higher than that from a state contract.

The second factor which distinguishes the two sectors is the effectiveness of contract enforcement. This is assumed to be greater in the state sector. Again, by appealing to the centralised nature of contracting in the state sector, contract enforcement of state contracts

¹⁴A contractual breach by the buyer (i.e. non-payment upon delivery) is thus excluded from the analysis.

¹⁵It may be of interest to analyse the outcomes of the game in which the buyers have the same preference for quality but differ in terms of their purchasing ability (income).

is assumed to be perfect and any breach is remedied by *specific performance* which forces the breaching party to do exactly as the contract specifies. In contrast, market sector contracts are enforced only with some probability $\lambda \in (0, 1)$,¹⁶ and the enforcement is facilitated by *reliance damages*, $d > 0$, which stipulate a monetary payment from the breacher (seller) to the victim (buyer) such that the victim of breach is made as well off as if there had been no contract.¹⁷ Additional assumptions on the mechanism of enforcement are (i) enforcement is invoked immediately after the contractual breach has occurred, (ii) litigation costs are zero, and (iii) dispute resolution is instantaneous.¹⁸

The timing of the game is as follows.

- (1) Nature determines the type of every seller and assigns every seller to a sector.
- (2) Each buyer chooses the sector in which to purchase the product.¹⁹
- (3) A buyer and a seller negotiate a contract. If they fail to agree, then each gets his outside option of 0. If the contract $(\tilde{z}, p(\tilde{z}))$ is agreed, the buyer pays $p(\tilde{z})$.
- (4) The seller delivers the product of quality z .
- (5) If a contract breach has occurred (i.e. if $z \neq \tilde{z}$), then the contract $(\tilde{z}, p(\tilde{z}))$ is enforced as follows: specific performance is enacted with probability 1 in the state sector, or a reliance damage measure is applied with probability λ in the market sector.
- (6) Payoffs are realized.

4 Analysis

Given the sequential nature of the game, the appropriate solution method is backward induction: having determined the best strategy for the quality choice by an opportunistic

¹⁶ λ captures the situation in which the laws governing contract breach are inadequate or confusing, judiciary is unpredictable, and/or the information necessary for remedying the breach is partly verifiable.

¹⁷See Edlin (1998) for definitions and a discussion of different breach remedies.

¹⁸Assumptions (i) and (iii) are ruled out by the one-shot nature of the model. Incorporation of a positive litigation cost (relaxation of (ii)) is not expected to change the model's qualitative results.

¹⁹This could result in an excess demand for a given sector, e.g. when the market contract price is sticky. This consideration is dealt with in the analysis of section 4.1 below.

seller in each sector at stage 4, I consider the buyers' best strategy for their choice of the contract at stage 3 and their choice of the sector at stage 2 given sellers' choice at stage 4. Costly provision of quality implies that the equilibrium quality in this setting will be determined by the proportion of opportunistic sellers and the extent of the formal contract enforcement.

The benchmark case, presented in section 4.1, is analysed assuming that the market contract price for quality \bar{z} is fixed somehow between the value of \bar{z} ($= \bar{z}$) to the buyer and the cost of \bar{z} (which is given by \bar{c}) to the seller. Fixed price may arise, for instance, when sellers have 'menu-costs'. With the fixed price, the benchmark predicts that inadequate enforcement will lead to a lower welfare in the economy undergoing decentralisation. Subsequent sections introduce various modifications into the basic model of 4.1. Section 4.2 endogenises the enforcement technology in a way that introduces a negative enforcement externality. This modification leads to multiple equilibria in contrast to the uniquely determined equilibrium (of one of three different types) which is obtained in the benchmark case. The modification in section 4.3.2 allows corruption in the enforcement of market contracts: the probability of enforcement is then lower than in the benchmark case because of corruptibility of enforcers. Compared to the predictions of the benchmark case, the analysis in 4.3.2 suggests that corruption makes it harder to achieve a Pareto optimal outcome, except in one special case (when corruptible enforcers have strong bargaining power). The last modification in section 4.4 relaxes the assumption of fixed market contract price, which is maintained in sections 4.1–4.3.2, by analysing determination of the negotiated market contract price in the environment where a buyer's valuation of the market contract reflects the expected level of quality. This modification is shown to lead to multiple equilibria, which arise due to asymmetric information about market seller's type. All analysis is restricted to pure strategies.

4.1 Benchmark case

When provision of quality is costly, an opportunistic seller in either sector prefers to supply a lower level of quality than contracted upon. Perfect contract enforcement in the state sector, however, forces opportunistic sellers to abide by the contractual terms and thus guarantees that the medium level of quality \underline{z} contractible in the state sector is delivered. Consequently, perfect state contract enforcement implies that the buyer will optimally choose contract

$(\underline{z}, \underline{p})$. The payoffs to the buyer and either type of seller are:

$$U_s(\underline{z}) = \underline{z} - \underline{p} \quad \text{and} \quad V_s(\underline{z}) = \underline{p} - \underline{c}. \quad (1)$$

It is reasonable to suppose that the planner will fix the state contract price for quality \underline{z} at the level which is between the seller's cost and the buyer's valuation of quality \underline{z} :

Assumption 1 (A1)

$$\underline{c} < \underline{p} < \underline{z}.$$

Now consider contracting under imperfect market contract enforcement. Let the price in the market be fixed at some exogenous level as follows:

Assumption 2 (A2)

$$p(\bar{z}) = \hat{p}, \quad \text{and} \quad \bar{c} < \hat{p} < \bar{z}.$$

Also let $q = \{0, 1\}$ denote the probability that an opportunistic seller will comply with his contract (\bar{z}, \hat{p}) . Under the enforcement regime λ with the reliance damage measure $d = \hat{p}$, the expected payoffs to the buyer and each type of seller, superscripted by γ and $1 - \gamma$, are:

$$U_m(\bar{z}, \lambda) = [1 - \gamma(1 - q)] \cdot \bar{z} - [1 - \lambda\gamma(1 - q)] \cdot \hat{p}, \quad (2)$$

$$V_m^\gamma(\bar{z}, \lambda) = [1 - \lambda(1 - q)] \cdot \hat{p} - q \cdot \bar{c}, \quad (3)$$

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \hat{p} - \bar{c}, \quad (4)$$

if contract (\bar{z}, \hat{p}) is agreed, or 0 otherwise. In the latter case—when the buyer and the seller cannot agree on contract (\bar{z}, \hat{p}) —it is implicitly assumed that taking her outside option is more attractive to the buyer than contracting for zero quality.²⁰ In the above, q is set by the opportunistic seller so that (3) is maximised. Given the sellers' payoff-maximising value of q , the buyer expects to obtain \bar{z} in all cases except when she is matched with a breaching opportunistic seller (with probability $\gamma(1 - q)$) and she expects to pay the price \hat{p} up front unless the breached contract is enforced (with probability $\lambda\gamma(1 - q)$). An honest seller complies with his contract (\bar{z}, \hat{p}) , and thus expects the payoff given by (4). An opportunistic seller expects to retain the up front payment \hat{p} unless his breach is enforced (with probability $\lambda(1 - q)$), while he expects to incur the cost of supplying high quality

²⁰This can be justified by assuming that signing a contract involves a small cost. It is clear that an incorporation of this cost into the analysis will not change the results. Qualitatively, an interpretation of the results to come (e.g. regarding the collapse of the market when enforcement is ineffective) is the same irrespective of whether no-contracting or contracting for zero quality in the market is the preferred modelling choice.

only if he complies (with probability q). In deciding whether to contract or take her outside option when in the market sector, the buyer takes into account the sellers' optimal value of q and chooses the larger of the two payoffs: $U_m(\bar{z}, \lambda \mid q)$ or 0.

In order to analyse each buyer's equilibrium choice of a sector, I introduce the following additional notation. Let $f \in [0, 1]$ be the fraction of buyers who choose the market sector and $\beta \in [0, 1]$ be the probability that a given buyer chooses the market sector. Separate notation for the equilibrium choice of all buyers (f) as opposed to the choice of an individual buyer (β) allows to check whether an individual deviation from the equilibrium behaviour is profitable. In deciding on her choice of the sector, each buyer will attempt to go to the sector that gives her the largest expected payoff. However, the assumption of a single contract per seller implies that the success of a buyer in contracting in her preferred sector is determined by the size of the sector and the proportion of buyers who choose that sector. With the fixed market contract price, there is likely to be an excess demand for one of the two sectors. Whether the excess demand is a feature of the equilibrium in the setting with a fixed market contract price will depend on the assumption made about contracting possibilities of buyers who were not successful in obtaining a contract in their preferred sector. Formally, assume that:

Assumption 3

The buyer who is not successful in obtaining a contract in her preferred sector has the opportunity to contract in the other sector. (A3)

(A3) states that excess demand for a given sector is absorbed by the other sector. This seems to be a reasonable assumption for a setting in which the price is sticky and cannot adjust in response to excess demand. (At the end of this section I briefly discuss the implications of reversing this assumption and allowing excess demand in equilibrium.)

Assuming (A3), the buyer's problem of sector choice at stage 2 is stated as follows:

$$\max_{\beta} \left[\beta \cdot \left(\min\left\{\frac{\mu}{f}; 1\right\} \cdot \max\{0, U_m\} + \left(1 - \min\left\{\frac{\mu}{f}; 1\right\}\right) \cdot U_s \right) + \right. \\ \left. + (1 - \beta) \cdot \left(\min\left\{\frac{1 - \mu}{1 - f}; 1\right\} \cdot U_s + \left(1 - \min\left\{\frac{1 - \mu}{1 - f}; 1\right\}\right) \cdot \max\{0, U_m\} \right) \right]. \quad (5)$$

When f buyers choose the market sector, the individual choice of a buyer is determined by comparing her ex ante expected payoff from the market sector (factored by β in (5) above)

and her ex ante expected payoff from the state sector (factored by $1 - \beta$). If the buyer chooses to go to the market sector (with probability β), given the fraction of buyers who prefer market (f), then the buyer expects to succeed in finding a contractual partner with probability μ/f for $\mu < f$, or with certainty for $\mu \geq f$. The two conditional probabilities form factor $\min\{\mu/f; 1\}$ of the first term in the first round bracket in (5). The second factor in this term reflects the buyer's two possibilities: going ahead with the market contract if $U_m > 0$, or taking her outside option otherwise. Should the buyer fail to find a contractual partner in the market (with probability $1 - \min\{\mu/f; 1\}$), she has the opportunity to contract in the state sector and obtain U_s .

If the buyer chooses to go to the state sector instead (with probability $1 - \beta$), while the fraction of the buyers who prefer the state sector is $1 - f$, then the buyer expects to succeed in finding a contractual partner in the state sector, and hence to get the payoff of U_s , with probability $(1 - \mu)/(1 - f)$ for $1 - \mu < 1 - f$, or with certainty for $1 - \mu \geq 1 - f$. As before, the two conditional probabilities form factor $\min\{(1 - \mu)/(1 - f); 1\}$ of the first term in the second round bracket. If, having chosen the state sector, the buyer fails to find a contractual partner in the state sector (with probability $1 - \min\{(1 - \mu)/(1 - f); 1\}$), the buyer could go to the market sector where she will be choosing between the greater of the two values: U_m and 0.

Consider possible equilibria of the sequential game. It is noted above that opportunistic sellers in the market may choose to breach ($q = 0$) or honour ($q = 1$) their contract for quality \bar{z} . Also, seller of either type prefers contracting to no contracting. Buyers who end up in the state sector prefer contracting for \underline{z} to their outside option since $U_s(\underline{z}) > 0$ under the perfect enforcement of state sector contracts. Buyers who end up in the market sector prefer contracting for \bar{z} to their outside option if $U_m(\bar{z}, \lambda | q) > 0$, or take their outside option if $U_m(\bar{z}, \lambda | q) \leq 0$. Under assumption (A3), we therefore have three candidates for equilibria in this game and these are listed in Table 1. Which of these surpluses are attained is given in Proposition 1 below.

TABLE 1: *Description of equilibria (with absorbed excess demand).*

<i>Equilibrium</i>		<i>Contracting in which sector?</i>	<i>Economy trade surplus</i>
Strong enforcement (SE)	$q = 1$	state and market	$(1 - \mu)(\underline{z} - \underline{c}) + \mu(\bar{z} - \bar{c})$
Intermediate enforcement (IE)	$q = 0$	state and market	$(1 - \mu)(\underline{z} - \underline{c}) + \mu(1 - \gamma)(\bar{z} - \bar{c})$
Weak enforcement (WE)	$q = 0$	state only	$(1 - \mu)(\underline{z} - \underline{c})$

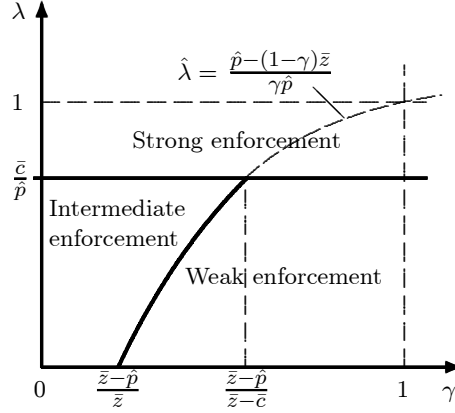
Proposition 1 *Assume (A1)–(A3), and let $\hat{\lambda} \equiv [\hat{p} - (1 - \gamma)\bar{z}]/(\gamma\hat{p})$. There exists a unique (pure strategy) equilibrium of the game and it is*

- (i) *SE* if $\lambda > \bar{c}/\hat{p}$,
- (ii) *IE* if $\hat{\lambda} < \lambda \leq \bar{c}/\hat{p}$ and $\gamma < \frac{\bar{z} - \hat{p}}{\bar{z} - \bar{c}}$,
- (iii) *WE* if $\lambda \leq \min\{\hat{\lambda}; \bar{c}/\hat{p}\}$.

Figure 1 illustrates Proposition 1. The intuition behind the proposition is straightforward. A sufficiently high probability of formal contract enforcement (case li) forces opportunistic sellers to comply with the terms of their contract thus making it attractive for the buyers in the market to contract for quality \bar{z} . For a given size of the sector and assuming (A3), all beneficial trades are realized in the entire economy. In contrast, a low probability of enforcement (case liii) makes the market contract inferior compared to the buyers' outside option and beneficial trades in the market are lost. In the intermediate equilibrium (case lii), the probability of enforcement is high enough while the proportion of breaching sellers is small enough, so that the combination of these two parameters makes the buyer's expected payoff from the market contract for \bar{z} larger than her outside option and thus induces those buyers who are in the market to contract even though enforcement is not sufficient to deter breach by opportunistic market sellers.

Visual inspection of Figure 1 suggests that the strong enforcement equilibrium disappears when \hat{p} is close to \bar{c} . In other words, it is more difficult to achieve compliance when the bargaining power of the buyers is too strong. If this is so, then even a relatively high

FIGURE 1: *Pure strategy equilibrium with a fixed market contract price.*



probability of formal contract enforcement is not sufficient to deter breach of market contracts by opportunistic sellers. Intuitively, when the buyers can extract most of the trade surplus, opportunists do not have a large enough stake in the contract (\bar{z}, \hat{p}) and would prefer to breach it even when enforcement is highly likely.

It immediately follows from Proposition 1 that liberalisation of the economy (a rise in μ) when enforcement of market contracts is strong (1i) leads to a higher welfare in the economy. However, when enforcement is poor (1iii) then an increase in the size of the market leads to an inferior outcome for this economy, since a large number of potentially beneficial trades are lost. This implication has an intuitive appeal in the light of the recent reform experience of the formerly planned economies of Eastern Europe. The results presented in this section vindicate the focus on the simplest possible setting which allows us to understand the output fall puzzle observed in the initial years of transition in terms of informational asymmetries and a lack of formal enforcement. This explanation is complementary to the technological explanations proposed in the literature (see discussion in section 2.1 above).

To complete the analysis of the benchmark case, consider the alternative to (A3) which under the fixed market price allows excess demand for a given sector in equilibrium.

Assumption 4

The buyer who is not successful in obtaining a contract in her preferred sector, has no opportunity to contract in the other sector and hence gets her outside option. (A4)

Under (A4), the buyer's problem of sector choice at stage 2 is now stated as follows:

$$\max_{\beta} \left[\beta \cdot \min\left\{\frac{\mu}{f}; 1\right\} \cdot \max\{0, U_m\} + (1 - \beta) \cdot \min\left\{\frac{1 - \mu}{1 - f}; 1\right\} \cdot U_s \right]. \quad (6)$$

The difference between the expression above and that in (5) reflects (A4), namely that the buyer is forced to take her outside option of zero when being unsuccessful in finding a contractual partner in her preferred sector. This happens either when (a) having chosen the market sector (probability β), she fails to find a market seller to contract with (probability $1 - \min\{\mu/f; 1\}$), or (b) having chosen the state sector (probability $1 - \beta$), she fails to be matched with a seller in the state sector (probability $1 - \min\{(1 - \mu)/(1 - f); 1\}$).

Due to rationing of contracts, individual rationality of a given buyer in equilibrium with $f = 1$ dictates $\mu \max\{U_m, 0\} > U_s$ which in turn implies:

$$\mu > \frac{U_s(\underline{z})}{U_m(\bar{z}, \lambda \mid q)}. \quad (7)$$

(7) suggests that demand for market sector contracts will exceed their supply in equilibrium when, firstly, the market price, which is fixed by (2), is fixed at a sufficiently low level (necessary condition):

$$\hat{p} < \Delta z + \underline{p}, \quad (8)$$

and, secondly, the market sector is not too small (sufficient condition):

$$\mu > \frac{\underline{z} - \underline{p}}{(1 - \gamma)\bar{z} - (1 - \lambda\gamma)\hat{p}}. \quad (9)$$

Assuming that these two conditions hold, the equilibria under (A4) are now described by Table 2.

TABLE 2: *Description of equilibria (with unabsorbed excess demand).*

<i>Equilibrium</i>		<i>Contracting in which sector?</i>	<i>Economy trade surplus</i>
Strong enforcement (SE)	$q = 1$	market only	$\mu(\bar{z} - \bar{c})$
Intermediate enforcement (IE)	$q = 0$	market only	$\mu(1 - \gamma)(\bar{z} - \bar{c})$
Weak enforcement (WE)	$q = 0$	state only	$(1 - \mu)(\underline{z} - \underline{c})$

It is easy to check that under the alternative assumption (A4) the analysis of this section will lead to the statement of results which is the same as in Proposition 1 above, except for the qualifications given by (8), (9), and Table 2. Not surprisingly, the analysis of the benchmark case under the alternative assumption suggests that when rationing of contracts leads to excess demand in equilibrium, the economy will have a lower level of welfare compared to the situation under (A3) in which absorption of excess demand is possible. Furthermore, assumption (A3) seems more plausible since coercion of the kind implied by assumption (A4) is not generally observed in reality. For this reason, (A3) is maintained in subsequent sections, unless stated otherwise.

4.2 Endogenous enforcement technology

This section considers a modification of the benchmark model. The modification exploits the idea that the resources devoted to enforcement are fixed and therefore the effectiveness of enforcement (specifically, its likelihood) will decline with the rise of the fraction of breached market contracts.

Let $\lambda(q) = \underline{\lambda} \cdot (1 - \delta \cdot (1 - q))$, where $\underline{\lambda}$ is the exogenous level of enforcement available in the economy, q is the probability with which opportunistic sellers comply with their market contract, and $\delta \in (0, 1)$ is the enforcement externality parameter, introduced to capture fixed resources available for enforcement. For a given proportion of breaching opportunists, the larger the externality, δ , the lower is the probability of enforcement, $\lambda(q)$. By construction, enforcement is more likely the fewer breached contracts there are: $\lambda(0) = \underline{\lambda} \cdot (1 - \delta) < \underline{\lambda} = \lambda(1)$. Similar to the analysis in section 4.1, the following cut-off value functions are derived for the exogenous level of the enforcement probability:

$$\text{if } \underline{\lambda} > \frac{\bar{c}}{\hat{p}} \equiv \lambda_1 \quad \text{then } V_m^\gamma(\bar{z}, \lambda)|_{q=1} > V_m^\gamma(\bar{z}, \lambda)|_{q=0}, \quad (10)$$

$$\text{if } \underline{\lambda} \leq \frac{\bar{c}}{\hat{p}(1 - \delta)} \equiv \lambda_2 \quad \text{then } V_m^\gamma(\bar{z}, \lambda)|_{q=1} \leq V_m^\gamma(\bar{z}, \lambda)|_{q=0}, \quad (11)$$

$$\text{if } \underline{\lambda} \leq \frac{\hat{p} - (1 - \gamma)\bar{z}}{\gamma\hat{p}(1 - \delta)} \equiv \lambda_3 \quad \text{then } U_m(\bar{z}, \lambda; q = 0) \leq 0. \quad (12)$$

Comparison of these three cut-offs for $\underline{\lambda}$ suggests that, in contrast to the results in section 4.1, the equilibrium may no longer be unique.

Proposition 2 *Assume (A1)–(A3). Then for any $\delta \in (0, 1)$ there exists a (pure strategy) equilibrium of the game.*

2.1 The equilibrium is unique if

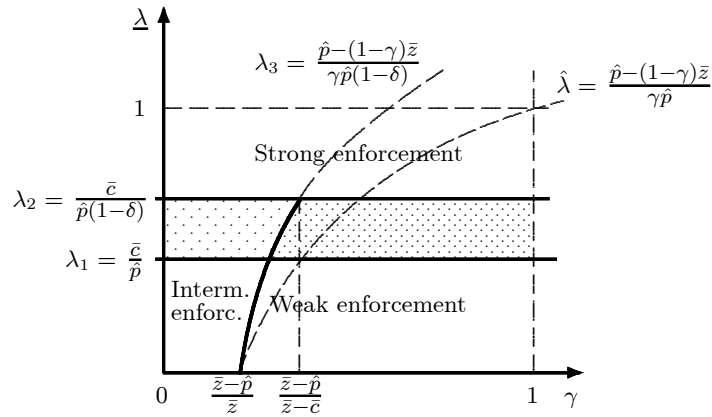
- (i) $\underline{\lambda} > \lambda_2$ and $\delta < 1 - \bar{c}/\hat{p}$ (SE); or
- (ii) $\lambda_3 < \underline{\lambda} \leq \lambda_1$ (IE), or
- (iii) $\underline{\lambda} \leq \min\{\lambda_1, \lambda_3\}$ (WE).

2.2 Otherwise, if $\lambda_1 < \underline{\lambda} \leq \lambda_2$ the equilibrium is not unique:

- (i) if $\max\{\lambda_1, \lambda_3\} < \underline{\lambda} \leq \min\{\lambda_2, 1\}$ then SE and IE equilibria coexist;
- (ii) or if $\lambda_1 < \underline{\lambda} \leq \min\{\lambda_2, \lambda_3, 1\}$ then SE and WE equilibria coexist.

Figure 2 illustrates the proposition for the case when $\delta < 1 - \bar{c}/\hat{p}$ and therefore $\lambda_2 < 1$. The

FIGURE 2: Equilibria when enforcement is endogenous.



shaded area in the figure depicts the range of parameters in which the two pure strategy equilibria coexist: the strong and intermediate enforcement equilibrium in the sparsely shaded area, or the strong and weak enforcement equilibrium in the densely shaded area. Visual inspection of Figure 2 suggests the significance of the enforcement externality: if it is sufficiently high ($\delta \geq 1 - \bar{c}/\hat{p}$), then $\lambda_2(\gamma)$ shifts out to the level of 1 or beyond, and multiple equilibria exist for any reasonably high value of the exogenous enforcement level, $\underline{\lambda} > \bar{c}/\hat{p}$.

The intuition behind the existence of multiple equilibria is straightforward. Notice that in each region of multiple equilibria (the densely and sparsely shaded areas in Figure 2), the two choices of action by opportunistic sellers at stage 4 of the game, $q = 1$ and $q = 0$, are optimal. (And the difference between the two areas of multiple equilibria involves the

buyers' choice of contracting vis-à-vis their outside option when in the market sector and $q = 0$.) The negative externality in contract enforcement—the higher the proportion of the breaching sellers in the market, the more difficult is the detection of breach—leads to a situation in which the equilibrium is determined by what every seller believes all other sellers are going to do. If a seller believes that all other sellers are going to breach their market contract, then it is unprofitable to deviate from this strategy by complying because compliance is costly (involves cost \bar{c}), while the breach is detected with a low probability because the exogenously fixed enforcement resources are spread thinly over the large number of breachers. Similarly, if a seller believes that all other sellers are going to comply, then his breach of the market contract is costly due to a high probability of detection: all the enforcement resources in such a case will be devoted to detecting the seller's breach.

The argument above yields the following policy implication for transition economies. Decentralisation of economic activity will increase the size of the market sector, μ . A rise in μ will require more enforcement. The citizens' perception of effectiveness of enforcement may, however, vary over the sectors. If everyone believes that the market transactions are unpoliced, then everybody in the market sector will find it optimal to breach their contract, thus, perhaps, further undermining the public perception of the effectiveness of formal contract enforcement. The larger is the enforcement externality, the more detrimental could decentralisation turn out to be because the multiplicity of equilibria is more likely for higher δ . The reformers-in-charge could improve the situation by publicising the measures which reduce this externality: e.g. by adopting a tough stance towards all breaches of law. Of course, this prescription can only be pushed so far as the fixed resources allow it to be credible to the populace.

4.3 Corruptible enforcers

This section presents the analysis of another modification of the benchmark model. The modification here studies the implications of corruption in formal contract enforcement. Suppose that at date 5 *Nature* determines whether the market contract (\bar{z}, \bar{p}) between a given pair of a buyer and a seller is 'enforceable' (with probability λ) or 'not enforceable' (with probability $1 - \lambda$). Crucially, the realized state of the world with regard to enforceability of the contract is now private information of the enforcer (while the value of λ is common knowledge, as before). Thus the source of corruption in market contract enforcement is due

to the informational advantage possessed by the enforcer.²¹ A contractual breach, when it occurs, is remedied by a self-interested enforcer (the supervisor) who may well prefer not to take any enforcement action in exchange for a bribe from the seller.

If the contract is not enforceable—whether genuinely so or because of corruption in enforcement—no further action is taken by the enforcer. To maintain the focus on imperfect enforcement of contracts in the market, I continue to assume that there is no uncertainty with respect to enforceability of contracts in the state sector (i.e. the enforcer of the state contract does not possess any private information regarding contract enforceability). Corruption in the state sector contract enforcement is still possible, however, as briefly discussed below. The level of corruption in the economy is assumed to be exogenous: a contract enforcer in sector i is corruptible with probability $0 < r_i \leq 1$ in which case he will accept a bribe $b_i > 0$ in exchange for either concealing the information regarding enforceability of the market contract ($i = m$), or for condoning the bilateral breach of the state contract ($i = s$), as briefly explained below.²² Additionally, let $0 < n \leq \mu$ denote the fraction of enforcers of market contracts relative to the size of the market.

4.3.1 Corruption in enforcement of state contracts

For a scenario which gives rise to corruption in the state sector, suppose the buyer and the seller in a given trading pair were forced to sign the state contract $(\underline{z}, \underline{p})$, but in fact they prefer to re-contract with each other for (\bar{z}, \hat{p}) . Suppose also that re-contracting, or a bilateral breach of the state contract, is possible only if the planner (the enforcer of the state contract) is prepared to overlook the breach. Inability to re-contract without the planner's condoning the breach may be due to the state sector arrangement in which the planner holds the up front payment \underline{p} made by the buyer upon signing the contract $(\underline{z}, \underline{p})$ and releases the up front payment to the seller upon delivery of \underline{z} . If the planner is corruptible, then for a bribe the planner will allow re-contracting and transfer the up front payment \underline{p} back to the buyer. Of course, the re-contracted deal (\bar{z}, \hat{p}) , if breached by the seller, will be enforced as

²¹This seems to be a reasonable assumption in the context of complicated or overlapping legislation with loopholes, as reported to have been the case in the initial years of reforms in countries of Eastern Europe. For more details, see Hay and Shleifer (1998), Pistor (1996) and Greif and Kandel (1995) for the case of Russia; Rubin (1998), Gray (1993) and especially Rubin (1997) for the case of other Eastern European countries.

²²We therefore leave out the analysis of the incentives of the enforcer to get corrupt.

any other market contract. In this scenario, corruptibility of enforcers in the state sector would increase the number of contracts which may require market contract enforcement.

4.3.2 Corruption in enforcement of market contracts

Consider the bribe payment which the seller will be prepared to pay to the enforcer in order to conceal the fact that the contract is, in fact, enforceable. If the enforcer agrees to conceal, then the seller expects no enforcement at the cost of the bribe payment, $\hat{p} - b_m$. Otherwise, in the absence of a collusive agreement with the enforcer, the seller expects to obtain $\hat{p} - d = 0$. For bribery to occur, therefore, the bribe cannot exceed \hat{p} . Let $b_m = k\hat{p}$ with $0 < k < 1$ representing the bargaining power of the enforcer. Additionally, let $0 < \eta \leq 1$ be the probability of being matched with an enforcer once contract (\bar{z}, \hat{p}) is breached. It is straightforward to calculate this probability, given the number of enforcers in the market sector and the expected number of (\bar{z}, \hat{p}) contracts that would be breached in equilibrium and therefore would require enforcement. When re-contracting in the state sector is possible (as discussed in section 4.3.1), then (\bar{z}, \hat{p}) contracts that would require enforcement would include all those between a buyer and a breaching opportunistic seller in the market as well as in the state sector:

$$\eta = \eta(q) = \min\left\{\frac{n}{\gamma(1-q)(\mu + r_s(1-\mu))}; 1\right\} \quad \text{and} \quad q \neq 1. \quad (13)$$

(When $q = 1$, then the probability of being matched with an enforcer is irrelevant since there is no breach.)

Before calculating the players' expected payoffs in the game with corruptible enforcers, observe that an honest seller's expected gain from the market contract (\bar{z}, \hat{p}) , as specified in (4), is not affected by considerations of corruption simply because corruption is only possible once a contract is breached and honest sellers are assumed to comply with their contracts without fail.²³ On signing the market contract (\bar{z}, \hat{p}) in the environment with corruptible enforcers, the expected payoff of a buyer and an opportunistic seller respectively become:

$$U_m(\bar{z}, \lambda, r_m, \eta) = [1 - \gamma(1 - q)] \cdot \bar{z} - [1 - \lambda\gamma\eta(1 - q)(1 - r_m)] \cdot \hat{p}, \quad (14)$$

$$V_m^\gamma(\bar{z}, \lambda, r_m, \eta) = [1 - \lambda\eta(1 - q)[1 - r_m(1 - k)]] \cdot \hat{p} - q\bar{c}, \quad (15)$$

²³Allowing for framing or blackmail by enforcers may well reverse this conclusion. See Polinsky and Shavell (2001) for an analysis of framing in law enforcement.

where q is chosen by the opportunistic seller in order to maximise (15), as before. In the above, the seller expects to incur the cost of providing the high quality if he complies with the contract (probability q). He will keep the buyer's up front payment, \hat{p} , unless he breaches the contract (probability $1-q$). In the latter case, the breach is either remedied by an honest enforcer (with probability $\lambda\eta(1-r_m)$), and the seller loses the up front payment; or the breach is not remedied because the enforcer is bribed (with probability $\lambda\eta r_m$), the seller then loses k portion of the up front payment. When enforcers are corruptible, the buyer's gain, (14), from the contract (\bar{z}, \hat{p}) is smaller by $\lambda\gamma(1-q)[1-\eta(1-r_m)] \cdot \hat{p}$, as compared to the no corruption market contract payoff (2), namely it is smaller by the expected loss of the up front payment in all circumstances except when the breach is remedied by an honest enforcer.

It is easy to check that an opportunistic seller will choose to comply with his contract (\bar{z}, \hat{p}) if $[1 - \lambda\eta \cdot (1 - r_m(1 - k))] \cdot \hat{p} \geq \hat{p} - \bar{c}$ where $\eta = \eta(0)$, or equivalently if:

$$\lambda > \frac{\bar{c}}{\hat{p}} \cdot \frac{1}{\eta(1 - r_m(1 - k))} \quad \text{with} \quad \eta = \eta(0). \quad (16)$$

Remark 1 *SE equilibrium is more difficult to sustain when market contract enforcers are corrupt.*

In other words, when contract enforcers are corruptible the institution of formal contract enforcement needs to be more effective (the probability that the contract is enforceable has to be higher) for opportunistic sellers to choose compliance in equilibrium. The proof of the remark is a straightforward comparison of the cut-off in (16) with its analogue in the no-corruption environment of section 4.1, \bar{c}/\hat{p} . Clearly, the cut-off in (16) exceeds the no-corruption cut-off for any $0 < \eta \leq 1$, $0 < k < 1$, and $0 < r_m \leq 1$.

Remark 2 *SE equilibrium, in which opportunistic sellers comply and buyers in the market sign (\bar{z}, \hat{p}) contract, exists if (16), $r_m < [\eta(0) \cdot \hat{p} - \bar{c}]/[\eta(0) \cdot \hat{p} \cdot (1 - k)]$ and $\eta(0) > \bar{c}/\hat{p}$.*

Intuitively, in equilibrium the sellers would choose to comply with their market contract for high quality only when contract enforcement is sufficiently likely, that is the enforceability of the contract as well as the probability of being matched with an enforcer are both high enough, while the fraction of dishonest enforcers is low enough.

Remark 3 *Assuming $n < \gamma\mu$, the contract enforceability threshold in (16) has to be higher*

the higher the level of corruption in market contract enforcement, and the larger the market sector.

Thus, in the presence of corruption the institution of contract enforcement has to become more robust if the economy is to liberalise or if the number of enforcers accepting bribes is to rise. For a proof, recall that $\eta(0) = n/(\gamma\mu)$ and check that the partial derivative of the RHS in (16) with respect to μ , and r_m , is positive. Summing up the analysis above, we have established that an indirect effect of state sector corruption (due to $\eta < 1$) on the effectiveness of formal enforcement of market contracts is detrimental. If, however, $\eta = 1$, then there is no link between state sector corruption and market sector corruption.

To simplify the exposition of the analysis in this section, it is henceforth assumed that $\eta = 1$.

Proposition 3 *Assume (A1)–(A3); let $\eta = 1$ and $0 < k < 1$. Then there exists a unique (pure strategy) equilibrium of the game with corruptible enforcers and it is WE equilibrium, unless*

(i) $\lambda > \bar{c}/[\hat{p}(1 - r_m(1 - k))]$ and $r_m \leq \min \{[\hat{p} - \bar{c}]/[\hat{p}(1 - k)]; 1\}$, in which case it is SE equilibrium; or

(ii) $[\hat{p} - (1 - \gamma)\bar{z}]/[\gamma\hat{p}(1 - r_m)] < \lambda \leq \bar{c}/[\hat{p}(1 - r_m(1 - k))]$, $\gamma < (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$, and $r_m < [\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c})]/[\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k(\hat{p} - (1 - \gamma)\bar{z})]$, in which case it is IE equilibrium.

The logic of the proof is the same as that for Proposition 1. The figure illustrating this proposition in (γ, λ) axes would look similar to Figure 1, except that the curves representing the functions for both cut-off values of λ will lie above their analogues in Figure 1. The intuition behind Proposition 3 is simple. For buyers to prefer contracting in the market to their outside option, enforceability of contract (\bar{z}, \hat{p}) must be sufficiently high, as in either (i) or (ii). In addition, for an opportunistic seller to prefer compliance, and thus for a strong enforcement equilibrium to exist cost of breach must be large enough (e.g. the number of corruptible enforcers is relatively small). As before, in the intermediate enforcement equilibrium some contract enforceability per se is not sufficient to deter breach by all opportunistic sellers in the market; the buyers however prefer market contracting because the expected value of (\bar{z}, \hat{p}) contract is higher than their outside option. In the

environment with corruptible enforcers, this would be the case when both the proportion of breaching sellers as well as the level of corruption among the enforcers is small enough. When neither of this two scenarios is possible, then it is less harmful for the buyers to opt out of market contracting altogether.

Unbundling the condition on r_m in Proposition 3(i) above we have the following interesting result:

Remark 4 *Assume (A1)–(A3), (16), $\eta = 1$ and $r_m = 1$. If additionally $k > \bar{c}/\hat{p}$, then SE equilibrium prevails despite the high level of corruption in the market sector enforcement.*

In other words, breach of market contracts will not occur when all enforcers in the market are corrupt, have sufficiently strong bargaining power, and are large in number. To prove this rather surprising result, check that in the specified range of parameters the opportunistic sellers optimise by setting $q = 1$, thus making the buyers in the market to prefer contract (\bar{z}, \hat{p}) over their outside option. The key to understanding this result is the strong bargaining power enjoyed by the corrupt market contract enforcer when formal enforcement is relatively effective (λ is high enough as in (16)). Since all enforcers are corrupt, once the market contract is breached, bribery is certain to occur (due to $\eta = 1$ and $r_m = 1$), and thus the breaching seller stands to lose a large part of the gain from his breach (due to $k > \bar{c}/\hat{p}$). Consequently, corruptibility of enforcers who can extract large bribes serves as a deterrent for contract breach. It is cheaper for the seller to comply with his market contract than to get involved in the bribing game. This result highlights the relative importance of strengthening formal institutions in an economy with a high level of corruption (so that, in the simple model, it is ensured that (16) holds). An improvement in formal institutions supporting markets is beneficial in curbing opportunistic behaviour of both private agents (sellers) and holders of public office (enforcers).

4.4 Endogenous market contract price

This section presents a modification of analysis contained in section 4.1 by allowing the contractual price of quality \bar{z} to adjust with the buyers' demand for market sector contracts. Intuitively, we expect that the sellers will raise the market contract price at the negotiating stage, if the aggregate demand for the market sector (the proportion of buyers who prefer the market sector, f) is larger than the size of the market. (The assumption of a one-to-one

contracting plays a crucial role here.) At the same time, we expect that at the negotiating stage of the contract on quality \bar{z} , the buyers will take into account the average quality, denoted by \hat{z} , supplied by market sellers. This is exactly the first term, $[1 - \gamma(1 - q)] \cdot \bar{z}$, in the expression of the buyer's expected market contract payoff in (2). The average quality is just \bar{z} when all opportunistic sellers comply with their contracts ($q = 1$), and otherwise (if $q = 0$) it is less than \bar{z} . Since a buyer cannot distinguish between the two types of sellers when negotiating and signing her contract, the market contract price now has to reflect the average quality: higher expected quality will command a higher price.²⁴

As a shorthand, denote by \bar{p} the market contract price when the average quality is known to be the same as the contracted upon quality (if $q = 1$ then $\hat{z} = \bar{z}$), and by \hat{p} when the average quality is known to be less than the contracted quality ($q = 0$, $\hat{z} < \bar{z}$). Of course, it has to be $\bar{p} > \hat{p}$ for buyers to be willing to trade when the expected quality in the market is lower than \bar{z} . The expressions for the players' expected payoffs, once in a given sector are the same as in section 4.1, except that one has to substitute \hat{p} with \bar{p} when analysing the equilibria with $q = 0$, and \hat{p} with \bar{p} when considering the equilibrium with $q = 1$.

Recall that section 4.1 introduced two alternative assumptions (A3) and (A4) which determined whether the buyer who failed to obtain a contract in her preferred sector had the opportunity to contract in the other sector. According to (A3) the buyer has such opportunity, but according to (A4) she is forced to take her outside option. These two alternative assumptions were shown to lead to two different formulations of the buyer's sector choice problem at stage 2: (5) under (A3), or (6) under (A4). The analysis of the problem with a fixed market contract price in section 4.1 suggested that in the situations with $U_m > 0$ (i.e., in SE and IE equilibria) the buyer's equilibrium choice of the sector i ($i = s, m$) was determined from $\max_i \{U_m; U_s\}$ under (A3), or from $\max_i \{\mu \cdot U_m; U_s\}$ under (A4).

It turns out that with an endogenous market contract price, i.e. when the market price can adjust in response to an imbalance in supply/demand for market contracts, the equilibrium in which market contracting takes place (i.e. SE and IE equilibrium) will exhibit a balanced demand/supply of market contract under either (A3) or (A4).²⁵

²⁴This reasoning is akin to that of the 'lemons' problem in Akerlof (1970).

²⁵It is immediately clear that $\beta = 0$ is optimal when $0 \geq U_m$. In such a case the level of the market contract price is irrelevant because there is no contracting in the market.

Claim 1 *In equilibrium with market contracting ($\beta > 0$), the market contract price is determined by balanced demand in each sector ($f = \mu$) which makes the buyers indifferent between the two sectors ($U_m = U_s$).*

The intuition behind the statement of the claim is simple. If there is an excess demand for market contracts, $0 < \mu < f \leq 1$, then the price for the average quality supplied in the market is ‘too low’, which makes the buyers’ expected net gain from the market contract on quality \bar{z} strictly greater than their expected net gain from the state contract on quality \underline{z} : $0 < \mu < f \leq 1$ implies $U_m > U_s$ in both (5) and (6). Due to rationing ($\mu < 1$ and one-to-one contracting), market sellers can exploit excess demand and improve their payoff by negotiating a higher price for the given average market quality. A price increase, however, reduces the expected net gain of the buyer and would also reduce the demand for market contracting. If the market price is increased too much, the state contract becomes more profitable from the buyers’ viewpoint, which leads to an excess demand for the state contracts: $0 \leq f < \mu < 1$ implies $U_m < U_s$ in both (5) and (6). In such a case the market price is too high for the average quality supplied in the market when compared to the price-quality mix in the state sector. In equilibrium with market contracting, the sellers would therefore be charging the price which, firstly, balances aggregate supply (μ) of the market contracts with the aggregate demand (f) for market contracts, and secondly, in the setting with identical buyers makes every buyer indifferent between contracting in the market and contracting in the state sector ($U_m = U_s$).

Because of buyers’ indifference between the two sectors in SE and IE equilibria (by Claim 1), the equilibrium allocation of buyers across sectors will be μ buyers in the market sector and $1 - \mu$ buyers in the state sector. This in turn implies that the description of equilibria given by Table 1 (section 4.1, page 14) is appropriate for the present analysis, provided that the market contract price (\bar{p} when $q = 1$, or \dot{p} when $q = 0$) is determined by balanced demand according to Claim 1.

Determination of \bar{p} is immediate: in equilibrium with $q = 1$, we must have balanced demand $f = \mu$ and $\beta \in (0, 1)$ is such that every buyer is indifferent between entering the state sector or the market sector: $U_m(\bar{z}, \lambda \mid q = 1) = \bar{z} - \bar{p} = \underline{z} - \underline{p} = U_s(\underline{z})$ where \underline{p} is given by (A1). The market contract price when $q = 1$ is therefore equal to:

$$\bar{p} = \Delta z + \underline{p}. \quad (17)$$

In the case of $q = 0$ an analogous argument gives $U_m(\bar{z}, \lambda \mid q = 0) = (1 - \gamma)\bar{z} - (1 - \lambda\gamma)\dot{p} =$

$\underline{z} - \underline{p} = U_s(\underline{z})$, and therefore the market contract price when $q = 0$ is given by:

$$\dot{p} = \frac{(1 - \gamma)\bar{z} - (\underline{z} - \underline{p})}{1 - \lambda\gamma} = \frac{\bar{p} - \gamma\bar{z}}{1 - \lambda\gamma}, \quad (18)$$

where the second equality sign takes into account (17).

In order to simplify the exposition of the main result stated below, I introduce the following threshold value functions of the enforcement probability:

$$\lambda^\# \equiv \lambda(\gamma) = \frac{\gamma\bar{z} - (\bar{p} - \bar{c})}{\gamma\bar{c}} \quad \text{and} \quad \lambda^b \equiv \lambda(\gamma) = \frac{\bar{c}}{\bar{p} - \gamma(\bar{z} - \bar{c})}, \quad (19)$$

with \bar{p} calculated according to (17). The origin of these cut-offs is the following. For a given value of γ , $\lambda > \lambda^\#$ implies that the market contract price in the case of $q = 0$ (namely \dot{p} in (18)) is above the cost of supplying quality \bar{z} , making it attractive for all sellers in the market to contract for delivery of quality \bar{z} . The reverse, $\lambda \leq \lambda^\#$, implies $\dot{p} \leq \bar{c}$, and the honest sellers would refuse to contract in the market. Honest sellers' refusal in turn suggests that the only quality that is deliverable under the market contract (\bar{z}, \dot{p}) is the zero quality, since only opportunistic sellers would sign contracts in this case, and all opportunistic sellers breach their market contracts with certainty. Consequently, the buyers would not be willing to contract in the market sector. The other cut-off, λ^b , determines opportunistic sellers' preference for (if $\lambda \leq \lambda^b$) or against (if $\lambda > \lambda^b$) breaching their market contract.

Proposition 4 *Assume (A1) and (A2). There exists an equilibrium of the game.*

4.1 *The equilibrium is unique if*

- (i) $\lambda > \lambda^b$ (SE); or
- (ii) $\lambda^\# < \lambda \leq \bar{c}/\bar{p}$ (IE), or
- (iii) $\lambda \leq \min\{\lambda^\#, \bar{c}/\bar{p}\}$ (WE).

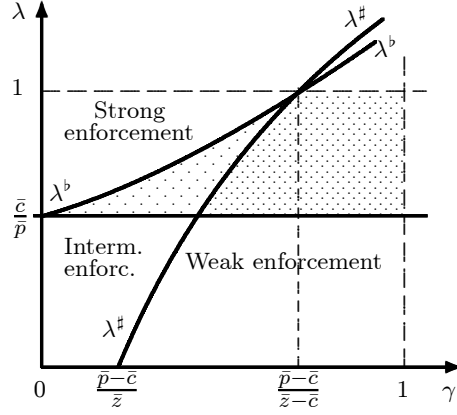
4.2 *Otherwise, if $\bar{c}/\bar{p} < \lambda \leq \min\{\lambda^b; 1\}$ the equilibrium is not unique:*

- (i) *if $\max\{\bar{c}/\bar{p}; \lambda^\#\} < \lambda \leq \lambda^b$ then SE and IE equilibria coexist;*
- (ii) *or if $\bar{c}/\bar{p} < \lambda \leq \min\{\lambda^\#; 1\}$ then SE and WE equilibria coexist.*

The market contract price is given by (17) in SE equilibrium, or by (18) in IE equilibrium.

Figure 3 illustrates Proposition 4. In Figure 3, the (γ, λ) combinations for which each type of equilibrium exists are similar to the regions for the case of exogenously fixed market contract

FIGURE 3: *Pure strategy equilibria with endogenous market contract price.*



price (Figure 1, page 15). When the market price is endogenously determined by the aggregate demand for market sector contracts, a relatively high enforcement probability is necessary to support the strong enforcement equilibrium ($\lambda > \bar{c}/\bar{p}$). The weak enforcement equilibrium cannot be avoided (in other words, it is unique) in the region of relatively low enforcement probability combined with a high proportion of breaching sellers, while the intermediate enforcement equilibrium is unique when both the enforcement probability and the fraction of breaching sellers is relatively low. (These ranges look similar in both figures except for the threshold value function of λ which determines buyers' preference for or against market contracting: $\hat{\lambda}$ in Figure 1 and $\lambda^\#$ in Figure 3.)

The crucial difference between the results in these two sections is highlighted by the shaded area of Figure 3. The shaded regions depict the range of parameters for which two equilibria coexist: the strong and intermediate equilibria in the sparsely shaded region, and the strong and weak enforcement equilibria in the densely shaded region. The key to the existence of multiple equilibria lies in the price difference $\bar{p} \neq \hat{p}$ which reflects $\bar{z} \neq \hat{z}$, that is the difference between the contracted quality and the expected quality upon delivery in the market sector.

For the intuition behind the coexistence of equilibria, consider, for example, the sparsely shaded region, $\max\{\bar{c}/\bar{p}; \lambda^\#\} < \lambda \leq \lambda^b$, where the strong and intermediate enforcement equilibria coexist. Suppose the buyers believe that all opportunistic sellers are going to play $q = 1$. Then the buyers are willing to pay the price \bar{p} . Is it individually rational for a given opportunistic seller to deviate from $q = 1$ by playing $q = 0$? The answer can be found

by comparing the two expected payoffs. In either case, the opportunist gets \bar{p} up front. In the case of no deviation the opportunist expects to lose \bar{c} , while in the case of a deviation he expects to lose $\lambda\bar{p}$. The comparison between the two payoffs is therefore equivalent to the comparison between \bar{c} and $\lambda\bar{p}$. But in the sparsely shaded region we have $\lambda\bar{p} > \bar{c}$. Hence, if the buyers believe that all market sellers comply, it is individually rational for every opportunistic seller to comply. Essentially, the expected loss of the up front payment following the enforcement of the seller's breach is greater than his saving of cost \bar{c} .

Suppose instead that in the same range of λ (the sparsely shaded area of Figure 3, as before) the buyers believe that all opportunistic sellers are playing $q = 0$. In such a case, the buyers would be willing to contract in the market only if the market contract price is equal to \dot{p} . In the sparsely shaded region, $\lambda > \lambda^\sharp$ which is equivalent to $\dot{p} > \bar{c}$ (see the proof of Proposition 4 in Appendix 5). The honest sellers in the market will therefore be willing to contract for \bar{z} . With all honest sellers willing to sign contract (\bar{z}, \dot{p}) , and all opportunistic sellers subsequently breaching it, the no deviation payoff to an opportunistic seller is $(1 - \lambda)\dot{p}$, while by deviating and playing $q = 1$ he would expect to get $\dot{p} - \bar{c}$. The comparison of the two payoffs is now equivalent to the comparison of the loss of $\lambda\dot{p}$ with the loss of \bar{c} . In the relevant range of parameters $\lambda \leq \lambda^b$ which turns out to be exactly equivalent to $\lambda\dot{p} \leq \bar{c}$ (see the proof of Proposition 4). A unilateral deviation does not bring any extra gain and therefore is shown again to be unprofitable.

It is clear from the argument above that the key to the coexistence of the two equilibria is the endogenously determined price which falls with a decline in expected quality. In such a case, the buyers' beliefs play a crucial role, since it is the belief that all market sellers comply that leads the buyers to agree to the highest price, \bar{p} , for quality \bar{z} , and thus induces all opportunistic sellers in the market to comply. Alternatively, the belief that all opportunistic sellers are going to breach their contracts makes it impossible for the buyers to agree to pay anything but $\dot{p} < \bar{p}$ for quality \bar{z} .²⁶

The intuition behind the coexistence of the strong and weak enforcement equilibria in the densely shaded area of Figure 3 is essentially the same: it again involves the buyers' beliefs regarding the opportunistic sellers' choice of action once the up front payment has been made. The argument for the case of the weak enforcement equilibrium is, however,

²⁶The model does not address the issue of how a particular type of buyers' belief arises in equilibrium. One mechanism might be that of collective reputations, suggested in Tirole (1996).

more subtle: when the buyers believe that opportunistic sellers are going to play $q = 0$, the price acceptable to the buyers in the market, \hat{p} , now has to be below \bar{c} in order to compensate the buyers for the high probability of losing the up front payment (due to the high value of γ). This price, of course, would drive away the honest sellers since it will not cover their cost of supplying \bar{z} . We therefore have in this case the celebrated ‘lemons’ problem due to Akerlof (1970): the honest sellers are unable to separate themselves from opportunists and this leads to the break down in market contracting.

In order to derive the policy implications of the analysis of this section, notice that the economy trade surplus in each of the three possible equilibria with endogenously determined price is the same as that identified for the case of exogenously fixed market contract price (section 4.1, Table 1 on page 14). This is due to the balanced demand in the strong and intermediate enforcement equilibrium, and no market contracting in the weak enforcement equilibrium. Consequently, the conclusions drawn from the analysis of section 4.1 apply here *a fortiori*: the inferior outcome—namely, the beneficial market contracting not being pursued in the weak enforcement equilibrium—is now possible even when the level of enforcement is relatively high (the densely shaded area in Figure 3). Thus it is shown that the model developed in this paper helps explain the output fall puzzle as arising from the problem of asymmetric information, rather than technology. A transition economy which undergoes liberalisation of its economic activity may experience a large output fall if economic agents believe that a large proportion of market traders are opportunistic and would breach their contracts with certainty.²⁷

5 Concluding comments

The results of this paper highlight the importance of institutions for the transition from plan to market: absent or inadequate institutions lead to a loss of beneficial decentralised contracts. Moreover, when formal contract enforcement exhibits a negative externality, then even for a relatively large amount of fixed resources devoted to enforcement bad equilibrium may prevail, because the equilibrium is determined by trader’s perception of the effectiveness of enforcement. The larger the externality, the harder it is to achieve the good equilibrium in

²⁷Some support for this conjecture can be found in a path-breaking comparative survey of attitudes towards markets by Shiller, Boycko, and Korobov (1991) who find that ‘relatively more Soviets [when compared to Americans] do tend to expect more businessmen to be less honest’ (p. 395).

which all traders comply with their contractual obligations. The effect of a large externality on the welfare of the economy is indirect and feeds through the overall trading surplus. The larger the size of the market, the higher is the proportion of the beneficial trades which are lost in the weak enforcement equilibrium. This conclusion is likely to become even more grim if we accept that a large-scale change in the organisation of economic activity (e.g., a change from ‘plan to market’) is likely to require new laws which are better suited to the new economic order. In the notation of the model this means that the probability of enforcement, λ , may decline (or the enforcement externality, δ , rise) due to, perhaps a perception of, inadequacy of the old legal framework. And this, as the epigraph to this paper suggests, seems to be exactly what has happened in some transition economies. Perhaps more importantly, the analysis also suggests that institutions to support market interaction have a first order effect on the success of liberalisation in an environment of endemic corruption. This is because (a) corruption makes the good equilibrium less feasible, and (b) an effective legal framework helps to curb the high level of corruption in enforcement, as well as opportunism in contracting, by exposing the breacher to extortionary bribe demands of the enforcer.

The simple nature of the model presented here offers a number of fruitful avenues for future research. Firstly, allowing for repeated interaction could help evaluate the relative significance of formal mechanisms of enforcement versus informal ones. Survey-based evidence for the reforming economies of Eastern Europe (McMillan and Woodruff (1999b, 1999a, 2000) and Johnson, McMillan, and Woodruff (2000)) indicates that inadequacy of the legal infrastructure of laws, courts and police inherited from the years of directives and planning forces businesses to rely on reputation (e.g., gossip, social and/or business networks). Informal enforcement supported by information sharing cannot however substitute for formal enforcement entirely: while reputation helps to sustain established trading partnerships, effective courts encourage formation of new relationships by lowering switching costs and reducing risks.²⁸ These empirical findings therefore call for a detailed theoretical analysis of the relative merits of a particular enforcement mechanism in different

²⁸Note, however, that the results presented in section 4.2 suggest that reliance on a reputational mechanism such as trust to support cooperation when formal enforcement mechanisms are ineffective may be problematic: if economic agents believe there is a high probability of opportunism, then lack of formal institutions combined with lack of trust will force the economy into a bad equilibrium.

types of economic environment.²⁹ Secondly, the issue of financing formal enforcement, e.g. by means of taxes, could be studied. The existing literature suggests³⁰ that excessive taxation is typically the reason for the growth of the unofficial economy, which in some notable instances has led to the rise of organised crime and further undermined the development of adequate institutions that support well-functioning markets. Thirdly, the size of the market could be endogenised: it is natural to think of the market sector size as being determined by the proportion of sellers who prefer to operate in that sector. This line of inquiry is of interest for example for an evaluation of a privatisation programme. Fourthly, the effectiveness of the enforcement technology is likely to be determined by the size of the sector where it is employed: this would allow a better description of what happens in the economy as the size of the sector changes (e.g., as the economy liberalises). And lastly, it is of interest to analyse the optimal (government) allocation of limited resources for enforcement across sectors. Intuitively, the resources should be concentrated in the market sector, since it offers a higher return, however, the higher return will presumably attract a larger proportion of opportunistic traders.

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²⁹A recent formal analysis in Dixit (2001) offers a fruitful framework in which to tackle a comparative study of different enforcement mechanisms.

³⁰E.g., Johnson, Kaufmann, McMillan, and Woodruff (2000) and Roland (2000, pp. 174–8).

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Appendix

Proof of Proposition 1

Suppose $\lambda > \bar{c}/\hat{p}$. Then $V_m^\lambda(\bar{z}, \lambda \mid q = 1) = \hat{p} - \bar{c} > (1 - \lambda)\hat{p} = V_m^\lambda(\bar{z}, \lambda \mid q = 0)$ and hence $q = 1$ is optimal, which in turn leads to $U_m(\bar{z}, \lambda \mid q = 1) = \bar{z} - \hat{p} > 0$, i.e. buyers who are in the market will prefer contracting over their outside option. The buyers’ choice of a sector is determined by the sign of the difference $(\bar{z} - \hat{p}) - (\underline{z} - \underline{p})$ which may or may not be positive. Due to (A3) and irrespective of the sign of the difference, in equilibrium μ buyers will end up in the market sector and $1 - \mu$ in the state sector. This proves part (i) of the proposition.

Suppose instead that $\lambda \leq \bar{c}/\hat{p}$ and hence $q = 0$ is optimal. Substituting $q = 0$ into (2), it is checked that $U_m(\bar{z}, \lambda | q = 0) \leq 0$ if

$$\lambda \leq \frac{\hat{p} - (1 - \gamma)\bar{z}}{\gamma\hat{p}} \equiv \hat{\lambda}, \quad \text{where } \hat{\lambda} \in [0, 1] \quad \text{when } \gamma \in \left[\frac{\bar{z} - \hat{p}}{\bar{z}}; 1\right]. \quad (20)$$

If (20) and $\lambda \leq \bar{c}/\hat{p}$, or re-stating, if:

$$\lambda \leq \min \left\{ \hat{\lambda}, \frac{\bar{c}}{\hat{p}} \right\}, \quad (21)$$

then due to $U_s > 0 \geq U_m(\bar{z}, \lambda | q = 0)$ every buyer prefers the state sector, but when unsuccessful in obtaining the state contract she will opt out of market contracting. This proves part (iii).

Finally, when $\hat{\lambda} < \lambda \leq \bar{c}/\hat{p}$, then $q = 0$ and $U_m(\bar{z}, \lambda | q = 0) > 0$, while $U_m(\bar{z}, \lambda | q = 0)$ could be either lower or higher than $U_s(\underline{z})$. The buyers who ended up in the market sector will to contract for \bar{z} despite the certainty of the breach by opportunistic sellers. \square

Proof of Proposition 2

For the proof of the claim we consider all ranges of $\underline{\lambda}$ which are determined by the three cut-off values λ_1 , λ_2 and λ_3 defined in (10)–(12). It is easy to check that $\lambda_1 < \lambda_2$ for any $\delta \in (0, 1)$; $\lambda_2 \leq \lambda_3$ if $\gamma \geq (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$; and $\lambda_2 < 1$ if $\delta < 1 - \bar{c}/\hat{p}$. The key to the proof is the definition of the three cut-offs on $\underline{\lambda}$ given in (10)–(12). With these definitions in mind, the following statements are easily established.

If $\underline{\lambda} \leq \min\{\lambda_1, \lambda_3\}$, then the unique optimal choice of opportunistic sellers is $q = 0$ and buyers prefer not to contract in the market due to $U_m(\bar{z}, \lambda | q = 0) \leq 0$. Therefore, WE equilibrium exists and it is unique. If $\lambda_3 < \underline{\lambda} \leq \lambda_1$, then for the unique equilibrium choice of $q = 0$ by opportunistic sellers, the buyers now prefer to contract in the market due to $U_m(\bar{z}, \lambda | q = 0) > 0$, thus making IE equilibrium unique for this range of $\underline{\lambda}$. If $\underline{\lambda} > \lambda_2$ (provided that $\lambda_2 < 1$ which is equivalent to $\delta < 1 - \bar{c}/\hat{p}$), then the opportunistic sellers' unique choice at stage 4 of the game is $q = 1$. Assuming (A3), the buyer will prefer contracting to her outside option irrespective of the sector in which she ends up (since $U_s > 0$ and $U_m > 0$). Therefore in this range SE equilibrium is feasible and unique. Thus the first part of the proposition is established.

To check that the validity of the proposition regarding the multiple equilibria, it suffices to observe that the choice of action at stage 4 by opportunistic sellers is not unique when $\lambda_1 < \underline{\lambda} \leq \min\{\lambda_2, 1\}$. This choice could be either $q = 1$ or $q = 0$ depending on the belief of every opportunistic seller about the choice all other opportunistic sellers are going to make. If $q = 1$ is played in equilibrium, then the optimal choice of buyers in the market is to contract for \bar{z} (thus the strong enforcement equilibrium is feasible). If the sellers' equilibrium choice is $q = 0$, then the buyers' optimal choice will depend on the sign of $U_m(\bar{z}, \lambda | q = 0)$. If it is positive (this would be the case for $\underline{\lambda} > \lambda_3$) then IE equilibrium is feasible. Alternatively, when it is non-positive then WE equilibrium is feasible. \square

Proof of Proposition 3

For SE equilibrium, the opportunistic sellers must optimally set $q = 1$, which gives $V_m^\gamma(\bar{z}, \lambda, r_m)|_{q=1} > V_m^\gamma(\bar{z}, \lambda, r_m)|_{q=0}$ and this in turn gives the condition on λ stated in Prop 3(i). As previously, when $q = 1$, the buyers in the market will prefer contracting to their outside option. Thus part (i) of the Proposition is proved.

In IE equilibrium, all opportunistic sellers optimally breach their contract (\bar{z}, \hat{p}) , while the buyers prefer market contracting to their outside option despite the certainty of the breach by opportunists. These two conditions translate into the following:

$$V_m^\gamma(\bar{z}, \lambda, r_m)|_{q=1} \leq V_m^\gamma(\bar{z}, \lambda, r_m)|_{q=0}, \quad (22)$$

$$U_m(\bar{z}, \lambda, r_m | q = 0) > 0. \quad (23)$$

Writing out the payoffs, as specified by (14) and (15), and substituting the relevant values for q and $\eta = 1$, the two inequalities above result in

$$\frac{\hat{p} - (1 - \gamma)\bar{z}}{\gamma\hat{p}} \cdot \frac{1}{1 - r_m} < \lambda \leq \frac{\bar{c}}{\hat{p}} \cdot \frac{1}{1 - r_m(1 - k)}, \quad (24)$$

where the first inequality sign is due to (23), and the second inequality sign is due to (22). Note that the first inequality sign will be true for any $\lambda \in (0, 1)$ if $\gamma \leq (\bar{z} - \hat{p})/\bar{z}$. Therefore, consider

$$\gamma > (\bar{z} - \hat{p})/\bar{z}. \quad (25)$$

For the existence of IE equilibrium, the two end points of the range given by (24) must be compatible, which after re-arranging translates into:

$$\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) > r_m \cdot \left\{ \bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k \cdot [\hat{p} - (1 - \gamma)\bar{z}] \right\}. \quad (26)$$

Denoting the term in curly brackets by $\{D\}$, the solution to (26) is given by:

$$\text{If } \{D\} > 0, \text{ then } r_m < \frac{\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c})}{\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k \cdot [\hat{p} - (1 - \gamma)\bar{z}]}, \quad (27)$$

$$\text{if } \{D\} < 0, \text{ then } r_m > \frac{\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c})}{\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k \cdot [\hat{p} - (1 - \gamma)\bar{z}]}, \quad (28)$$

$$\text{if } \{D\} = 0, \text{ then } 0 < r_m \leq 1 \text{ and } \gamma < \frac{\bar{z} - \hat{p}}{\bar{z} - \bar{c}}. \quad (29)$$

It needs to be checked in (27)–(29) above that $k \in (0, 1)$ and, if relevant, $r_m \in (0, 1]$. Specifically, since $k > 0$, the condition $D = 0$ in (29) implies $\gamma > [\bar{z} - \hat{p}]/[\bar{z} - \bar{c}]$, which is a direct contradiction to the statement in (29). In (28), $\{D\} < 0$ together with (25) and $k > 0$ implies $\gamma > [\bar{z} - \hat{p}]/[\bar{z} - \bar{c}]$, which in turn implies that the inequality with r_m in (28) has the RHS > 1 , and hence is impossible to satisfy when $r_m \in (0, 1]$. Lastly, turning to (27), $\{D\} > 0$ implies that either $k > [\gamma(\bar{z} - \bar{c}) - (\bar{z} - \hat{p})]/[\hat{p} - (1 - \gamma)\bar{z}]$ and $\gamma > (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$, or $k \in (0, 1)$ and $\gamma \leq (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$. If $\gamma > (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$ while $\{D\} > 0$, then the inequality with r_m has the RHS < 0 , and thus cannot be satisfied for $r_m \in (0, 1]$. We are therefore left with the solution $k \in (0, 1)$ and $\gamma \leq (\bar{z} - \hat{p})/(\bar{z} - \bar{c})$ to (26), which

together with $r_m < [\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c})]/\{\bar{z} - \hat{p} - \gamma(\bar{z} - \bar{c}) + k \cdot [\hat{p} - (1 - \gamma)\bar{z}]\}$ and (24) supports IE equilibrium. By completeness, in all other ranges of parameters (except those listed in parts (i) and (ii) of the Proposition), $q = 0$ is optimal while $U_m(\cdot | q = 0) < 0$. Therefore buyers in the market opt out of contracting. \square

Proof of Claim 1

Consider the case of $q = 1$ (the argument for the case $q = 0$ is analogous) under each of the two alternative assumptions (A3) and (A4). Substitute $q = 1$ into 2, and both of these into the buyer's problem of sector choice in (5) under (A3) and (6) under (A4). Suppose there is (a) an excess demand for the market sector ($\mu < f$), (b) an excess demand for the state sector ($\mu > f$), and (c) there is no excess demand for either sector ($\mu = f$).

Since all buyers are identical, then under (A3) we must have:

$$\text{If (a) then } f = \beta = 1 \text{ and } \bar{z} - \bar{p} > \underline{z} - \underline{p}. \quad (30)$$

$$\text{If (b) then } f = \beta = 0 \text{ and } \bar{z} - \bar{p} < \underline{z} - \underline{p}. \quad (31)$$

$$\text{If (c) then } f = \mu, 0 < \beta < 1 \text{ and } \bar{z} - \bar{p} = \underline{z} - \underline{p}. \quad (32)$$

while under (A4) we must have:

$$\text{If (a) then } f = \beta = 1 \text{ and } \mu(\bar{z} - \bar{p}) > \underline{z} - \underline{p}. \quad (33)$$

$$\text{If (b) then } f = \beta = 0 \text{ and } \bar{z} - \bar{p} < (1 - \mu)(\underline{z} - \underline{p}). \quad (34)$$

$$\text{If (c) then } f = \mu, 0 < \beta < 1 \text{ and } \bar{z} - \bar{p} = \underline{z} - \underline{p}. \quad (35)$$

Solving the above expressions for the market price, we obtain:

$$\text{If (a) then } \bar{p} \stackrel{A3}{<} \bar{z} - (\underline{z} - \underline{p}) \text{ or } \bar{p} \stackrel{A4}{<} \bar{z} - \frac{1}{\mu} \cdot (\underline{z} - \underline{p}), \quad (36)$$

$$\text{if (b) then } \bar{p} \stackrel{A3}{>} \bar{z} - (\underline{z} - \underline{p}) \text{ or } \bar{p} \stackrel{A4}{>} \bar{z} - \frac{1 - \mu}{1 - f} \cdot (\underline{z} - \underline{p}), \quad (37)$$

$$\text{if (c) then } \bar{p} \stackrel{A3, A4}{=} \Delta z + \underline{p}. \quad (38)$$

The RHS of (36) and (38) is smaller than \bar{z} , and thus the buyers are willing to sign market contracts if either (a) or (c). Notice also that $\bar{z} - \frac{1}{\mu} \cdot (\underline{z} - \underline{p}) < \Delta z + \underline{p} < \bar{z} - \frac{1 - \mu}{1 - f} \cdot (\underline{z} - \underline{p})$, which suggests that in (a) the market price is too low, while in (b) the market price is too high, as compared with the price when demand is balanced in (c). Therefore, in the situation of excess demand the sellers could increase the price slightly and still get the buyer to trade, hence this cannot be an equilibrium. Likewise, in the situation of excess demand for the state sector, the market contract price could be reduced so that those market sellers who previously were unable to find contractual partners can now do so. Thus (b) cannot be an equilibrium either. It is therefore shown that (a) is the equilibrium outcome: the demand is balanced, both the buyers and the sellers are willing to trade, and the market price cannot be changed without changing the demand for market contracting. \square

Proof of Proposition 4

To prove the proposition, I show that

$$\text{SE equilibrium exists if } \lambda > \bar{c}/\bar{p} \text{ and } \bar{p} = \Delta z + \underline{p}. \quad (39)$$

$$\text{IE equilibrium exists if } \lambda^\# < \lambda \leq \lambda^b \text{ and (18)}. \quad (40)$$

$$\text{WE equilibrium exists if } \lambda < \min\{\lambda^\#, 1\}. \quad (41)$$

SE equilibrium

For SE equilibrium to exist it is necessary that $q = 1$ is the optimal choice of opportunistic market sellers, honest market sellers are willing to trade, and, by Claim 1, the market contract price is such that the buyers are indifferent between the two sectors:

$$V_m^\gamma(\bar{z}, \lambda)|_{q=1} = \bar{p} - \bar{c} > (1 - \lambda) \cdot \bar{p} = V_m^\gamma(\bar{z}, \lambda)|_{q=0}, \quad (42)$$

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \bar{p} - \bar{c} > 0, \quad (43)$$

$$U_m(\bar{z}, \lambda|q=1) = \bar{z} - \bar{p} = \underline{z} - \underline{p} = U_s(\underline{z}). \quad (44)$$

In the above, (43) can be ignored since it is implied by (42). It is therefore immediate that the strong enforcement equilibrium exists if (39).

IE equilibrium

For IE equilibrium to exist opportunistic sellers must optimally choose $q = 0$, honest market sellers must be willing to trade at price \dot{p} , and the buyers must be indifferent between the two sector contracts:

$$V_m^\gamma(\bar{z}, \lambda)|_{q=0} = (1 - \lambda) \cdot \dot{p} \geq \dot{p} - \bar{c} = V_m^\gamma(\bar{z}, \lambda)|_{q=1}, \quad (45)$$

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \dot{p} - \bar{c} > 0, \quad (46)$$

$$U_m(\bar{z}, \lambda|q=0) = (1 - \gamma) \cdot \bar{z} - (1 - \lambda\gamma) \cdot \dot{p} = \underline{z} - \underline{p} = U_s(\underline{z}). \quad (47)$$

Re-statement of the necessary conditions for IE equilibrium in terms of the market contract price gives the following:

$$\dot{p} \leq \frac{\bar{c}}{\lambda}, \quad (48)$$

$$\bar{c} < \dot{p} < \bar{p}, \quad (49)$$

$$\dot{p} = \frac{(1 - \gamma) \cdot \bar{z} - (\underline{z} - \underline{p})}{1 - \lambda\gamma}. \quad (50)$$

(Equation (50) is the same as (18), and re-stated here for ease of reference.) Notice that (49) takes into account both that honest sellers (first inequality sign) as well as buyers (second inequality sign) must be willing to trade at price \dot{p} when the average quality is known to be less than \bar{z} .

The solution to (48)–(50) must satisfy the following:

$$\bar{c} < \dot{p} = \frac{(1-\gamma) \cdot \bar{z} - (\underline{z} - \underline{p})}{1-\lambda\gamma} \quad \Leftrightarrow \quad \lambda > \frac{\gamma\bar{z} - (\bar{p} - \bar{c})}{\gamma\bar{c}} \equiv \lambda^\sharp, \quad (51)$$

where the expression of the cut-off value function λ^\sharp makes use of $\bar{p} = \Delta z + \underline{p}$. Additionally it is verified that:

$$0 \leq \lambda^\sharp \leq 1 \quad \text{if} \quad \frac{\bar{p} - \bar{c}}{\bar{z}} \leq \gamma \leq \frac{\bar{p} - \bar{c}}{\bar{z} - \bar{c}}. \quad (52)$$

It remains to be checked that (50) satisfies (48) as well as the second inequality in (49). It is easy to see that when $\lambda \leq \bar{c}/\bar{p}$ then (48) is implied by (49) and can be ignored. Then the second inequality in (49) combined with (50) gives:

$$\lambda < \frac{\bar{p} - (1-\gamma)\bar{z} + (\underline{z} - \underline{p})}{\gamma\bar{p}} = \frac{\bar{z}}{\bar{p}}, \quad (53)$$

which is satisfied for any $\lambda \in (0, 1)$ since $\bar{z} > \bar{p}$. If alternatively $\lambda > \bar{c}/\bar{p}$ then the solution to (48)–(50) must satisfy

$$\dot{p} = \frac{(1-\gamma) \cdot \bar{z} - (\underline{z} - \underline{p})}{1-\lambda\gamma} \leq \frac{\bar{c}}{\lambda} \quad \Rightarrow \quad \lambda \leq \frac{\bar{c}}{\bar{p} - \gamma(\bar{z} - \bar{c})} \equiv \lambda^\flat, \quad (54)$$

where again $\bar{p} = \Delta z + \underline{p}$ is used. It is also checked that

$$\text{if } 0 \leq \gamma \leq \frac{\bar{p} - \bar{c}}{\bar{z} - \bar{c}} \quad \text{then} \quad \frac{\bar{c}}{\bar{p}} \leq \lambda^\flat \leq 1 \quad (55)$$

Collecting all the parts of the solution, namely (50), (51) and (54), we have the necessary conditions for the existence of IE equilibrium as stated in (40).

WE equilibrium

For existence of WE equilibrium, the necessary conditions are (45), (47) and (56):

$$V_m^{1-\gamma}(\bar{z}, \lambda) = \dot{p} - \bar{c} \leq 0. \quad (56)$$

In words, in WE equilibrium all opportunistic sellers optimally breach their market contracts. The breach makes the market contract price which would be acceptable to the buyer (and that would make the buyers indifferent between the two sectors) too low for the honest sellers to be willing to contract in the market. Notice that (56) is the reverse of (46), while (45) is implied by (56). The solution to (56) and (47) is therefore immediate:

$$\bar{c} \geq \dot{p} \quad \Leftrightarrow \quad \lambda \leq \min\{\lambda^\sharp, 1\}, \quad (57)$$

which gives the statement (41). \square