Trade and Contract Enforcement

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Abstract

We model imperfect contract enforcement when the victims of default resort to spot trading because the act of repudiation reveals a favorable outside option. We show that enforcement imperfection is essentially distinct from the contract incompleteness analyzed in the previous literature. Improved contract execution benefits traders on the excess side of the spot market by attracting potential counter-parties, but harms them by impeding their exit from unfavorable contracts. Multiple optima are possible, with anarchy a local optimum, perfect enforcement a local minimum and imperfect enforcement a global optimum. LDCs exhibit parameter combinations such that imperfect enforcement may often be optimal.
(100 words)

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Intuition suggests that the imperfect enforcement of contracts limits trade (Rauch, 2002; Rodrik, 2000). Empirical analysis confirms intuition. For example, Anderson and Marcouiller (2002) show that imperfect enforcement and other forms of insecurity reduce the international trade of Latin American countries by as much as their tariffs. Variation in contract enforcement across countries with seemingly similar institutional capabilities (see the data reported in Anderson and Marcouiller, 2002) suggests wide international variation in the demand for contract enforcement. Why should countries fail to capture the gains from trade that would be stimulated by improvements in contract enforcement that seem well within their institutional capabilities? This paper provides a theoretical model of the demand for enforcement. It reveals conditions under which enforcement of any degree will be opposed, even when costless, and other conditions under which partial enforcement will be supported, but not perfect enforcement.

Our setup is particularly relevant to international trade, though it is more widely applicable. The quality of enforcement offered to foreigners is commonly less than that offered to nationals. The treatment of foreign traders is a decision variable in the rule-setting stage of the game. Plausibly, enforcement is only as good as the home side permits it to be, leading to a theory of national demand for contract enforcement with foreign traders. Enforcement includes formal legal processes, as well as informal arbitration and conflict resolution backed by social sanctions. Enforcement ultimately implies that a defaulter is compelled to honor his contract by a national 'court'. Enforcement is modeled here as the probability that a defaulter will be forced to execute his contract; tighter rules or fairer implementation raise the probability.

Our model combines imperfect enforcement with limited search for an alternative partner when a contract is repudiated. In equilibrium, the model implies that no victim of default ever renegotiates. Improved enforcement in this setting raises trade volume and trade efficiency. But potential repudiators may lose because the lower chance of successful repudiation may cost them more than the gains from the larger numbers of counter-parties attracted into the market. Each element of our model is essential to an environment where enforcement matters. As we confirm below, the level of contract enforceability is irrelevant to trade volume and trade efficiency when contract repudiation always leads the traders to renegotiate, or when search for other trading partners is freely available as an alternative to renegotiation.

Imperfect contract enforcement is distinct from the incompleteness of contracts, an important aspect of institutional quality that has been analyzed by Caballero and Hammour (1998) and Grossman and Helpman (2002, 2005). This literature presumes that verifiable actions are included in contracts perfectly enforced by a 'court'; actions that cannot be verified cannot be included. To highlight our departure from this literature, we shall translate the setup of Caballero and Hammour to our model and show that partial enforcement of all actions that are not perfectly contractible then results in efficient trade. By contrast, our core model of imperfect contract enforcement results in inefficient trade because the victims of contract repudiation have random outside options and recourse to a spot market. Thus, our core model highlights implications of imperfect enforcement that are essentially different from the implications of incompleteness in the contracts to be enforced.[1] Imperfect enforcement fits into the 'incomplete contracts' approach only in the sense that it reflects the impossibility of contracting on the performance of the 'court'. Our model does share with Caballero and Hammour the conclusion that institutional improvement can increase the scope of activities that are contractible, but such improvements need not be supported by all agents.

In the literature, the model closest to ours in spirit focuses on imperfect enforcement within a social network where reputation alone sustains cooperative behavior. Dixit (2003, Ch. 3) models how a social network extends the reach of reputation, even when the probability of again meeting a particular trade partner in the future is low.[2] Perfect enforcement requires a fixed cost, so it is only worthwhile for sufficiently large markets. The model has an equilibrium in which some trades are constrained by reputation alongside others resulting default and in enforced execution. In Dixit's model, all traders in the social network would prefer costless enforcement, whereas in our model some traders might prefer imperfect enforcement.

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[1] Tirole (1999) notes that the incomplete contracts approach can be defended as realistic, though it is often vulnerable to the charge of hand-waving.

[2] The network's ability to report on the history of individuals decays with distance while the gain from non-cooperative behavior rises with distance. The probability of cooperative behavior in any given match first rises and then falls as the size of the market

Section1 lays out our analytical strategy and tactics. Section 2 presents the basic model. Section 3 develops the implications of improved enforcement for trader profits. The opportunity to trade may stimulate improved institutions. Section 4 interprets the model and its parameters in terms of levels of development, arguing that there is a plausible force running from economic development to improvements in trade institutions. Section 5 analyzes alternative trading mechanisms. Section 6 discusses the wider implications of our analysis for institutional evolution and future research directions.

1. Analytical Strategy and Tactics

Contracts are understood in this paper as a response to the holdup problem that arises when traders must sink some costs to trade. We sketch our modeling strategy to persuade the reader that it encompasses the essential ingredients and only the essential ingredients. Then we summarize our analytical tactics.

Most trade costs are sunk prior to exchange. Traders' bargaining ignores their sunk costs, splitting the surplus to be gained from trade as a convex combination of their outside options at the time they bargain. The bargaining outcome may turn out to be inefficient because it ignores sunk costs; the holdup problem. For example, the bargained price anticipated by the seller may not cover his sunk cost, even though the buyer is willing to pay more than the sunk cost to obtain the good.

When contracts are negotiated on a competitive market, there will be no holdup and exchange will be efficient if contracts are perfectly enforced. Efficient trade also results if each trader can respond to contract repudiation by freely searching for an alternative partner. No trader would then accept a bilateral exchange at terms worse for himself than the best available on his side of the market. Free search drives valuations to converge to the market-clearing price. But then, contracts would be unnecessary and the level of contract enforcement would be irrelevant.

Imperfect contract enforcement can matter if search after contract repudiation is limited in some fashion, rather than being freely available. Such search must be *possible*,

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grows. Traders in large markets may gain by replacing the social network with perfect government enforcement, paid for with a lump sum tax to cover the fixed cost.

however, to build a model that conforms to empirical observation. To see this, consider the contrary case where search after contract repudiation is impossible. We show below in Section 5 that if traders always renegotiate when contracts are defaulted, then so long as there is even a small probability of execution, trade would be efficient and the equilibrium trade volume would be invariant to the rate of contract enforcement. On the other hand, if renegotiation is impossible (perhaps for psychological reasons) while search remains impossible, then improved contract enforcement raises trade volume and trade efficiency. The expected gain from executed contracts weakly exceeds the expected loss on defaulted contracts for both sides of the market. Both sides would gain ex ante from reductions in default, so all traders would support improved enforcement and all countries would maximize the quality of contract enforcement. However, the survey data reported by Anderson and Marcouillier (2002) appear to reject this implication, while economic intuition suggests that professional traders cannot easily commit to non-renegotiation and that search costs are rarely prohibitive.

The conclusions of the two preceding paragraphs indicate that a realistic model of contract enforcement ought to permit some search after contract repudiation, as an alternative to renegotiation, but ought not to assume that the search process can proceed freely, else contract enforcement would be economically irrelevant. Our model limits search by a victim of contract repudiation by supposing that he/she has only one opportunity to match with a new trading partner. Matching is chosen for simplicity; more complex models with explicit search costs would require complicated modeling of bargaining rounds in sequence with search rounds, but should have the same qualitative properties.

In our model, the opportunity to match arises once only, prior to bargaining on the spot market. Matched traders bargain, while traders unmatched (or unsuccessful in bargaining) return home to their outside options. An essential property of this setup is that in equilibrium the victims of default refuse to renegotiate. A repudiator reveals that he has an outside option that is more favorable than average. His victim would do better with a random match from the 'spot' market, which some counter-parties will have entered without contracts. Thus, an interesting feature of our model is that imperfect enforcement calls forth a spot market alongside the contract market. The spot market generally has unequal numbers of buyers and sellers, so trade is inefficient and enforcement affects trade volume.

Better contract enforcement always benefits traders on the scarce side of the market by reducing the proportion of trades that must be bargained, following matches with counter-parties that include some defaulters with better-than-average outside options. By contrast, traders on the excess side of the market can gain or lose with better enforcement. On the one hand, better enforcement induces more scarce siders to enter the trade arena; this increases the probability of a match in the spot market for excess side traders. On the other hand, better enforcement reduces the proportion of contracts that can successfully be repudiated, given the draw of a favorable outside option. The enforcement policy preferred by excess siders trades off these two factors. This provides the basis for a theory of the demand for contract enforcement.

Analytical Tactics

Sellers and buyers exchange goods for money via two different processes. Some trades occur at contracted prices, either because both parties voluntarily execute the contract or because a court forces a repudiator to execute. Other trades occur at bargained prices between buyers and sellers who have successfully matched in a 'spot' market. Each bargained price is a convex combination of the willingness-to-pay of the buyer and the reservation price of the seller. The bargained price shares the surplus in the relationship, where each player's outside option when the bargaining breaks down is equal to zero. The buyers and sellers each receive idiosyncratic random shocks to their willingness-to-pay and reservation prices respectively, with known distributions.

Traders who wish to do so sign contracts in a frictionless contract market. Then traders sink their trading costs and receive random draws of their willingness-to-pay and reservation prices. These remain private information until bargaining commences. Some traders have an incentive to default on their contracts, for example, a buyer who draws an unusually low willingness-to-pay. All victims of default appeal to a court, which enforces a parametric proportion of defaulted contracts. The victim of a repudiated contract could either renegotiate or enter the matching process on the spot market. Following the close of matching, pairs of matched traders reach bargains based on their draws of willingness-to-pay and reservation prices, which are revealed to their partners. Then trade is executed at either the contracted price (for executed contracts) or the bargained price (on the spot market). Traders unsuccessful in matching return home. For analytic convenience, the random shocks to one side of the market are restricted so that that side never defaults. The potentially defaulting side is the excess side of the market. Figure 1 depicts the timing of moves and the decision tree of an excess side buyer, with payoffs, which are defined below in Section 2.

Our equilibrium analysis assumes that traders have rational expectations. The objective probability of a match depends on the ratio of buyers to sellers on the spot market, some there by choice, others through contract repudiation. The spot market is generally not in equilibrium ex post; it equilibrates ex ante in the sense that traders shift between the spot and the contract markets until their expected profits are the same in the two markets. Via this equilibrium condition, traders' beliefs about the rate of contract execution determine the cutoff values of their random shocks (at which they repudiate their contracts); the rate of enforcement then determines the actual rate of contract execution.

For simplicity we assume that improved enforcement increases the rate of contract execution, as would be true for additive shocks (see Anderson and Young, 2002, for analysis of the non-monotonic case, which can induce multiple equilibria).[3] Then equilibrium is unique for a given enforcement rate.

We next analyze in Section 3 the effect of improved enforcement on the profits of buyers and sellers. Scarce siders always gain. To see that traders on the excess side of the market can be harmed by better enforcement, consider an "excess demand equilibrium", i.e., an ex ante equilibrium in which there is excess demand in the spot market. Improved contract execution harms buyers directly by impeding exit from contracts found to be unfavorable, thereby worsening their expected terms of trade; but benefits buyers indirectly as more sellers are attracted by the higher price that they expect. Buyers are

[3] Under rational expectations, a given level of enforcement can be compatible with multiple rates of execution when these rates are highly sensitive to the cutoff value of the shocks. This would be true when, on the scarce side of the spot market, the disturbances have a heavy concentration well above their mean: an "upside shock". In this case, greater enforcement could increase the rate of repudiation of contracts, so that fewer are executed. This would certainly harm traders on the scarce side of the spot market.

harmed overall if the supply elasticity is low. We show that in low elasticity cases, buyers' profits fall monotonically with enforcement; that in high elasticity cases, buyers' profits rise with enforcement; while in intermediate elasticity cases the buyers profits rise to a maximum at some interior level of enforcement.

Section 4 applies the preceding analysis to sorting out why some nations have better enforcement than others. Key parameters in the model point to developing nations having less good institutions than rich nations, even when enforcement is costless.

Section 5 analyzes alternative trading/contracting mechanisms to verify that the elements of our model are necessary for contract enforcement to matter. Section 6 concludes.

2. The Formal Model

Risk neutral buyers and sellers meet to exchange a good in a trading zone which they enter at a deterministic cost that generally differs from trader to trader. The trading cost schedules determine the ex ante demand and supply schedules, as further explained below. Each buyer buys one unit of the good, which accounts for an infinitesimal share of the market. A buyer anticipates his willingness-to-pay based on re-selling the purchased unit back in his home market at a price $b+\mu$; a seller anticipates procuring or re-selling the good in his home market at a price $c-\nu$. Here, b and c are fixed numbers; μ, ν are random disturbances with zero means, unknown at the time that the traders have to sink their costs of entering the trading zone, but realized immediately afterward. The disturbances μ (ν) for the various buyers (sellers) are identically distributed and all disturbances are pairwise independent. A buyer who enters and executes a deal at price p receives payoff $b+\mu-p$; a buyer who enters, but executes no deal, returns home to buy and re-sell the good at $b+\mu$ and receives zero payoff. A seller who enters and executes a deal receives payoff $p-c+\nu$; a seller who enters, but does not execute, returns home to resell the good at $c-\nu$ and receives zero payoff.

Before sinking trading costs, each trader can enter into a contract to deliver the good. The market mechanism for such contracts costlessly determines a market-clearing price. Once he learns his own benefit/cost disturbance, each party to a contract must decide whether or not to repudiate it, knowing the probability distributions of disturbances of all traders, but not the disturbance suffered by his counter-party. The victim appeals to a court, which, however, enforces only a parametric proportion $\theta \in [0,1]$ of the repudiated contracts.

The victim of a repudiated, unenforced contract must choose between (i) renegotiating with the repudiator, (ii) returning to his home market or (iii) entering the spot market. We open our analysis of traders' decisions under the interim assumptions:

(1.1) The victim of a repudiated, unenforced contract enters the spot market, i.e., he neither renegotiates with the repudiator nor goes home.

(1.2) Traders who would be on the scarce side of the spot market never repudiate a contract.

These assumptions will be maintained until Lemmas 3 and 4, which provide conditions ensuring that these assumptions hold in a rational expectations equilibrium.

On the spot market, any trader has but one chance of being matched with a counter-party, then bargains one-on-one with common information about each other's valuations. The spot market contains all parties to non-executed contracts, but will also contain traders who enter without previously having contracted, based on expected returns which cover their trade costs. Thus the spot market typically has a mismatch between supply and demand. We assume that all scarce side traders match, but on the excess side, some must return home without trading. Excess side traders shift ex ante between the spot and the forward markets (i.e. between not contracting and contracting) until their expected return is the same in both. Their equilibrating movement determines the contract price. In a rational expectations equilibrium, excess side traders' subjective beliefs about the probability that they will match on the spot market equal the objective probability.

2.1. Buyers

Buyers can contract or enter the spot market directly where they seek a match with sellers. The various possibilities and their payoffs are summarized in Figure 1. It is very helpful in learning the model to work back and forth from the text to Figure 1.

PLACE FIGURE 1 HERE

All matches result in asymmetric Nash bargaining, where the threat points are the zero net payoffs the traders receive if they return home. This leads to the price:

$$\omega(b+\mu)+(1-\omega)(c-\nu)$$

where $\omega \in (0,1)$ indexes the seller's bargaining power. [4] Conditional on a match, spot buyers expect to pay:

(1.3) $p^* \equiv E[\omega(b+\mu)+(1-\omega)(c-\nu)] = \omega b + (1-\omega)c$.

Conditional on a failure to match, they expect to pay b. Therefore, a buyer who directly enters the spot market expects to pay:

(1.4) $p^b = \pi p^* + (1-\pi)b$.

where π is the probability of matching, to be determined in equilibrium.

Let p^C be the price that would be paid by contracting buyers who execute, including those who repudiate their contracts but find them enforced nevertheless. After contracts have been signed, both parties sink the cost of entering the trading zone. Each buyer then learns the price $b+\mu$ at which he can sell the good in his home market; each (foreign) seller learns the price $c-\nu$ at which he can procure the good in his home market. Traders then decide whether or not to repudiate their contracts; under our interim assumptions (1.1) and (1.2), repudiators who evade enforcement and their victims then enter the spot market.

A buyer who suffers disturbance μ expects to negotiate a price $p^* + \omega\mu$ on the spot market if he matches; otherwise, he expects to pay $b+\mu$ on his home market. Therefore, a buyer who fails to execute his contract expects to pay $\pi(p^* + \omega\mu) + (1-\pi)(b+\mu)$. The disturbance at which this equals the contract price p^C is:

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[4] This is the price p that maximizes $(b+\mu-p)^{\omega}(p-c+\nu)^{1-\omega}$. The buyer gains $b+\mu-p$ with a deal and 0 otherwise; the seller gets $p-c+\nu$ with a deal and 0 otherwise. We interpret asymmetric Nash bargaining in terms of strategic play of alternating offers with a probability that bargaining will end. Meeting the critique of Binmore, Rubinstein and Wolinsky (1986) we suppose that the random event that ends the bargaining is a movement of price in one of the partners' home markets that is more favorable to that partner than any feasible bargain. Then the other partner must return home to his fallback option. This rationalizes using traders' fallback options as the threat points in Nash bargaining. (We implicitly restrict the probabilities of favorable price movements to be small enough that the expected payoff to bargaining dominates waiting for the favorable event.)

(1.5) $\mu^* = \dfrac{p^C - p^b}{\pi\omega + 1 - \pi}$.

A buyer expects to pay less than the contract price on the spot market if and only if he realizes a disturbance $\mu < \mu^*$. Thus, across the buyer population, the probability of repudiation is:

$$F(\mu^*) \equiv \int_{\underline{\mu}}^{\mu^*} f(\mu) d\mu$$

where $f(\mu)$ is the marginal probability (density function) of μ, assumed to be piecewise continuous over its support $[\underline{\mu}, \bar{\mu}]$.

We now compute the buyer's ex ante gross benefits from a contract, taking account of his option to default. Given a rate of enforcement $\theta \in [0,1]$, contracts are executed at rate:

(1.6) $\beta = 1 - F + \theta F$.

A buyer who does not execute his contract must have chosen to repudiate it. The expected value of the disturbances which induce repudiation is the expected value of those disturbances that are less than μ^* times the probability of receiving a disturbance below the critical value:

$$m(\mu^*) \equiv \int_{\underline{\mu}}^{\mu^*} \mu f(\mu) d\mu .$$

$m(\mu^*)$ is negative, being less than the zero mean of the distribution of μ. The buyer expects to pay $p^* + \omega m(\mu^*)$ if he matches on the spot market; $b + m(\mu^*)$ if he fails to match and returns home. Thus, by (1.4), conditional on non-execution, the buyer on the contract market expects to pay:

$$\pi[p^* + \omega m(\mu^*)] + (1-\pi)[b + m(\mu^*)] = p^b + (\pi\omega + 1 - \pi) m(\mu^*).$$

Overall, the buyer who contracts expects to pay:

$$\beta p^C + (1-\beta)[p^b + (\pi\omega + 1 - \pi) m(\mu^*)].$$

Buyers shift between the contract and the spot markets until this equals the price p^b that they expect on the spot market if they enter it directly, i.e., until:

(1.7) $p^C - p^b = -m(\mu^*)(\pi\omega + 1 - \pi)(1-\beta)/\beta > 0$ for $\beta < 1$.

(1.7) is the premium over the expected spot price that buyers are willing to pay for a contract, because if they suffer an unfavorable benefit disturbance, then they have the option to repudiate the contract and seek a lower spot price. Eliminating p^C between (1.5) and (1.7), we conclude that equilibrium between the contract and the spot markets requires that:

$$(1.8) \qquad -\frac{\mu^*}{m(\mu^*)} = \frac{1-\beta}{\beta}.$$

This determines the critical value $\mu^* = \mu(\beta)$ compatible with equilibrium, given an execution rate $\beta \in [0,1]$.

We can solve for the contract price as a function of θ by noting that, in equilibrium, the rate of execution β must generate a repudiation rate $F(\mu(\beta))$ via (1.8) that confirms (1.6), i.e.:

$$(1.9) \quad 1-\beta = (1-\theta)F(\mu(\beta))$$

Lemma 1: (A) For $\beta \in [0,1]$, there exists a unique $\mu(\beta)$ satisfying (1.8). $\mu(0)=\bar{\mu}$, $\mu(1)=0$.

(B) For $\theta \in [0,1]$, there exists a $\beta(\theta) \in [0,1]$ satisfying (1.9). $\beta(0)=0$, $\beta(1)=1$.

Lemma 1 determines a $\mu(\beta(\theta))$ compatible with equilibrium in the contract market. This depends only on the distribution of benefit disturbances μ and the parametric rate of enforcement θ: it does not depend on the probability π of a match, nor on sellers' bargaining power ω. Then $\mu(\beta(\theta))$ determines equilibrium values for F and m. Henceforth, μ, F and m shall be understood to take these equilibrium values, unless other arguments of these functions are specified. Given buyer beliefs about π, p^C is then determined by (1.7) and (1.4).

2.2. Sellers

The above calculation allows for excess demand in the spot market ($\pi < 1$) as well as excess supply ($\pi = 1$). A symmetrical derivation is possible for sellers. Below, we present the sellers' decisions only for the case where the spot market equilibrium exhibits excess demand. We can show that sellers then always sign contracts, never default and never renegotiate if faced with a defaulter.

The proportion of buyers in the spot market who have defaulted on contracts equals the ratio of seller victims of default to total buyers in the spot market. Our interim assumption that traders who would be on the short side of the spot market never repudiate contracts implies that this ratio equals π, the buyer's probability of matching on the spot market. Defaulting buyers suffer a benefit disturbance of $m < 0$ on average, so the impact of their disturbances on the spot price that sellers expect to negotiate is $\omega\pi m$. Seller victims of default expect to receive $p^* + \pi\omega m$, so sellers with a contract expect to receive:

(1.10) $p^s = \beta p^C + (1-\beta)(p^* + \pi\omega m)$.

Solving (1.7) for p^C and substituting into (1.10):

(1.11) $p^s = \beta p^b + (1-\beta)p^* - m(1-\beta)(1-\pi)$

By (1.4):

(1.12) $p^b = p^s + (1-\beta)(1-\pi)(b + m - p^*)$

In the last term in (1.12), $b + m - p^*$ equals the premium over the spot price expected by buyers who avoid executing their contracts, fail to match and therefore pay their home price, which they expect to be $b + m$. $(1-\beta)(1-\pi)$ is the probability of the latter two events. Thus, $(1-\beta)(1-\pi)(b + m - p^*)$ is the additional amount that buyers expect to pay over what sellers expect to receive because buyers can end up purchasing at home rather than from sellers.

In an excess demand equilibrium, sellers always sign contracts because their expected price p^s with a contract exceeds the price $p^* + \pi\omega m$ that they expect if they enter the spot market uncovered. This can be seen from (1.11), (2.3), (1.4) and (1.8), which imply that:

(1.13)
$$\begin{aligned} p^s - p^* - \pi\omega m &= \beta(p^b - p^*) - m(1-\beta)(1-\pi) - \pi\omega m \\ &= \beta(1-\pi)(b - p^*) - m(1-\beta)(1-\pi) - \pi\omega m > 0. \end{aligned}$$

2.3. Equilibrium

To determine equilibrium, we specify the structure of demand and supply in more detail. Risk neutral buyers demand the good (enter the trading zone) at price p if their trading cost is weakly less than the gain $b - p$ that they expect. Risk neutral sellers supply the good (enter the trading zone) at price p if their trading cost is weakly less than the gain $p - c$ that they expect. Ordering buyers and sellers by increasing trading cost, let $t^d(q)$ be the trading cost of the marginal buyer when the total quantity bought is q; let $t^s(q)$ be the trading cost of the marginal seller when the quantity sold is q. The ex ante demand at price p is the $d = d(p)$ such that the marginal buyer is indifferent between trading or not trading, i.e., $t^d(d) + b = p$. The ex ante supply at price p is the $s = s(p)$ such that the marginal seller is indifferent between trading or not trading, i.e., $t^s(s) + c = p$.

The expected outcome of bargaining on the spot market is the p^* specified in (2.3). If $d(p^*) > (= /<)\ s(p^*)$, then, absent a contract market, the spot market would exhibit excess demand (equilibrium/ excess supply). We shall show that this conclusion remains valid after the introduction of the contract market. For concreteness, we focus on the excess demand case where $d(p^*) > s(p^*)$; the excess supply case follows from symmetry.

In a rational expectations equilibrium, the ex ante subjective probability of a match for the excess side and of a match with a defaulter for the scarce side must equal the ex post objective probability. Thus, the equilibrium π satisfies:

$$\pi = h(\pi, \beta) \equiv \frac{(1-\beta)s(p^s)}{d(p^b) - \beta s(p^s)} \tag{1.14}$$

The numerator on the right side equals the number of sellers who are in the spot market because their contracts were repudiated. The denominator equals the number of buyers in the spot market, i.e., the total number committed to trade, less those whose contracts are executed.

Lemma 2: If $d(p^*) > s(p^*)$, then for each $\beta \in [0,1]$, (1.14) has a unique solution $\pi[\beta] \in (0,1)$.

The π determined by Lemma 2 defines an excess demand equilibrium. To close the model, we now state conditions ensuring that the interim assumptions (1.1) and (1.2) used so far in our analysis of individual buyers and sellers hold in a rational expectations equilibrium because they would be in the interests of the traders.

Lemma 3: In an excess demand equilibrium, a seller victimized by a repudiated, unenforced contract expects a higher payoff from entering the spot market than from renegotiating with the repudiator or returning to his home market, provided that under any cost disturbance v, he expects gains from spot trade. This would be true if and only if:

(1.15) $$\omega(b - c + \pi m) > - \underline{v}$$

where $\underline{v}$ is the worst (most negative) realization of v.

Lemma 4: (A) In an excess demand equilibrium, a seller who learns his cost disturbance expects higher profits from honoring the contract than from entering the spot market, provided that cost disturbances are small compared to benefit disturbances, specifically:

(1.16) $$\frac{\mu(\beta(\theta))\omega}{1-\omega} > -\underline{v}$$

i.e., the worst cost disturbance to the seller is less than the cutoff value $\mu(\beta(\theta))$ of the buyer's benefit disturbance (at which he would be indifferent between honoring and repudiating the contract) — weighted by the relative bargaining power of sellers.

(B) If (1.15) also holds, then the seller expects higher profits from honoring the contract than from returning to his home market or renegotiating with his counter-party.

Proposition 1: Suppose that (1.15) and (1.16) hold and $\theta \in (0,1)$. If $d(p^*) > s(p^*)$, then there exists an excess demand equilibrium in which:

(i) buyers directly enter both the spot and contract markets; for some benefit disturbances, buyers with a contract repudiate it; those who evade enforcement enter the spot market;

(ii) sellers always sign contracts and never repudiate them; victims of repudiated contracts enter the spot market.

If $d(p^*) < s(p^*)$ then similar conclusions hold for an excess supply equilibrium.

The really essential result in Proposition 1 is that victims of repudiation do not renegotiate, the others are simplifications. The no renegotiation result is actually quite robust when search is an option because default is a very powerfully informative action about the defaulter's bargaining position. For example, advance payments by defaulters to victims cannot undo it.[5]

[5] In excess demand equilibrium, the buyer who defaults can offer the seller an *advance payment* to renegotiate rather than search. At the average cost disturbance for default, the buyer could afford to pay up to $(1-\pi)\omega m$. For buyers with sufficiently favorable realizations of the cost disturbance process, such a payment is feasible. But for many

Assumptions (1.15) and (1.16) will be maintained henceforth. For concreteness, the following comparative static analysis assumes an excess demand equilibrium where the sellers are on the scarce side. Similar results hold for an excess supply equilibrium.

3. Impact of Enforcement on Sellers and Buyers

3.1 Enforcement and Execution

We analyzed the equilibrium by determining the endogenous variables as functions of the rate of contract executionβ, then determined β as a function of the enforcement rate θ. Similarly, we analyze the impact of θ on the endogenous variables via β. A subscriptindicates partial differentiation with respect to the corresponding variable; for functions with only one argument (such as $\mu(\beta(\theta))$, $m(\mu(\beta))$ or $F(\mu(\beta))$), a subscript indicates total differentiation.

Lemma 5: $\mu_\beta < 0$, $m_\beta < 0$, and $F_\beta < 0$.

Thus, key endogenous variables are monotonic in β. However, β itself need not be monotonic in θ. Recall:

(2.1) $1-\beta = (1-\theta)F(\mu(\beta))$.

The left side is the subjective non-execution probability; the right side is the objective non-execution probability, given the subjective non-execution probability. An increase in θ decreases the objective probability of non-execution below the subjective probability. How must β change to restore equality? An increase in β decreases $1-\beta$, but also decreases $\mu(\beta)$ and hence $F(\mu(\beta))$. If its proportional impact on $F(\mu(\beta))$ is stronger than

defaulting buyers, their realization of the disturbance is insufficiently favorable (such as those in the interval $[m,\mu^*]$). More important, any buyer who could afford to make such an offer signals to the seller that his disturbance is even better. Thus, advance payment of this type is unable to prevent a victim's recourse to a spot market. A more involved question is whether the excess side can commit advance payment at the contract stage which is sufficient to achieve efficient trading. It turns out to be impossible to simultaneously reach efficient trade and yet ensure that the advance payment to the putative scarce side does not induce them to default. Proof is available on request.

on $1-\beta$, then equality could be restored only by a decrease in β. Lemma 6 excludes the perverse outcome when F is inelastic to μ, such as when F is linear in μ.

Lemma 6: If:

(2.2) $$\mu' f(\mu') < \frac{F(\mu')}{1-[1-F(\mu')]\mu'/m(\mu')} \text{ for some } \mu' \in (0,\bar{\mu}),$$

then $\beta_\theta(\theta) > 0$ for all $\theta \in [0,1]$. This is true when μ isuniformly distributed, in which case $\beta(\theta) = \sqrt{\theta}$.

See Anderson and Young (2002) for analysis of the perverse case.

3.2 Profits

Now consider the effect of enforcement changes on sellers and buyers given the condition of Lemma 6. We identify specific factor interests[6] with the quasi-rents or profits (producers' surplus) earned on the buyers' and sellers' sides of the market:

$$S^b = \int_0^{q^b} [b - p^b - t^b(x)]dx$$

$$S^s = \int_0^{q^s} [p^s - c - t^s(x)]dx.$$

The buyers' surplus is decreasing in p^b while the sellers' surplus is increasing in p^s .

Lemma 7 extends the above analysis of β as a function of θ to the sellers' price p^s, hence to the typical seller's expected profits as a function of θ. This leads to Proposition 2.

Lemma 7: $dp^s / d\beta > 0$.

Since $S^s_\beta = q^s dp^s / d\beta$ (due to competitive entry of sellers), we have:

Proposition 2: Improved enforcement always benefits scarce side sellers.

The impact of improved enforcement on excess side buyers, in contrast, is ambiguous. Due to competitive entry of buyers and applying the definition of p^b, $S^b_\beta = q^b(b - p^*)d\pi / d\beta$. Thus the buyers' quasi-rents under competitive entry vary

[6] Implicitly, the diminishing returns in trade services that lie behind rising unit trade costs must imply a specific factor that receives quasi-rents.

directly with π. The reduced form function $\pi[\beta]$ that relates π to β can have both rising and falling portions, leading to interior maxima for quasi-rents, or to boundary maxima at either limit, depending on parameter values.

From (1.14) and Lemma 2, the match probability changes with the execution rate according to

$$h_\beta = -(1-\pi) + (1-\beta+\beta\pi)\frac{\varepsilon^s}{p^s}\frac{\partial p^s}{\partial\beta}. \tag{2.3}$$

The first term represents the loss of partners in the spot market from the scarce side as more repudiating buyers are forced to execute. The second term represents the gain in partners from the scarce side as more are induced to enter trade by the increase in their expected price p^s. As the elasticity of supply is large (small), the match probability is increasing (decreasing) in the execution rate.

Sorting out the possibilities requires the boundary values of $\pi[\beta]$, the reduced form match probability as a function of the execution rate. The match probability $\pi[0]$ can be ranked relative to $\pi[1]$ using Figure 2. The efficient price benchmark p^e lies at the intersection of $d(p)$ and $s(p)$. The appendix shows that as $\beta \to 1$, the match probability implied by (1.14) is given by $\pi[1] = (b - p^e)/(b - p^*)$, that value of π which induces the same demand as does the efficient price.

PLACE FIGURE 2 HERE

The new element in Figure 2, $\tilde{d}(p)$, is the unit elastic hypothetical demand curve through *R**, yielding all along its length the same revenue as $R^* = (b - p^*)s(p^*)$. Point *R** must be located to the left of the demand curve *d* at price $b - p^*$, by Lemma 2. The intersection of $\tilde{d}$ with *d* to the left (at the unlabeled price p^1) is irrelevant because it is associated with excess supply. The intersection of $\tilde{d}$ with *d* to the right lies at the excess demand equilibrium price p^0 that is greater (less) than p^e as the elasticity of supply $\bar{\varepsilon}^s$ in an average sense over the relevant range is sufficiently small (large) as illustrated by the solid (dashed) supply function s (s^a).

The intersection of $\tilde{d}$ with d solves for $p^0 = \pi[0](b - p^*)$ and hence the match probability using $R^* = \pi[0](b - p^*)d\{\pi[0](b - p^*)\}$. The range of supply elasticities that can be used to rank $\pi[0]$ relative to $\pi[1]$ is restricted by the fact that the average demand elasticity $\bar{\varepsilon}^b$ must equal 1 over the interval (p^1, p^0) and hence $\bar{\varepsilon}^b < 1$ over the relevant interval $(b - p^*, p^0)$. Thus

Lemma 8: $\pi[0] - \pi[1] > (<) 0$ as the elasticity of supply $\bar{\varepsilon}^s < \bar{\varepsilon}^b < 1$ $(\bar{\varepsilon}^s >> \bar{\varepsilon}^b)$.

Pulling the possibilities together, Figure 3 illustrates the four most plausible scenarios for $S^b[\beta]$. Lemma 8 establishes the boundary rankings, so panels A and B represent the large average elasticity cases while panels C and D represent the small average elasticity cases.

It is possible that with small elasticity of supply, $d\pi / d\beta < 0$ throughout the range of enforcement values. With large elasticity of supply it is possible that $d\pi / d\beta > 0$ throughout the range. More interesting possibilities mix rising and falling ranges of π. The behavior of $\pi[\beta]$ between the bounds is based on (2.3). As β rises the second term of (2.3) becomes smaller at constant π and ε^s / p^s while it is plausible that the ε^s / p^s declines as β rises. Note that $\varepsilon^s / p^s = 1 / \sigma t^s$ where σ is the elasticity of the sellers' unit trade cost with respect to trade volume. This will decline with volume unless σ falls sufficiently fast. The switch in sign of $d\pi / d\beta$ can occur with either large or small average elasticity regimes.

Summarizing the discussion:

Proposition 3: (a) For sufficiently large elasticity of supply, improvements in enforcement are always favored by buyers' interests, (b) for sufficiently low elasticity of supply, improvements in enforcement are always opposed by buyers' interests, and (c) for intermediate ranges of elasticity of supply, an interior level of enforcement is optimal for buyers' interests.

Beyond the importance of the supply elasticity, additional complexity comes into (2.3) through $\partial p^s / \partial \beta = (1 - \pi)(b + m - p^*) - (1 - \beta)(1 - \pi) m_\beta > 0$. Tighter bounds are possible through exploiting this structure. Tighter specifications of trade costs and distributions of the buyers' shocks can produce yet tighter implications, but the flavor of all results will be those of Proposition 3.

4. Implications: Enforcement and Development

The introduction asked why LDCs do not set up institutions that ensure the enforcement of international contracts. Our analysis identified circumstances where improved enforcement harms a country's traders. We now argue that these circumstances are often found in LDCs.

LDC traders are likely to be on the excess side of the spot market if their spot bargaining power is strong, since higher bargaining power will drive p^* away from p^e and toward the other party's outside option, all else equal. Reasons why this might be so are suggested both by a formal model of bargaining and by informal considerations.

In Rubinstein's (1982) formal model of bargaining as alternating offers, each agent has some chance of a very favorable price offer arriving from his home market before the next round which would cause him to exit from the bargaining. In refusing his last offer and starting another round of bargaining, his partner faces the possibility that he will exit. The bargaining power of an agent in this setup is his probability of the very favorable home price divided by the sum of the two probabilities of favorable prices.[7] In LDCs, markets tend to be thin and background institutions unstable, leading to regime shifts; both factors make prices highly variable, so that the LDC trader has a high probability of a very favorable home price, hence strong bargaining power according to the formal model.

At an informal level, casual empiricism suggests that LDC traders have strong bargaining power on home turf because they can exploit local institutions and rules of the business game, which are opaque and poorly codified. Bargaining success is enhanced by personal qualities: shrewdness, charm, ruthless focus. Even if both countries have the same distribution of personalities across their populations, business competition in an LDC with weak institutions is more likely to select for bargaining skills, while business

[7] As noted previously, this setup meets the critique of Binmore, Rubinstein and Wolinsky (1986) by justifying the use of fallback options as the threat points in the bargaining game.

competition in a developed country with strong institutions is more likely to select for other skills, such as navigating complex formal rules and managing large bureaucracies.

Consideration of elasticities reinforces the likelihood that LDCs are to be found on the excess side of markets. Supply elasticities of traders facing many LDC countries are likely to be relatively small, as infrastructure is limited, as is the supply of foreign traders that are informed about selling into or buying from the LDC market. (Trade theorists' standard intuition about the small country case implying infinitely elastic supply is captured in our model by the constant outside option c. The elasticities of supply and demand used in this paper reflect trade costs that are ignored in standard trade theory.) Detailed by commodity by country data confirms that bilateral shipments come from only a few sources, a phenomenon that is especially marked for small developing countries on both the import and export sides. For given p^* and $d(p)$, lower elasticity of supply drives p^e above p^*, tending to excess demand; while for given p^* and $s(p)$, lower elasticity of demand drives p^e below p^*, tending to excess supply.

The above discussion leads us to focus on the case where LDC buyers are on the excess side of the market.[8] We now explore the implications of our analysis for this case. Proposition 3 (b) states that such buyers oppose attempts to enforce contracts in any degree if and only if the supply elasticity is sufficiently small. A low price elasticity of international supply of goods to many LDC is likely since small and insecure markets do not induce investment in infrastructure to support much trade while language and informational barriers restrict the number of potentially informed sellers. The poorest LDCs, like those in Sub-Saharan Africa, provide a plausible context for spot bargaining that yields a price p^* that is lower than the competitive equilibrium price p^e, while the latter is driven higher than p^0 by a demand elasticity that exceeds the supply elasticity. In such countries, Proposition 3 (b) predicts domestic opposition to attempts to improve enforcement of contracts from any initial condition.

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[8] Similar remarks apply to the case of LDC exports to a developed country where LDC sellers are on the excess side of the market. However, the inelasticity of the supply of knowledgeable traders from the developed country buyers is perhaps less obviously likely.

Proposition 3 (c) states that buyers will support any costless attempt to improve contract enforcement starting from zero enforcement when the supply elasticity is sufficiently large, but when their size is large in world markets the ratio ε^s / p^s falls with better enforcement and thus they will oppose efforts to perfect enforcement. This situation characterizes large developing countries such as China, India and Russia. Their large markets induce investment in infrastructure and in specialized knowledge of the markets, aided in the Chinese and Indian cases by a large diaspora of traders.

Proposition 3 (a) states that buyers will support costless attempts to improve enforcement from any initial level when the supply elasticity remains sufficiently high. If this situation characterizes any countries, it might be those rich countries with English language and English common law traditions.

5. Alternative Trading Mechanisms

Alternative trading mechanisms that lack one or more features of our model lead to unrealistic implications. In some variants contract enforcement becomes irrelevant to efficiency while in others the incentive of buyers or sellers to lobby for changes disappears or becomes unrealistically simple.

We discuss several possibilities, focusing especially on a model of Caballero and Hammour (1998) that we translate into our setting. Their institutional model is simpler than ours and is useful for thinking about abstract institutional regimes and possible resistance to institutional improvement that includes the degree of completeness of contracts. However, their model does not capture the special features of imperfect contract enforcement. A central implication of both models is that institutional improvements need not be favored by all parties.

We first set up the Caballero and Hammour model of institutional friction and verify that inefficient trade results, with ambiguous interests in institutional improvement. Then we show that if contracts are introduced with some positive probability of enforcement, efficient levels of activity always result. Moreover, the buyers' and sellers' ex ante interests are unaffected by the degree of enforcement.

Efficient trade results because the Caballero and Hammour setup gives agents no reason to search for an alternative partner after a default because all potential partners are identical to the defaulter. Knowing this, the contract price will adjust to fully incorporate the consequences of default. Since this is so, any change in the probability of enforcement just induces an offsetting change in the contract price such that the efficient volume of trade is preserved, with no consequences to any economically relevant ex ante variable.

Efficient trade similarly results with random outside options if search is impossibly expensive. In this case, even though the defaulter reveals his favorable outside option, he and his victim always renegotiate because this is the best ex post move for both. Enforcement effort has consequences for ex post payoffs, but not for ex ante rents to buyers and sellers, so there is no incentive to lobby for institutional change.

Finally, if agents never renegotiate (due perhaps to a psychological commitment device) and search is impossible, trade is inefficient, is always increased by improvements in enforcement, and the parties on both sides of the market have an incentive to support improved enforcement. Thus this model is unable to explain the variety of institutional settings.

The Caballero and Hammour Setup

We develop the argument by translating the essential ingredients of the Caballero and Hammour setup into our model. Their model features production with two factors. Each factor could produce autarkically, but in combination they could produce more. The combination requires some specific investment by each factor that cannot be recovered if subsequently the factor reverts to autarky. The degree of specificity, the share that cannot be recovered, is institutionally influenced. Perfect contracts permit efficient production whereas the absence of contracts (interpreted as the non-contractability of some aspects of the parties' interaction) can support a limited volume of joint production while some fraction of the total supply of each factor produces autarkically.

In terms of our model, trade is the activity that is jointly produced, the share lost to specificity when taking the outside option of reverting to autarky is the change in the outside option that each side of the market incurs, and the institutional influence acts on these changes in outside options of buyers and sellers.

Trade costs for buyer and seller are modeled (more simply than elsewhere in the paper) as $t^b = \tau^b (q^b)^\eta, t^s = \tau^s (q^s)^\sigma$ respectively. Assume excess demand equilibrium and the absence of contracts. As before, the ex post bargained price is the convex combination of the outside options of the parties, but in this section we treat the shocks μ, ν as deterministic specificity parameters, hence $p^* = \omega(b+\mu) + (1-\omega)(c-\nu)$, where *b,c* denote the ex ante outside options of the parties.[9] The expected price to buyers is $p^b = \pi p^* + (1-\pi)(b+\mu)$. In equilibrium the expected net benefit must cover trade costs: $b - p^b = \pi(b+\mu-p^*) = t^b$.

The quantity demanded is given by

$$q^b = \left(\frac{\pi(b+\mu-p^*)}{\tau^b} \right)^{1/\eta}.$$

Similarly, since suppliers always expect to receive p^*, the quantity supplied is given by

$$q^s = \left(\frac{p^* - c + \nu}{\tau^s} \right)^{1/\sigma}.$$

Our essential point can be conveyed clearly for the special case $\eta = \sigma$.

The probability of a match in excess demand equilibrium is given by q^s / q^b. The rational expectations equilibrium probability is given by:

$$\pi = \left[\frac{(\tau^b)}{(\tau^s)} \frac{(p^* - c + \nu)}{(b+\mu-p^*)} \right]^{1/(1+\eta)}.$$

The benchmark is efficient trade. In the present setup the efficient market clearing price is given by

$$p^e = b\frac{\tau^s}{\tau^b + \tau^s} + c\left(1 - \frac{\tau^s}{\tau^b + \tau^s}\right).$$

Efficient trade with $p^e = p^*$ obtains in the absence of contracts for special values of the parameters. One interesting case of efficient trade is $\omega = \tau^s / (\tau^b + \tau^s)$ and $\omega\mu = (1-\omega)\nu$; in Caballero and Hammour's terms, balanced specificity implies efficient

[9] Caballero and Hammour treat the specificity as multiplicative rather than additive, but this is an irrelevant detail.

trade.[10]

Buyers' Incentives for Institutional Improvement

Now consider the incentives of buyers and sellers to push for institutional change that alters the 'degree of specificity' as represented by μ, ν. The rising unit cost of trade implies a specific factor (merchant capital) that receives rents. The rent to merchant capital on the buyers' side is given by $S^b = \int_0^{q^b} [b - \tau^b (x)^\eta - p^b]dx$. Substitute $\pi(b+\mu-p^*)$ for $b-p^b$ and differentiate using the competitive equilibrium condition $b - t^b - p^b = 0$. The interest of the buyers' side merchant capital in altering μ is given by

$$\frac{dS^b}{d\mu} = -q^b\left[\pi\frac{dp^*}{d\mu} - (b+\mu-p^*)\frac{d\pi}{d\mu}\right]$$
$$= -q^b\pi\left[\omega - \frac{b+\mu-p^*}{1+\eta}\left(\omega\frac{1}{p^*-c+\nu} - (1-\omega)\frac{1}{b+\mu-p^*}\right)\right].$$

The first term in square brackets on the first line is always positive, indicating that a reduction in the specificity on the buyers' side (a fall in μ) would raise rents by lowering the bargained price as the better outside option makes buyers tougher in bargaining. A potential offset to this advantage is contained in the second term if $d\pi / d\mu > 0$. The second line reveals conditions under which this offset obtains. Taking full advantage of available substitutions reduces the incentive expression to

$$\frac{dS^b}{d\mu} = -\frac{\pi q^b}{1+\eta}\left[\eta\omega - 1 + \omega\frac{\tau^b}{\tau^s}\frac{1}{\pi^{1+\eta}}\right].$$

For (free) parameters such that the match probability is small, the right hand side

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[10] With multiplicative specificity, $p^* = \omega b(1+\mu) + (1-\omega)c(1-\nu)$. Then balanced specificity means $c\nu = b\mu + b[\omega - \tau^b / (\tau^b + \tau^s)] + c[1 - \omega - \tau^s / (\tau^b + \tau^s)]$. Then $\omega = \tau^b / (\tau^b + \tau^s)$ reduces the balanced specificity condition to $c\nu = b\mu$. This is essentially Caballero and Hammour's condition, recognizing that their production requirements conditions translate in the trading framework to requiring 1 unit offered and 1 unit purchased.

is necessarily negative. It is possible that the right hand side is negative throughout the range of π, in which case the buyers' side always has an incentive to reduce its institutionally determined specificity. It is also possible that for free parameters such that large values of π obtain, the buyers' side has an incentive to increase its institutionally determined specificity, inducing more suppliers to enter and gaining more from a higher match probability than it loses from the increase in the bargained price.

A similar analysis of the buyers' side incentives to alter the sellers' institutionally determined specificity yields:

$$\frac{dS^b}{dv} = \frac{\pi q^b}{1+\eta}\left[\eta(1-\omega) + \omega\frac{\tau^b}{\tau^s}\frac{1}{\pi^{1+\eta}}\right] > 0.$$

Thus, the buyers' rents always are increased because their greater bargaining strength from increasing sellers' specificity outweighs the possible reduction in the match probability due to the loss of sellers to the market.

Some plausible institutional reforms might reduce specificity on both sides of the market. The effect on buyers side rents would be a linear combination of the two separate effects above.

Partial Enforcement

A key problem with applying the Caballero and Hammour institutional model to imperfect contract enforcement is that efficient trade results with any finite probability of execution of contracts. While the approach can capture the degree of incompleteness of perfectly enforced contracts, it is unable to capture the essence of real world contract enforcement.

To verify this claim, suppose that in a preliminary period, buyers and sellers costlessly communicate and can sign contracts at price p^C with some probability of execution β, however small. Sellers expect to receive $\beta p^C + (1-\beta)p^*$. Buyers expect to pay $\beta p^C + (1-\beta)p^*$. During ex ante contracting, p^C adjusts to clear the market at the efficient price. All parties match and contract, and there is no reason for anyone to search for an alternative partner in the event of default because all potential alternative partners are identical to the defaulter. The interpretation is that βp^C is in effect an advance payment (in expected value)that exactly cancels out the unbalanced specificity that drives inefficiency in the Caballero and Hammour setup.

Embedding the Caballero and Hammour model in our model of random outside options and a spot market restores trading inefficiency. Considering the mean of the buyers' outside option to represent contractual incompleteness while θ represents enforcement, both parameters can be shown to have different but similarly ambiguous effects on the quasi-rents of buyers.

Enforcement in the Absence of Search

Efficient trade also results when the model is expanded to include random outside options, as elsewhere in the paper, provided that the victim of a default will renegotiate with the defaulter. The common price to buyers and sellers becomes $\beta p^C + (1-\beta)(p^* - m\omega)$, and the contract price adjusts to clear the market. Changes in enforcement (leading to changes in β) simply cause offsetting changes in the equilibrium contract price, with no consequence for efficiency or the rents to buyers or sellers.

Now suppose that agents never renegotiate with a defaulter. In this case $p^b = \beta p^C + (1-\beta)b$ and $p^s = \beta p^C + (1-\beta)c$. The contract price is determined by the equilibrium condition:

$$d(\beta p^C - (1-\beta)b) = s(\beta p^C + (1-\beta)c).$$

Trade would be inefficient because there is a gap between the buyers' and sellers' prices. Increases in β, the probability of execution, would raise trade volume and increase trader rents on both sides of the market, hence all agents would prefer better enforcement.

6. Conclusions

In the absence of scale economies and market imperfections, standard microeconomics determines general equilibrium market outcomes as smooth functions of endowments, tastes and technology. This paper shows the complex phenomena that can emerge from general equilibrium interactions when contracts are imperfectly enforced, but the economic structure is otherwise smooth and conventional. Incorporating a spot market in which contract repudiators and their victims meet to trade is a parsimonious way to close a model of imperfect contracting, while capturing the general equilibrium effects of feedbacks between enforced and unenforced contracts. These feedbacks can lead to non-monotonic dependence of trader profits on contract execution levels, with zero a local maximum and perfect execution a local minimum, given the transaction externalities in the spot market.

Thus, even in a simple economy specified by smooth functions, general equilibrium interactions subject to imperfect institutions can make the impact of institutional improvements perverse and subject to reversals. This reinforces a basic insight of New Institutional Economics — path dependence — by showing that the identification of one state of affairs as being Pareto inferior to another discretely far away is no guarantee that a political economy, let alone its institutional infrastructure, can find a path from the inferior to the superior state.

Several extensions suggest themselves. Long run implications of improved enforcement can be drawn by embedding the present model in a larger structure that could alter the short run analysis of this paper. (i) It is tempting to hypothesize that improved enforcement effort will in the long run raise the bargaining power of foreigners.[11] Intuitively, the model suggests that this is likely to amplify the interest group pressure for raising or lower the enforcement level. (ii) Improved enforcement for foreigners could induce increased investment by them in trading, raising the elasticity of supply. Fixed export costs will be likely to have a powerful effect here. (iii) Improved contract enforcement for foreigners may have effects domestically that alter the constituency for further improvement. In the model of this paper, such effects could show up either in the demand function (which underpins the reduced form $\pi[\beta]$ function) or in the distribution of shocks to buyers' outside options.

Within a unified political system, a veto of incremental institutional improvements by one side of the market could, in principle, be overcome by a government that imposes large-scale improvements from above. However, Barry

[11] In our informal discussion of bargaining power, the more stable domestic environment would reduce the bargaining advantage of LDC traders by improving the transparency and codification of local rules of the business game. It would also reduce pressures for LDC competition to select for bargaining rather than management skills. In the Rubinstein model of bargaining power, economic development would lower the LDC

Weingast has emphasized that "A government strong enough to protect property and enforce contracts is also strong enough to confiscate the wealth of its citizens." Thus, broad consensus is essential for a move toward the rule of law, as opposed to rule by law: our analysis offers one reason why a consensus for incremental improvements might not be forthcoming in the vital arena of contract enforcement.

Two more complex political economy issues suggest themselves. Within a country, the tradeoff between the competing enforcement interests of importers and exporters (and producers of import-competing and export goods) could be analyzed within an interest group competition model (Grossman and Helpman, 1995). On the international front, negotiations over trade policy and enforcement occur both sequentially and simultaneously, raising the issue of whether contract enforcement and tariffs are substitutes or complements.

Our model does not formally distinguish public from private enforcement of contracts. Braudel (1992) presents many historical examples of ethnic networks that facilitate trust; see also recent empirical work by Rauch and Trindade (2002). Do effective private networks impede or complement the development of official enforcement? Dixit (2003) provides a model in which the availability of courts lessens the efficacy of private networks, while lawyers informally think of the two as complements. The domestic markets of buyers and sellers are exogenous in this paper, though we have hinted at connections between the formal protection extended to foreigners and subsequent domestic developments. A richer model of the domestic markets and the nature of enforcement should yield many insights.

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trader's bargaining power by lowering the probability of a very favorable price offer arriving from his home market.

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Appendix: Proofs

Proof of Lemma 1

(A) To apply Rolle's Theorem to (1.8), note that as $\mu \rightarrow \bar{\mu}$, $m(\mu) \rightarrow 0$ so $-\mu/m(\mu) \rightarrow \infty$. As $\mu \rightarrow \underline{\mu}$, $-\mu/m(\mu)$ becomes negative. Given a piecewise continuous probability density function $f(\mu)$, $-\mu/m(\mu)$ is monotonic and continuous in μ. Rolle's Theorem implies that there is a $\mu(\beta)$ between $\bar{\mu}$ and $\underline{\mu}$ satisfying (1.8). This is unique since $-\mu/m(\mu)$ is monotonic in μ. For $\beta = 0$, the requisite μ is $\bar{\mu}$. For $\beta = 1$, the requisite μ is 0. $\mu(\beta)$ is monotonic and differentiable in β.

(B) To apply Rolle's Theorem to (1.9), note that as $\beta \rightarrow 0$, $(1-\beta)/\beta \rightarrow \infty$ so the solution to (1.8) $\mu(\beta) \rightarrow \bar{\mu}$, and $(1-\beta)/F(\mu(\beta)) \rightarrow 1 > 1-\theta$ when $0 < \theta$. As $\beta \rightarrow 1$, $(1-\beta)/\beta \rightarrow 0$, so $\mu(\beta) \rightarrow 0$, $F(\mu(\beta)) \rightarrow F(0)$ so $(1-\beta)/F(\mu(\beta)) \rightarrow 0 < 1-\theta$ when $\theta < 1$. Moreover, $(1-\beta)/F(\mu(\beta))$ is continuous in β. Rolle's Theorem now implies that there exists a $\beta \in [0,1]$ satisfying (1.9) . For $\theta = 0$, the requisite β is 0. For $\theta = 1$, the requisite β is 1.

Proof of Lemma 2

From the text, the objective probability of a match in an excess demand equilibrium is:

$$h(\pi,\beta) = \frac{(1-\beta)\,s(p^s)}{d(p^b) - \beta s(p^s)} \quad \text{where}$$

$$p^s = \beta p^b + (1-\beta)p^* - m(\mu(\beta))(1-\beta)(1-\pi)$$

$$p^b = \pi p^* + (1-\pi)b$$

$$p^* = \omega b + (1-\omega)c.$$

At an excess demand equilibrium, $d(p^*) > s(p^*)$. This implies that:

$$h(1,\beta) = \frac{(1-\beta)\,s(p^*)/d(p^*)}{1-\beta s(p^*)/d(p^*)} < 1$$

Suppose that $\beta \in [0,1)$. As π approaches 0 from above, $h(\pi,\beta)$ remains positive so that $h(\pi,\beta) > \pi$. Since $h(\pi,\beta)$ is continuous in π, Rolle's Theorem now implies that the equation

(5.1) $\quad \pi = h(\pi,\beta)$

has a solution $\pi[\beta]$ in the open interval $(0,1)$. This is unique since:

(5.2)
$$\frac{\partial p^s}{\partial \pi} = -\beta(b - p^*) + m(1-\beta) \le 0$$
$$\frac{\partial p^b}{\partial \pi} = -(b - p^*) < 0$$

(5.3) $$h_\pi = \frac{\pi}{1-\beta}(1-\beta+\beta\pi)\left[\frac{\varepsilon^s}{p^s}\frac{\partial p^s}{\partial \pi} + \frac{\varepsilon^b}{p^b}\frac{\partial p^b}{\partial \pi}\right] < 0$$

Finally, when $\beta = 1$, $p^s = p^b = p^e$ so (1.14) determines $\pi[1]$ as the solution to:

$$p^e = p^b = \pi p^* + (1-\pi)b \text{ so } \pi[1] = \frac{b-p^e}{b-p^*}.$$

Since $p^e < p^*$ in an excess demand equilibrium, $\pi[1] \in (0,1)$. ||

Proof of Lemma 3

A seller default victim expects the willingness-to-pay of a repudiator in re-negotiations to be $b+m$; on the spot market he expects to meet some buyers who entered directly — whose willingness-to-pay in spot negotiations he expects to be b. Consequently, he expects a higher price in negotiations on the spot market than with the buyer who repudiated his contract. Specifically, he expects to negotiate a price with the repudiator of $p^*+\omega m$; in deriving (2.10), we showed that he would expect to achieve a higher price on the spot market of:

$$p^* + \pi\omega m = \omega b + (1-\omega)c + \pi\omega m$$

His expected gain from spot trade is $\omega(b - c + \pi m) + \underline{v}$, which is positive under hypothesis (1.15). Thus, he expects to do better than by returning home, which offers no gains from trade. Since the seller is always matched in an excess demand equilibrium, he expects a higher payoff from (i) entering the spot market than from (ii) renegotiating with the repudiator or (iii) returning home. It follows that (i) would be chosen by a victim faced with alternatives (ii) and (iii) without knowing the disturbance realized by the repudiator.

Proof of Lemma 4

(A) A seller who learns his cost disturbance v expects to negotiate a price on the spot market equal to the price $p^* + \pi\omega m$ that he expected before learning his cost disturbance plus the increase $-v(1-\omega)$ in that negotiated price due to the disturbance of his cost from its expected value. This second term is certainly less than its value $-\underline{v}(1-\omega)$ under his worst (most negative) cost disturbance. Thus, the seller expects a higher price from honoring the contract than from a spot negotiation, provided that:

(5.4) $p^C - (p^* + \pi\omega m) > -\underline{v}(1-\omega)$

(1.10) implies that:

(5.5) $p^s - (p^* + \pi\omega m) = \beta[p^C - (p^* + \pi\omega m)]$

Substituting from (1.13) for $p^s - (p^* + \pi\omega m)$, we conclude that (5.4) holds provided that:

$$\mu^*[(1-\pi) + \pi\omega/(1-\beta)] > -\underline{v}(1-\omega)$$

Given hypothesis (1.16), this will be true because:

$$(1-\pi)/\omega + \pi/(1-\beta) > 1$$

(B) An argument similar to that for Lemma 3 shows that if (1.15) holds, then a seller who enters the spot market expects higher profits than by returning home. Thus, if both (1.15) and (1.16) hold, then the seller expects more from honoring his contract than from returning home.

Next, consider what a seller expects from repudiating his contract and renegotiating with his victim. His victim will require a price no less than what he expects to negotiate on the spot market. His required price will depend on his benefit disturbance. The seller would not know this benefit disturbance when he repudiates the contract; his expectations would be based on the distribution of benefit disturbances across buyers. The seller rationally expects any renegotiation to extract no more than the price p^b that buyers themselves expect to negotiate on the spot market before they learn their benefit disturbance. (1.7) implies that in equilibrium, this is less than the contract price p^C. Thus, a seller expects more from honoring his contract than from renegotiating with his victim.

Proof of Proposition 1:

This follows immediately from Lemmas 1- 4.

Proof of Lemma 5

To compute how β affects μ(β), differentiate (1.8) logarithmically with respect to β and apply the Fundamental Theorem of Calculus to $m(\mu(\beta)) = \int_{\underline{\mu}}^{\mu(\beta)} \mu f(\mu) d\mu$:

(5.6) $$\left[\frac{\mu f}{m} - \frac{1}{\mu}\right]\mu_\beta = \frac{1}{\beta} + \frac{1}{1-\beta} = \frac{1}{\beta(1-\beta)}$$

At $\mu = \mu(\beta) > 0,$ we have $m < 0$, so $\mu_\beta < 0$ and:

(5.7) $$m_\beta = \mu f \mu_\beta < 0.$$

Proof of Lemma 6

Differentiating (1.9) logarithmically using $g(\beta) \equiv (1-\beta)/F(\mu(\beta))$, we infer that β_θ has the sign of:

$$-\frac{g_\beta}{g} = \frac{1}{1-\beta} + \frac{f\mu_\beta}{F}$$

Substituting from (1.9) and (5.6), this has the same sign as:

$$\beta F\left[\frac{\mu f}{-m} + \frac{1}{\mu}\right] - f = \frac{-mF}{-m+\mu}\left[\frac{1}{\mu} + \frac{\mu f}{-m}\right] - f \text{ by (1.8)}$$

This has the same sign as:

(5.8) $$\mu f(-m+\mu) - mF - \mu^2 fF = -m(F - \mu f) - \mu^2 f(1-F)$$

This is positive at μ' provided that (2.2) holds.

Suppose that μ is uniformly distributed between –w and w for some constant w. Then:

$$m(\mu) = (\mu - w)/2,\ F(\mu) = (w + \mu)/2w.$$

(1.8) becomes:

$$\frac{2\mu}{\mu - w} = \frac{1-\beta}{\beta}.$$

Therefore:

$$\mu(\beta) = w\frac{1-\beta}{1+\beta} \text{ and } F(\mu(\beta)) = \frac{1}{1+\beta}.$$

(1.9) becomes:

$$1\text{-}\theta=(1\text{-}\beta)/F(\mu(\beta)) = 1\text{-}\beta^2$$

so $\beta(\theta) = \sqrt{\theta}$.

Proof of Lemma 7

Differentiating the equation (5.1) defining π with respect to θ yields:

$$\frac{d\pi}{d\beta} = \frac{h_\beta}{1-h_\pi} \tag{5.9}$$

Also:

$$\frac{dp^s}{d\beta} = \frac{\partial p^s}{\partial \beta} + \frac{\partial p^s}{\partial \pi}\frac{d\pi}{d\beta}$$

Substituting from (5.9) and rearranging:

$$\frac{dp^s}{d\beta}(1-h_\pi) = \frac{\partial p^s}{\partial \beta}(1-h_\pi) + \frac{\partial p^s}{\partial \pi}h_\beta \tag{5.10}$$

But:

$$h_\beta = \left[-(1-\pi)+(1-\beta+\beta\pi)\frac{\varepsilon^s}{p^s}\frac{\partial p^s}{\partial \beta}\right]\frac{\pi}{1-\beta}$$

Therefore:

$$\frac{dp^s}{d\beta}(1-h_\pi) = \frac{\partial p^s}{\partial \beta}\left[1-\frac{\pi}{1-\beta}(1-\beta+\beta\pi)\frac{\varepsilon^b}{p^b}\frac{\partial p^b}{\partial \pi}\right]-\frac{\partial p^s}{\partial \pi}\frac{\pi(1-\pi)}{1-\beta}. \tag{5.11}$$

By Lemma 5 and (5.2):

$$\frac{\partial p^s}{\partial \beta} = (1-\pi)(b+m-p^*)-(1-\beta)(1-\pi)m_\beta > 0$$

$$\frac{\partial p^s}{\partial \pi} = -\beta(b-p^*)+(1-\beta)m \le 0 \tag{5.12}$$

$$1-h_\pi > 0$$

The conclusion that $\frac{dp^s}{d\beta} > 0$ now follows from (5.11).

Figure 1. Decision Tree of Excess Demand Traders

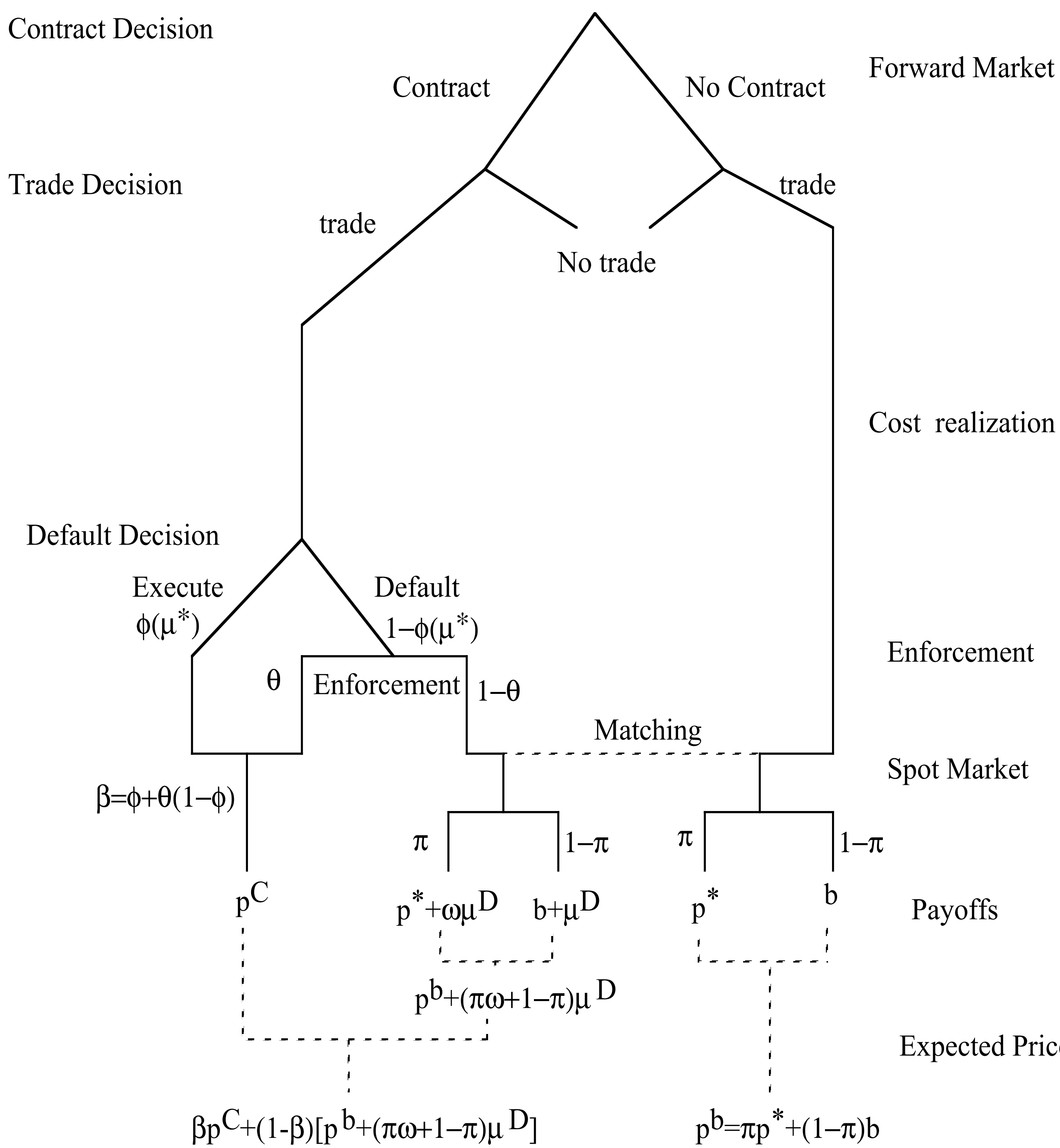

Figure 2. Equilibrium with Zero Execution

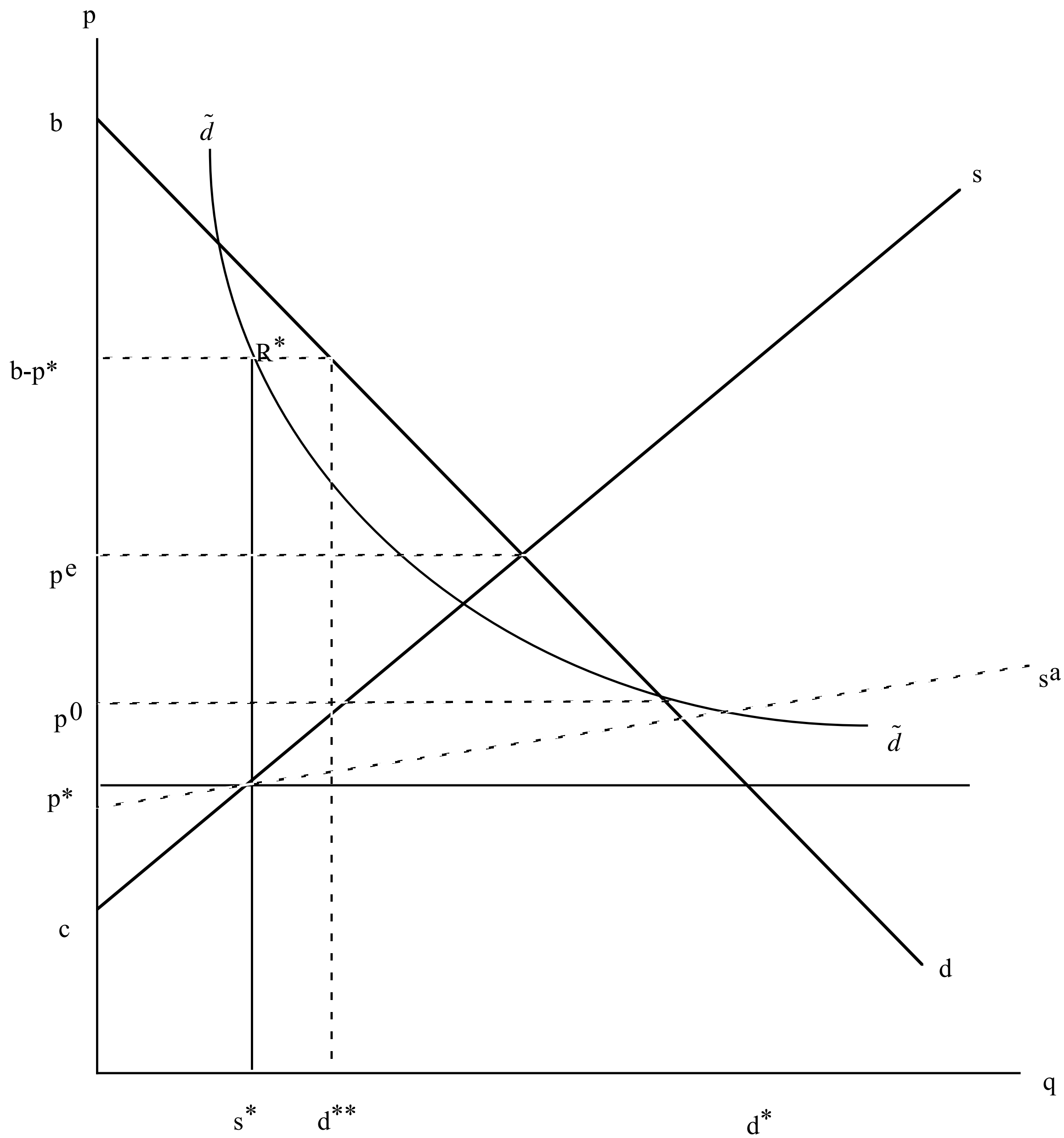

Figure 3. Match Probability and Enforcement