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Quality, Efficiency Premia, and Development

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Abstract

Improving quality is an important element of the transfer of production to low wage countries. Higher quality requirements are part of complex contracting arrangements in global supply chains. This paper analyzes how weak contract enforcement institutions and imperfect factor markets are affecting contracting for quality products; what the implications are for growth and equity; and how this changes with development.

JEL classification: C78; D23; O12; Q12

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1 Introduction

Recent technological developments and globalization are transforming the industrial organization and international location of production.[1] One of the most important mechanisms underlying the globalization process lies in the transfer of advanced production capabilities to low-wage economies. These capabilities comprise both an increase in productivity and in product quality (Goldberg and Pavcnik, 2007; Eswaran and Kotwal, 2007). Sutton (2001) argues that the quality aspect is far the more important element: poor productivity can be offset by low wage rates, but until firms attain some threshold level of quality, they cannot achieve any sales in global markets, however low the local wage level.

The introduction of higher quality requirements in developing and transition countries has coincided with the growth of contracting and technology transfer (Swinnen, 2007). The past decades have witnessed a strong growth in contracting for quality production in global supply chains with local suppliers (both firms and households) in developing and transition countries engaging in complex contracting with companies selling into high income markets - either domestically or internationally. These contracts not only specify conditions for delivery and production processes but also include the provision of inputs, credit, technology, management advice etc. (Minten *et al.*, 2007; World Bank, 2005). The latter are particularly important for local suppliers who face important local factor market imperfections. In particular imperfections in credit and technology markets are typically large, which implies major constraints for investments required for quality upgrading, especially for local firms and households who cannot source from international capital markets.

This paper is the first to formally analyze the efficiency and equity effects of the introduction of high quality production in the presence of weak contract enforcement

[1] One issue that has attracted much attention is outsourcing (e.g. Grossman and Helpman, 2005). Another issue, more closely related to our paper is the role of vertical integration in the globalization process. A series of models have studied under which conditions two firms will vertically integrate, either backward or forward, and how this affects the incentives to invest or innovate (Acemoglu *et al.*, 2005; Aghion *et al.*, 2006), drawing upon the earlier work of Williamson (1985), Grossman and Hart (1986), Hart and Moore (1990)). Some of the papers have considered the impact of weak enforcement institutions (Khanna and Palepu, 2006; Acemoglu *et al.*, 2005). The models typically assume (a) that both firms can make investments or take over the other firm (an exception is Macchiavello (2006), who allows for financial constraints), and (b) that vertical integration is a $0-1$ decision, i.e. they compare the two extremes of total ownership and total separation; or in Williamson (1975)'s terminology: "hierarchy" versus "markets". Our analysis studies whether contracting (a "hybrid" form of organization in Williamson's terms) is sustainable and what its efficiency and equity effects are.

institutions and imperfect factor markets; and how the process of development changes these effects.

The enforcement of contracts for quality production is difficult in developing and transition countries which are often characterized by poorly functioning enforcement institutions. This can add significantly to the cost of contracting and which may prevent actual contracting to take place.[2] Our analysis of the equity implications relates to the vigorous debate in the development community on the income distributional effects of the rapid growth of these modern supply chains in developing countries. Some have argued that they are reinforcing inequality and poverty as they are excluding the weakest from participating in these vertically coordinated processes and that large and often multinational companies are extracting all the surplus from the gains through their bargaining power within the chains (Reardon and Berdegu, 2002; Warning and Key, 2002). Others find positive effects on development (Maertens and Swinnen, 2006; Wang *et al.*, 2007). however, all these studies are empirical, without a clear theoretical framework.

Our main findings are that factor market imperfections induce interlinked contract arrangements, and that the extent of inefficient separation (absence of socially efficient contracting) is proportional to the size of the enforcement costs and the relationship specific investment. The distribution of the gains from contracting depend on the overall rent that can be created by the contract and the enforcement costs. Transfers from one agent to the other, which we call "efficiency premia", play a crucial role. With positive enforcement costs in contracting, an efficiency premium may have to be paid by one agent to the other in order to make the contract self-enforcing. The size of the efficiency premium depends on the enforcement costs and on the rents created by the contract. We find that the higher the enforcement costs and the lower the rents created by the contract, the higher the efficiency premium.

Moreover, we find that "development", i.e. an exogenous improvement of enforcement institutions and of the functioning of credit markets, has non-linear effects on both equity and efficiency, and may hurt some of the contracting parties under some conditions.

Our analysis is related to other research fields, in particular to research on FDI

[2]There is an extensive literature on the role of formal and informal enforcement institutions in development, e.g. North (1990), Platteau (2000), Greif (2006), Fafchamps (2004), Dhillon and Rigolini (2006), etc.

spillovers which suggests that foreign companies are more likely to engage in vertical integration and vertical coordination (Aghion *et al.*, 2006; Dries and Swinnen, 2004), and on the distribution of rents within companies, domestically (Blanchflower *et al.*, 1996) and internationally (Borjas and Ramey, 1995; Budd *et al.*, 2005). The analysis also relates to a large body of research on interlinking markets (Bardhan, 1989; Bell, 1988) on enforcement in contracts and credit markets (Genicot and Ray, 2006; Gow and Swinnen, 2001; Mookherjee and Ray, 2002), and to the growing literature on the role of standards and high value chains in trade and development (e.g. Jaffee and Henson, 2004).

The paper is organized as follows. The next section sets up the basic model. Section 3 analyzes rent distribution with production contracts under perfect enforcement. Section 4 analyzes efficiency and equity effects with enforcement costs, and Section 5 studies how third party enforcement can affect the outcomes. Section 6 analyzes how development affects the results, and Section 7 concludes.

2 The Model

Consider a local company or household in a developing country - which we will refer to as the *local supplier* - producing a quantity q of a low-quality product and selling it on the local market at a price p_l. The local market requires few or no quality standards. For notational simplicity we set $q = 1$. Then, a company which is interested in selling high-value products - which we will refer to as *the processor* - enters the market. The processor could for example be a processing, trading or retailing firm, either domestic or multinational. The processor wants to buy her raw material from the supplier, but imposes certain standards, e.g. regarding quality and safety, which are not required for the local market. The firm intends to process this raw material into high-quality products, that can be sold at a price p_h, with $p_h > p_l$.[3] We call $\theta = p_h - p_l$ the quality premium, as it is the amount of extra money customers are prepared to pay for a product of higher quality. If the supplier delivers his produce to the processor, the price the supplier receives will be derived from p_h, through a mechanism of rent sharing between the processor and the supplier.

[3] We assume p_h is fixed and cannot be influenced by the processor

We assume that the quality of the final product is determined by the quality of the raw material. It depends on the specific inputs used in the production process of the raw material. This is a realistic assumption, since the production of, for example, dairy products or textiles crucially depend on the quality of their raw material (milk and cotton). Note that our model allows for the high-quality market to involve the same commodity as the local market, or a different commodity. An example of the first is when suppliers choose between low-quality milk production for home or village consumption and high-quality milk for processing into high-value cheeses etc. An example of the second case is when suppliers choose between producing cotton for gins and basic food for household consumption or local markets.

To produce one unit of high-value products, the supplier requires specific inputs (e.g. credit, technology, seeds) with a value of I on top of his standard production cost C. I and C are assumed fixed for each supplier. We assume that the specific inputs for high-quality production are not available to the supplier because of factor market imperfections. Again, this is a realistic assumption as in many developing countries local producers and households face important factor market constraints. These constraints effectively prevent the supplier from producing high-quality raw material.

The market imperfections also hurt the processing firm by constraining its supplies. If no supplier can supply high-quality raw material, the processor is unable to sell products in the high-quality market, and both the supplier and the processor are stuck in a low-quality equilibrium. We assume that the processor does not consider switching to trade in the low-quality market, e.g. because its reputation for quality is critically linked to its brand name.

However, if the processing firm has better access to the specific inputs than the supplier, the processor can act as an intermediary in the input market and provide (sell or lend) the inputs to the supplier. This, again, is a realistic case since the processor may have better collateral, more cash flow or face lower transport or transaction costs in accessing the inputs. If so, the processor will consider offering a contract to the supplier, which includes the provision of inputs and the conditions (time, amount and price) for purchasing the supplier's product. We assume that the processor provides the supplier with the full amount of required inputs I per unit of production, or the processor does not provide any inputs.[4]

Note that in such a contract, each agent can hold-up the other agent. On the one hand, the supplier can divert the inputs to other uses, such as selling them or applying them to other production activities; or he may apply the inputs as agreed but then sell the high-quality output to other buyers than the one he has a contract with. On the other hand, the contracted buyer may also hold up the supplier by paying a lower price to the supplier than was originally agreed on, or simply postpone payment, as has been observed many times in reality (Swinnen, 2007).

In the rest of this paper we will show that both the creation of the surplus (i.e. whether a contract is agreed upon and enforced) and the distribution of the contract surplus depend on a variety of factors. The different options for the processor and the supplier can be represented by a two-player finite game of perfect information and the pure strategy Nash equilibrium can be derived through backward induction. For a contract to be feasible, it must satisfy the participation constraints (PC^i) and the incentive compatibility constraints (ICC^i) of both agents ($i = s, p$). In the next sections we derive how enforcement costs affect the equilibrium outcomes.

The model we use in this paper is a one-period game. There is an extensive literature on how contract enforcement is affected by repeated games. It is well known that in an infinitely repeated game, contract enforcement is easier to sustain, if only the agents are sufficiently patient. We capture these effects by including reputation costs, which allow for a somewhat broader interpretation of the cost of breach of contract (see further).

3 Contracting and Rent Distribution under Perfect Enforcement

To establish a baseline result for comparison purposes, we start with assuming perfect (and costless) contract enforcement. With perfect contract enforcement, none of the partners will deviate from the contract once it is agreed upon. As a result, the incentive compatibility constraint becomes irrelevant. There are only 2 necessary (and sufficient)

[4] This assumption implies that we do not allow for products of intermediate quality, produced by means of a non-zero but suboptimal amount of inputs. Note that the amount I will depend on transaction costs, productivity, current farm assets, etc.

conditions for the interlinking contract to be feasible, namely the supplier's and the processor's participation constraint (PC^i for $i = s, p$), implying that $Y \geq Y_l$ (PC^s) and $\Pi \geq \Pi_l$ (PC^p).

At first, the processor decides whether or not to offer a contract with inputs on credit to the supplier (see Figure 1). The processor will only do so if her expected income from such a contract is higher than from any other business option she has. Second, the supplier decides whether or not to accept the contract. He will only accept it if the contract offers him a larger payoff than any other opportunity he has. If both the processor and the supplier agree on the contract, the processor will supply her processed products to the high-quality market.

If one of the agents does not accept the contract, the payoffs are according to the no-trade or disagreement outcome (Y_l, Π_l) which is the payoff in the low-quality equilibrium, where respective payoffs are:

$$Y_l = p_l - C. \tag{1}$$

$$\Pi_l = 0 \tag{2}$$

Y_l is the income of the supplier when selling low-quality produce at a price p_l per unit at the local market with production cost C. The processor has no cost, but also no revenue, so her profits (Π_l) are 0.

If a contract agreement is reached, the processor provides inputs with value I to the supplier, which are repaid at the time of delivery of the product. High-quality raw material is produced, and the high-quality equilibrium is obtained, creating a surplus: the total income with contracting exceeds the total income without contracting.

Total income (G_j) is defined as: $G_j = \Pi_j + Y_j$, with $j = h$ for the high-quality equilibrium, and $j = l$ for the low-quality equilibrium. It amounts to the total output value, minus production costs. In case of high-value contract production, $G_h = (p_h - I) - C$. For notational simplicity, we assume the cost and valuation of processing to be zero. Otherwise, $G_l = p_l - C$. The contract surplus S_j is defined as the *extra* value created by the contract, relative to the disagreement outcome. It is obtained by subtracting both agents' outside options from total income G_j. Hence, in the high-quality equilibrium $S_h = G_h - G_l = \theta - I$.

Total income is shared among both agents according to a Nash bargaining process which leads to maximization of the product of the respective agents' increments in utility relative to their respective outside options. With perfect enforcement, the outside options are given by the disagreement outcome (Y_l, Π_l).

For reasons of simplification, we assume that the agents are equally risk averse[5] and that the supplier and the buyer are perfectly informed about each other's outside options. The contract income of the supplier equals the producer price p, minus the cost of basic inputs C $(Y_h = p_C)$. The contract income of the processor equals the remaining share of total income $(\Pi_h = G_h - Y_h = p_h - I - p)$. The price upon which the agents agree, is then given by the Nash bargaining solution:

$$p = \text{argmax}_p (Y_h - Y_l)^\beta (\Pi_h - \Pi_l)^{(1-\beta)} \tag{3}$$

$$p = \text{argmax}_p (p - p_l)^\beta (p_h - I - p)^{(1-\beta)} \tag{4}$$

We follow the standard approach in the theoretical literature in assuming a symmetric solution with $\beta = \frac{1}{2}$, as pioneered by Nash (1953) in his axiomatic approach, and followed by others like Osborne and Rubinstein (1990), Diamond and Maskin (1979), Muthoo (1999) etc.

The maximization of the Nash product above then leads to the following results:

$$p = p_l + \frac{1}{2}(p_h - p_l - I) \tag{5}$$

$$Y_h = p - C = p_l - C + \frac{1}{2}(\theta - I) \tag{6}$$

$$\Pi_h = G_h - Y_h = \frac{1}{2}(\theta - I) \tag{7}$$

As long as a surplus can be created by the contract $(S_h = \theta - I \geq 0)$, the participation constraint of the supplier $(Y_h \geq Y_l)$ and of the buyer $(\Pi_h \geq \Pi_l)$ are always satisfied. Both agents are then at least as well off with the contract relative to the disagreement outcome. Note that $S \geq 0$ as soon as $I \leq \theta$; i.e. if the per unit additional input costs are less

[5] This assumes away differences in risk attitudes. However, if one agent is more risk averse than the other agent, he will derive a larger utility from a small increment in income. An equal distribution of utility gains may then translate into an unequal income distribution, with a larger share going to the risk-neutral agent (cfr. Muthoo (1999); Osborne and Rubinstein (1990))

than the quality premium. Hence, with perfect contract enforcement, the contract will be chosen by both agents, and the high-quality equilibrium reached, if the quality premium is large enough to cover the additional input costs. This is a very intuitive result.

The impact on total income (G_j) is straightforward: if $I \leq \theta$, it is profitable for both the producer and the supplier to contract, and $G_h \geq G_l$ in this case. If, on the other hand, $I > \theta$, an upgrade to high-quality production will be unprofitable and no contract will come about. In this case, $G_h < G_l$. Hence, with perfect enforcement, the highest possible total income will always be achieved.

The distributional aspect relates to how total income from the contract is shared by the agents. With the set-up of our model, this is fully dependent on the respective agents' outside options. The better an agent's outside option, the higher the share of total income that will accrue to him/her.

Hence, as equation 6 shows, the contract income for the supplier (Y_h) increases in his outside option (Y_l) and in the net surplus of the contract ($\theta - I$).

4 Costly Enforcement

The game changes when enforcement is costly. In this case it is no longer certain that a contract which is agreed upon will be honoured. Hold-ups may occur if one of the agents has attractive alternatives to contract compliance. As we have said before, the supplier may divert the inputs to other uses or sell the high-quality output to alternative buyers. Competing processors may offer a higher price for high-quality products, as they do not need to count in specific input costs.

With perfect foresight, the processor will anticipate such enforcement problems. She has several options. She may modify the contract conditions, so as to make the contract more attractive to the supplier. This will result in a kind of premium for the supplier, which induces the supplier to comply with the contract; it renders the contract self-enforcing. Alternatively, she may invest in external enforcement mechanisms, such as hiring lawyers and paying for court expenditures, or hiring private enforcement agents (mafia or other types), or she may invest in monitoring systems to ensure that the suppliers use the inputs and deliver the output as agreed in the contract. If such options are either not feasible or too costly, she may decide not to agree upon a contract.

On the other hand, the processor may hold up the supplier. When the supplier delivers his produce to the processor, the latter may pay a lower price than was originally agreed upon. With perfect foresight, however, the supplier will also anticipate this problem. If the price proposed by the processor is not credible, the supplier may invest in external enforcement, if that is profitable. Otherwise, the supplier can deliberately propose an alternative, slightly lower producer price which is credible, or refuse the contract. This is equivalent to paying a premium to the processor in order to make the contract self-enforcing.

To understand under which conditions contracting will be sustainable and what the impacts are on the total surplus and on its distribution, we will start by considering the extreme situation when there are no external enforcement institutions - which is equivalent to assuming that external enforcement (by law or by a third party) is prohibitively costly. The contract is then only feasible if, in addition to the agents' participation constraints, also their incentive compatibility constraints are satisfied. The incentive compatibility constraint requires that the contract is such that the agents prefer to act in accordance with the contract without external enforcement, instead of having an incentive to breach it. This is similar to saying that the contract is self-enforcing.

4.1 Efficiency Premium with Supplier Hold-up

Take again the case where a processor offers a supplier a contract which includes the provision of specific inputs, while legal contract enforcement is prohibitively costly. Once he has received the inputs, the supplier has two options (see Figure 3): either he applies the inputs conscientiously, which will produce the desired high-quality product the processor needs; or he can divert the inputs to other purposes, e.g. applying them to other crops or selling them. If he diverts the inputs, his contracted crop will be of a low quality and will have to be sold on the low-quality market. By breaking the contract, the supplier will suffer a loss in terms of reputation, social capital, or future business opportunities. This *reputation loss* is like an informal penalty for contract breach and is represented by ϕ^s.[6]

[6] The variable ϕ^s is equivalent to McLeod (2006)'s "informal enforcement mechanism" through community norms, relationships and reputations, as opposed to formal (what we call "third party") enforcement through courts of law, mafia, supervision...

We refer to this as the contract breach outcome and the pay-offs are (Y_b, Π_b), whereas

$$Y_b = p_l - C + I - \phi^s \tag{8}$$

$$\Pi_b = -I. \tag{9}$$

In (8) and (9), I is the value of the specific inputs that the processing firm delivers to the supplier. In the case of breach of contract, the processing firm has no supplies and suffers a net loss equal to the cost of the provided inputs I, while the supplier's income consists of the revenue from sales at the low-value market $(p_l - C)$, augmented with the revenue from reselling the specific inputs (I), but lowered by the reputation cost ϕ^s.

Another possibility of producer hold-ups is at the time of product sale. Once the supplier has applied the inputs as requested by the processor, high-quality produce will result. The supplier can still decide to sell the high-quality produce to another buyer at the local market (see Figure 3). We assume for now that there is no other processor with access to the high-quality market and that the local market does not pay a premium for high quality. As a result, the supplier will only receive a price p_l at the local market.[7]

Also in this case, the supplier will suffer a reputation loss. The processor's payoff is as in (9), while the supplier's payoff is

$$Y_s = p_l - C - \phi^s \tag{10}$$

The new outside options will act as constraints to the bargaining solution described in Section 3 (cfr. Binmore *et al.*, 1989). They are treated differently from the disagreement payoff, as they represent opportunities that only arise after the processor has contracted the supplier and provided inputs to him. These constraints are in fact the supplier's incentive compatibility constraints: $Y \geq Y_b$ (ICC^s1) and $Y \geq Y_s$ (ICC^s2) need to be

[7] A more general model is to assume that the supplier receives γp_h for high-quality produce with other buyers, with $0 \leq \gamma \leq 1$. The supplier's payoff is then $Y_s = \gamma p_h - C - \phi^s$. If there is no alternative demand for high-quality products, $\gamma = 0$. If high-quality products are valued only as much as low-quality products, γ is such that $\gamma p_h = p_l$. If other processors buy high-quality produce, γp_h will be larger than p_l. this way, γ can be seen as a proxy for product specificity or for competition at the high-value market. In a following working paper we will analyze this in more detail. Note that in some cases, lower prices may also be received at the local market. Indeed, for some cash crops, there may not be a local market (yet) e.g. in the case of broccoli and cauliflower in Guatemala, as was described by Glover and Kusterer (1990). In reality this has been observed in the first stages of market development, but usually after some time, the local market starts to develop a taste for the novel product.

satisfied by the contract. From (8) and (10), it is obvious that $Y_b > Y_s$ hence that ex ante, input diversion is a more attractive outside option than selling high-quality produce at the local market hence that ICC^s1 is more restrictive than ICC^s2.

The processor is fully informed about the structure of the game and the outside options of the supplier and knows that by providing the supplier with inputs, she is creating new outside options for her supplier, who will be incited to break the contract if ICC^s1 or ICC^s2 is not satisfied. The processor can ensure that the supplier's ICCs are satisfied by paying a premium to the supplier. This makes the contract self-enforcing.

Note that, for now, we focus on a one-sided hold-up opportunity by the supplier, hence we assume that there is no profitable hold-up opportunity for the processor, in the sense that her reputation costs upon breach of contract are inhibitively high (e.g. $\phi^p > \theta$). This assumption is relaxed in the next section.

If Y_b is smaller than Y_h (as is Y_b^0 in Figure 2), ICC^s1 is not binding and hence it will not affect the contract outcome. However, if Y_b is larger than Y_h (as for Y_b^1 and Y_b^2 in Figure 2), it will affect the contract outcome. The processor must offer the supplier at least Y_b in the contract. We define the increase in payment $Y_b - Y_h$, that is required to satisfy ICC^s1, as the *efficiency premium* (ϵ).[8]

In our case, the efficiency premium amounts to

$$\epsilon = Y_b - Y_h = \frac{3}{2}I - \frac{1}{2}\theta - \phi^s \tag{11}$$

The efficiency premium will thus be larger when the value of required inputs is higher and when the supplier's reputation cost ϕ^s is lower, reflecting respectively larger opportunity costs and lower informal enforcement.[9]

Hence, if Y_b is as in Y_b^1 in Figure 2, E^0 cannot be an equilibrium, since the processor

[8] This is in analogy to the concept of efficiency wages (Salop, 1979). Salop describes how a firm can minimize its employee's incentive to quit and seek a job elsewhere, by paying a higher wage. This is profitable for the employer if it is expensive to train workers. The training cost of new workers is comparable to the cost of providing inputs to suppliers on credit.

[9] This result corresponds to Bardhan and Udry's (1999: 218) findings. They mention that, in the context of mercantile contracts, if there is no possibility to monitor, simple efficiency-wages considerations suggest that in order to keep along-distance trading agent honest, the agent has to be paid by the merchant (the principle) a wage higher than the agent's reservation income. However, in more "collectivist" forms of enforcement (in which e.g. the whole community is jointly liable if one of its members cheats), this wage need not be as high, as the penalty for cheating is higher or else peer monitoring makes cheating more difficult.

needs to ensure the supplier at least Y_b^1. E^1 will be the new equilibrium. Notice that, in this case, the supplier is better off with enforcement costs than without.

However, for the contract to be feasible, the processor's and the supplier's participation constraints should remain satisfied as well: $\Pi \geq \Pi_l$ and $Y \geq Y_l$. For example, if the ex post outside option is too large, the efficiency premium ϵ which the processor must pay to the supplier in order to make the contract self-enforcing, may become so large that it is no longer in the processor's interest to provide the contract. In Figure 2 this occurs when $Y_b > Y_b^2$. At that point, by paying an efficiency premium, Π_h would fall below Π_l and the processor's participation constraint is no longer satisfied. In other words, for $Y_b > Y_b^2$, the supplier's ICC^s1 is incompatible with the processor's PC. In this case, even though the contract would be socially desirable (i.e. it would increase total income), it will not emerge. This situation is referred to as "inefficient separation".

From Section 3, recall that with perfect contract enforcement, input provision is sustainable as long as the quality premium is at least as large as the additional cost of inputs (i.e. $\theta \geq I$).[10] Inefficient separation does not occur. However, when contract enforcement becomes costly, inefficient separation may occur in a number of cases.

In our example above, inefficient separation occurs when

$$I < \theta < 2I - \phi^s. \tag{12}$$

because for $\theta < I$ it is not efficient to contract, and for $\theta \geq 2I - \phi^s$ the surplus is high enough to make the contract self-enforcing: the supplier has no incentive to breach the contract.

Not surprisingly, reputation costs do play an important role. With $\phi^s \geq I$, i.e. when reputation costs are at least as high as input costs, condition (12) is never satisfied and inefficient separation never occurs. When there are no reputation costs ($\phi^s = 0$), then the inefficient separation condition becomes $I < \theta < 2I$ and the interval is largest: the quality premium has to be at least double the investment cost per unit to make the contract self-enforcing.

The impact of enforcement problems on contracting and its efficiency and equity impli-

[10]Note that efficient separation implies the socially efficient breakdown of contracts, i.e. when $\theta < I$.

cations are illustrated by Figures 4 and 5.[11] Figure 4 illustrates the surplus from high-value production without external enforcement opportunities, and without supplier reputation costs ($\phi^s = 0$). From equation (12) it follows that there is no contracting for $\theta < 2I$. We refer to the interval $[I; 2I]$ as the "inefficient separation interval" (ISI). At $\theta = 2I$, a contract is self-enforcing and the efficiency premium is equal to $\epsilon = \frac{1}{2}I = \frac{1}{2}S_h$, i.e. the processor's gains from contracting with perfect enforcement. The net benefit for the processor is therefore zero at $\theta = 2I$. All the gains are for the supplier: $\Delta Y = Y - Y_l = \frac{1}{2}S_h + \epsilon = I = S_h$.

With $\theta > 2I$, the efficiency premium will be lower (as the direct benefits of the contract for the supplier are higher). The reduction of the premium equals the increase in direct benefits and therefore the net contract gains for the supplier are constant with θ growing. At the same time the gains for the processor grow for two reasons: the efficiency premium she has to pay to the supplier declines while her direct gains are larger. Both effects reinforce each other to cause a strong growth in the benefits for the processor over the interval $2I \leq \theta < 3I$. When the quality premium equals $3I$ (or higher), the efficiency premium reduces to zero and the contract gains of the supplier and the processor are equal ($\Delta Y = \Delta\Pi$).

An important conclusion is that if only the supplier has the opportunity of doing a hold-up, weak contract enforcement actually benefits the supplier over the $2I \leq \theta < 3I$ interval, since his income is higher with no (or imperfect) external enforcement than with perfect enforcement as $Y_b > Y_h$ in that interval.[12]

Finally, Figure 5 illustrates the effect of reputation costs, which affect both the efficiency and the distributional effects of contracting. Reputation costs will reduce the ISI and the efficiency premium.[13] In Figure 5, $\phi^s = 0.5I$. In this case, the ISI reduces to $I < \theta < 1.5I$ and the maximum efficiency premium equals $0.25I$ (which is paid at $\theta = 1.5I$), compared to a maximum efficiency payment of $0.5I$ with $\phi^s = 0$. In general, it holds that if ϕ^s is very high, ϵ is only due at very low values of θ.

[11] We assume in these figures and the discussion that the processor's reputation cost is very high, such that we must only take into account a possible hold-up by the supplier. We relax this in the next section.

[12] Note that we continue assuming that $\phi^s = 0$.

[13] To see this, define reputation costs as a function of input costs, with $\phi^s = \mu I$, with $\mu \leq 0$. The ISI is then defined as $I < \theta < (2 - \mu)I$ and the efficiency premium as $\epsilon = (\frac{3}{2} - \mu)I - \frac{1}{2}\theta$. Both will reduce with ϕ^s (and thus μ) increasing.

4.2 Efficiency Premium with Two-Sided Hold-ups

So far, we have assumed that the reputation cost ϕ^p of the processor was sufficiently high to prevent her from holding up the supplier. However, this may not be the case. If the contracted price is higher than the supplier's outside option after production $(p_l - C)$, the buyer could ex post decide not to pay the contracted price, and push the supplier back to his ex post outside option instead. Obviously, the processor would also suffer a reputation loss (ϕ^p) from holding up her counterpart. The pay-offs in this case are:

$$Y_r = p_l - C \tag{13}$$

$$\Pi_r = \theta - I - \phi^p \tag{14}$$

The price that the processor offers to the supplier is only credible if it results in a payoff for the processor that is at least her payoff from breaking the contract. Hence, the processor's incentive compatibility constraint is $\Pi \geq \Pi_r$ (ICC^p), which, if not already satisfied by $\Pi = \Pi_h$, may induce the supplier to accept a lower price for his produce to guarantee contract enforcement. This will benefit both agents, as the resulting outcome will be better than the outcome in case of contract breakdown, i.e. the disagreement outcome. The price reduction that the supplier accepts, is equivalent to paying an efficiency premium (δ) to the processor. It makes the contract self-enforcing and amounts to

$$\delta = \Pi_r - \Pi_h = \frac{1}{2}(\theta - I) - \phi^p \tag{15}$$

The efficiency premium to the processor will thus be increasing in the contract surplus $S_h = \theta - I$, reflecting the processor's opportunity costs from complying with the contract. Similar to ϵ, it is decreasing in ϕ^p, i.e. the strength of informal enforcement.

As such, the possibility of a hold-up by the processor creates an upper bound to the supplier's contract gains. This is shown in Figure 6[14] where contract formation and surplus division are as in Figure 4, as long as θ is below $4I$. However, when the quality premium is high relative to the value of the required specific inputs, the processor's ICC will be binding. This creates an upper bound to the supplier's gains from the contract. In Figure

[14]Note that in this graph, we assign an arbitrary value of I to p_l

6, this occurs for $\theta \geq 4I$. At $\theta = 4I$, $\Pi_r = \Pi_h = 1.5I$. For any higher value of θ, Π_r will be larger than Π_h, and if her contract income is only Π_h, the processor will have an incentive to break the contract and pay the supplier Y_r, i.e. push him back to his ex post outside option. The supplier will be better off by agreeing to a lower contract price, i.e. by paying a negative efficiency premium that amounts to $\Pi_r - \Pi_h = \frac{1}{2}(\theta - I) - \phi^p$. For $\phi^p = 1.5I$, this implies that ΔY will remain constant at the level $1.5I$ for $\theta \geq 4I$. Note that this is exactly the magnitude of ϕ^p. Once the value of the contract θ exceeds $4I$, the processor extracts the whole surplus above this level. The processor's income is then increasing at the same rate as S with θ. Note that if the processor's reputation cost from contract breach (ϕ^p) is very high, the negative efficiency premium is only due at very high values of θ; for lower values of θ, the supplier's benefits increase strongly with θ.

Note that we have assumed that $\phi^p = 1.5I$. At this relatively high level of ϕ^p, the processor's outside option only has an impact on the distribution of S. It does not affect the incidence of inefficient separation. However, for low values of ϕ^p and ϕ^s, there may be a conflict between the supplier's ICC^s1 and the processor's ICC^p. This may result in inefficient separation. Take again the above example, but now assuming that $\phi^s = 0$ and $\phi^p = 0.5I$. Then, ICC^p is satisfied if $\Delta Y \leq \phi^p$ hence $\Delta Y \leq 0.5I$. If $\Delta Y > 0.5I$, the processor will hold up the supplier. In the meantime, ICC^s1 requires that $\Delta Y \geq I - \phi^s$ hence $\Delta Y \geq I$. If $\Delta Y < I$, the supplier will hold up the processor. The range of ΔY for which a contract is feasible (i.e. $0.5I > \Delta Y \geq I$), is empty. As a general rule, inefficient separation will occur over the whole domain of θ if the required $I > \phi^s + \phi^p$ and efficiency premium payment is the only enforcement mechanism available.

5 Third Party Enforcement

Let us now complicate the model further by considering that contracts can also be enforced by bringing in third parties at a cost M. We assume that M is the cost of guaranteed enforcement: for example in case of contract breach by the supplier, a fine ψ is imposed on the supplier that is high enough to ensure that $Y_b - \psi$ and $Y_s - \psi$ are lower than Y_h under all conditions (for all possible values of the other exogenous parameters).[15]

[15] This will be the case if $\psi \geq I - \phi^s$. In the case of maffia or court enforcement ψ is like an effective penalty on the supplier. In case of investing in a supervision system, the cost to the supplier is the loss of

M could, for example, be the cost of hiring lawyers for a formal court of law.[16] It could also be the premium that must be paid in order to hire the local maffia to enforce the contract. Another way to interpret the third party enforcement cost is as the cost of setting up a system to effectively monitor the application of inputs and the production and sales of the high-value commodity. These costs can be very substantial. For example, Minten *et al.* (2007) describe how a vegetable exporting company in Madagascar has invested in an extensive supervision and monitoring system, including hundreds of specially trained people, to monitor its suppliers.[17] To analyze this, we assume that these costs are paid ex ante (as in Dye (1985) and in Bajari and Tadelis (2001)), and as in the previous section, we start with considering the case of a one-sided hold-up opportunity (where only the supplier's ICC is relevant, e.g. by assuming $\phi^p > \theta$). The case of a two-sided hold-up opportunity (hence for ϕ^p relatively low) is discussed in Section 5.2.

5.1 Supplier Hold-up

The processor will first compare which mechanism is the cheapest to enforce the contract: by hiring a third party or by paying an efficiency premium, and will then compare the cost of the cheapest mechanism with her benefits from the contract to see whether the contract is still worth the while. More specifically: including third party enforcement costs, the gains for the processor of a contract are $\frac{1}{2}(\theta - I - M)$. This will be cheaper than paying an efficiency premium if $\frac{1}{2}M < \epsilon$, or, alternatively, if $M < 2\epsilon$. Note that in the former inefficient separation interval $[I, 2I - \phi^s]$, where the processor is not able to pay an efficiency premium, third party enforcement may render contracting viable. Here, the processor will compare the cost of third party enforcement with the other costs and benefits from the contract, i.e. she will hire a third party if $\frac{1}{2}(\theta - I - M) > 0$, i.e. if

his gains from sideselling, which equal $(I - \phi^s)$.

[16] The cost of pursuing a law suit is a measure of the quality of the legal system (MacLeod, 2006). Djankov *et al.* (2003) study the variation of quality of law by country and by legal system.

[17] To monitor the correct implementation of the contracts of 10,000 small suppliers, the firm has put in place a strict hierarchical system of around 300 extension agents who are permanently on the payroll of the company. Every extension agent, the chef de culture, is responsible for about thirty farmers. To supervise these, (s)he coordinates five or six extension assistants ("assistant de culture") that live in the village itself. The chef de culture has a permanent salary paid by the firm. During the cultivation period of the vegetables under contract, each supplier is monitored intensively (visits of more than once a week) to ensure correct production management as well as to avoid side-selling. For some crucial aspects of the vegetable production process, such as pesticide application, representatives of the company will even intervene in the production management to ensure it is rightly done (Minten *et al.*, 2007).

$M < \theta - I$. This is illustrated in Figure 7, with $M = 0.5I$. Observe that with $\phi^s = 0$, the processor will hire a third party over the domain $[1.5I, 2.5I]$. With θ between $1.5I$ and $2I$, hiring a third party is the only option to enforce contracts. If θ is between $2I$ and $2.5I$, third party enforcement is cheaper for the processor than paying an efficiency premium to the supplier. At $\theta = 2.5I$, she is indifferent between both systems, but at $\theta > 2.5I$ she will prefer paying an efficiency premium since this is cheaper.

The implications for equity and efficiency are as follows. The availability of third party enforcement has a positive effect on efficiency in the range $I < \theta < 2I - \phi^s$ ($I < \theta < 2I$ if $\phi^s = 0$) as there, it induces the shift from a low-quality equilibrium to a high-quality equilibrium and it benefits both the supplier and the processor.

However, if $\theta > 2I - \phi^s$ but $M < 2\epsilon$ (as is the case for the interval $2I < \theta < 2.5I$), third party enforcement will simply replace efficiency premium payment. Overall, this results in a loss M, the cost of enforcement to society.[18] The payoff of the supplier decreases from $Y_h + \epsilon$ to $Y_h - \frac{1}{2}M$. The processor's payoff improves from $\Pi_h - \epsilon$ to $\Pi_h - \frac{1}{2}M$. For $M > 2\epsilon$, the availability of third party enforcement does not have any impact as it is still too expensive as an enforcement device.

5.2 Two-Sided Hold-ups

If the processor's reputation cost ϕ^p is low, such that there may be an incentive for the processor to hold up her supplier, the supplier will also consider third parties to enforce the contracts (at a cost M). This is illustrated in Figure 8 (which assumes that $M = 0.5I$, $\phi^s = 0$, $\phi^p = I$).

The processor will act as in Section 5.1. If $\Pi_r > \Pi_h$, to avoid a hold-up by the processor, the supplier will pay an efficiency premium δ to the processor as long as $\delta < \frac{1}{2}M$. Otherwise, he will appeal to third party enforcement. Figure 8 shows how the contract will be made self-enforcing through payment of an efficiency premium δ to the processor for $\theta \in [3I; 3.5I]$. For $\theta > 3.5I$, third party enforcement will be invoked.

The implications for efficiency and equity are shown in Figure 8. S represents the

[18] Notice that in this paper, we consider the social gains of the contract as the sum of the gains of the supplier and the processor. As such, M is a cost to society. One could argue that payments to third parties, be it mafiosi, lawyers or local people hired to supervise, also benefit society and should be included in the gains, rather than costs.

effectively realized surplus for the contracting parties, and as before $\Delta Y = \frac{1}{2}S + \epsilon - \delta$ and $\Delta\Pi = \frac{1}{2}S - \epsilon + \delta$ where $\epsilon \geq 0$ or $\delta \geq 0$ is the efficiency premium with $\epsilon, \delta > 0$ if used as an enforcement device. Where third party enforcement is chosen ($1.5I < \theta < 2.5I$ and $\theta > 3.5I$), $\Delta\Pi = \Delta Y = \frac{1}{2}S = \frac{1}{2}(\theta - I - M)$ if $\beta = 0.5$. Contracting is now possible with θ between $1.5I$ and $2I$ and surplus can be created in this interval (compared to when there was no third party enforcement). Hence, inefficient separation is less likely with third party enforcement. However, in contrast to the efficiency premium, the cost of third party enforcement (M) to the processor does not benefit the supplier. Hence, the surplus S of the contract is lower by an amount M for $2I < \theta < 2.5I$ and $\theta > 3.5I$.

Note that if the processor's reputation cost from contract breach (ϕ^p) is very high, the negative efficiency premium is only due at very high values of θ, and for lower levels of θ, the supplier's benefits increase strongly with θ.

Finally, in a broader framework, it should be pointed out that the private costs of the absence of a public enforcement system differ depending on the size of $\theta - I$. At low and (very) high levels of $\theta - I$, the costs are equal to the private costs of organizing third party enforcement. At intermediate levels of $\theta - I$, these costs are lower as a system of self-enforcing contracts, with or without efficiency premia, can be designed.

6 Development

Development is a broad concept and is both cause and consequence of the formation of interlinked contracts. Here we look specifically at the impact of changes in two factors which we assume to be determined exogenously and which coincide with "development": the improvement of the functioning of factor markets and the improvement of (public) enforcement of contracts. First, if factor markets develop, producers' access to specific inputs will become less constrained, and this will obviously affect contractual arrangements. Second, if enforcement will be less costly with the emergence and better functioning of formal institutions, this will also affect the emergence and the distributional effects of interlinked contracts. To precisely identify the mechanisms, we analyze these effects separately.

6.1 Factor market development

As factor markets develop, suppliers can get access to inputs directly. It will no longer be necessary for processing firms to provide input on credit to their suppliers. Contracts are no longer interlinked. They may still be used to ensure an output market for the supplier and/or a sufficient supply of quality raw material fitting for the buyer. We refer to this as a ”pure” output contract.

The only option for contract breach by the supplier is now selling his high quality products at the local market. If, as we have assumed in Section 4, the local market values the high-quality product only as much as a low-quality product, the supplier's only outside option ($Y_s^d = p_l - C - I - \phi^p$) would make him worse off than the disagreement payoff $Y_l = p_l - C$.[19] Hence, the supplier has no incentive to break the contract; the processor faces no enforcement problems.

On the other hand, the processor's ex post outside option improves, as she has not paid for the input costs of the supplier. Her contract breach outcome will change to $\Pi_r^d = \theta - \phi^p$. This is higher (by a magnitude I) than in (14), where the processor is providing inputs to the supplier. This may create an incentive for hold-up of the supplier if $\Pi_h < \Pi_r^d$. Then the supplier needs to pay for contract enforcement, either through an efficiency premium, or through third party enforcement. In a pure output contract, as her outside option has increased, the efficiency premium to be paid to the processor will be higher and amount to

$$\delta^d = \frac{1}{2}(\theta - I) + I - \phi^p. \tag{16}$$

Obviously, as explained before, third party enforcement can substitute for this efficiency premium whenever the latter is more costly than the former.

What are the implications for equity and efficiency? Interestingly, an analysis shows that these effects are not straightforward and depend importantly on the economic conditions and institutional parameters. The comparison between Figures 8 and 9 illustrates these effects. Figure 9 presents the same situation as Figure 8 but for a pure output contract instead of an interlinked contract.

[19] Note that the local market valuation of the high-quality product may as well increase relative to its valuation of the low-quality product, as markets (and tastes) develop. This will be discussed in a following working paper.

6.1.1 Efficiency

First, one would expect efficiency to go up with the reduction of factor market imperfections. This is indeed the case for a certain range of values of θ. Since the processor needs no longer fear contract breach by the supplier, the processor does not need to use any enforcement mechanism to inhibit opportunistic behaviour by the supplier.

As a consequence, it does no longer happen that to make the supplier comply with the contract, the processor needs to pay him a premium that is so large that she would make loss because of that. With other words, inefficient separation due to an incompatibility between the supplier's ICC^s and the processor's PC^p does no longer arise.

In Figure 9, an example is in interval $[I, 1.5I]$, hence at low values of θ. While inefficient separation would occur over this interval if the supplier would have needed to rely on interlinked contracts to have access to inputs, the high quality equilibrium can be realised at low values of θ if the supplier is providing his own inputs.

However, secondly, the fact that the processor is no longer providing inputs to the supplier, also means that she is less "tied" into the contract. She has not done a specific investment in the contract, in terms of input provision to the farmer. This makes the supplier more subject to opportunistic behaviour by the processor.

As a result, the supplier may need to use more resources on contract enforcement. As the required efficiency premium becomes more expensive in this case, the supplier is more likely to resort to third party enforcement to protect himself against contract breach. This behaviour will clearly affect efficiency as well. In Figure 9, an example is in interval $[2.5I, 3.5I]$, where efficiency is reduced compared to the interlinked case in Figure 8 due to the increased cost of inhibiting breach of contract by the processor.

Note that when $\phi^p < I$, the supplier's PC^s and the processor's ICC^p can never be simultaneously satisfied. Indeed, for $\phi^p < I$, the efficiency premium that the supplier needs to pay to the processor to give her the incentive to comply with the contract is very high. It is so high that if the supplier pays for it, his own participation constraint is violated. In this case, the supplier prefers not to sign a contract at all. Note that inefficient separation is in this case independent of θ.[20] In Figure 9, $\phi^p > I$ hence no

[20] In case $\phi^p < I$, inefficient separation may for example still be overcome by sharing the investment costs (i.e. the cost of the inputs) between the processor and the supplier (cfr. Gow and Swinnen, 2001).

inefficient separation occurs at all.

6.1.2 Equity

It is obvious that if interlinking is not feasible, the supplier is at least as good off with a pure output contract than with no contract at all. However, if interlinking is feasible, the supplier will be better off with an interlinked contract than with a pure output contract. The main reason is that his own outside option is lower in a pure output contract, while his counterparty's outside option improves.

More specifically, in a pure output contract, the supplier will no longer receive an efficiency premium (at any value of θ). Instead, he will need to pay more for contract enforcement, either by paying $\frac{1}{2}M$ for third party enforcement or by paying an efficiency premium δ^d to the processor.[21] This will reduce the supplier's income from the contract. The size of the loss varies with θ.

For example, when we compare Figure 8 and Figure 9, we see that for $\theta = 2.5I$, the supplier's extra income from an interlinked contract is I (see Figure 8), while it is $0.5I$ in a pure output contract (see Figure 9).

Furthermore, at low values of θ ($\theta \in [I, 1.5I]$), although there is no longer inefficient separation, the supplier continues to earn only his disagreement outcome from the contract, as the whole contract surplus is required as an efficiency premium to the processor, to ensure contract compliance.

Hence, as a conclusion, we can say that improving factor markets may or may not benefit the supplier. It may benefit him in the sense that as he gets access to inputs by himself, there is no inefficient separation anymore (as long as $\phi^p > I$). Hence, the high-quality equilibrium can be achieved, also at low values of θ (see Figure 9, interval $[I, 1.5I]$).

However, the share of total income which accrues to the supplier may be lower in a pure output contract than in an interlinked contract. In Figure 9, this is the case at low ($\theta \in [I, 1.5I]$) and intermediate values of θ ($\theta \in [2.5I, 3.5I]$).

[21] For some values of θ, he will need to pay an efficiency premium where he did not have to pay one before, and at other values he will need to pay a higher premium than before.

6.2 Improvement of contract enforcement institutions

A second effect that occurs with development is that enforcement institutions become more effective and, hence, external enforcement becomes less costly. One way to model this effect is as a decrease in M, the cost of hiring a third party to ensure enforcement. An obvious implication is that enforcement will occur in more circumstances (for a larger range of θ) and that third party enforcement will be preferred to efficiency premium payment. This will have both efficiency and equity implications.

We also first analyze this effect separately. Hence, consider again the case of interlinked contracts instead of pure output contracts. Figure 10 illustrates the effect of a reduction in M (in comparison with Figure 8).

6.2.1 Efficiency

First, a decreased M will extend the range where contracts are enforceable. Indeed, as M decreases, there is a wider interval for which $\theta - I - M > 0$. While the inefficient separation interval is $[I, 1.5I]$ with $M = 0.5I$ (see Figure 8), it reduces to $[I, 1.25I]$ with $M = 0.25I$ (see Figure 10).

Second, when third party enforcement was already the cheapest option for contract enforcement with a higher M (cfr. Figure 8 for $\theta \in [1.5I, 2.5I]$ or $\theta > 3I$), third party enforcement now becomes cheaper. This increases the contract surplus, with a positive effect on efficiency.

However, thirdly, as the cost of third party enforcement decreases, it will substitute for efficiency premium payment for certain values of θ. Indeed, as explained in Section 5.1, a processor will appeal to third party enforcement if $M < 2\epsilon$, with $\epsilon = \frac{3}{2}I - \frac{1}{2}\theta - \phi^s$. Likewise, the supplier will appeal to third party enforcement if $M < 2\delta$ with $\delta = \frac{1}{2}(\theta - I) - \phi^p$. Hence, the smaller M, the wider the range of θ in which the processor or the supplier will invoke third party enforcement instead of an efficiency premium. This will affect the contract surplus S. Indeed, $S = \theta - I - M$ where third party enforcement is employed, while $S = \theta - I$ where the efficiency premium is employed. If M is employed over a wider interval, this obviously reduces S over a wider interval. In Figure 10, efficiency is reduced at intermediate values of θ; more specifically for the intervals $[2.5I, 2.75]$ and

$[3.25I, 3.5I]$.[22]

6.2.2 Equity

Where cheaper third party enforcement will substitute for efficiency premia, the distribution of the contract surplus will also be affected.[23] Indeed, in Figure 8, where $M = 0.5I$, efficiency premium payment is used to enforce contracts for $\theta \in [2.5I; 3.5I]$. In Figure 10, where $M = 0.25I$, efficiency premium payment is only used to that purpose for $\theta \in [2.75I; 3.25I]$. This leads to an income loss for those benefiting from the payment.

For example, in the case where $\theta = 2.5I$, the supplier receives an efficiency premium if $M = 0.5I$. However, if $M = 0.25I$, he no longer receives one. His income is reduced, while the processor's income increases, as her share of the payment to third parties is lower than the efficiency payment.[24]

Another case is where $\theta = 3.5I$. At this value of θ, the processor receives an efficiency premium if $M = 0.5I$. At $M = 0.25I$, she no longer receives one. Her income is reduced, while the supplier's income improves.

A third case is at $\theta = 1.4I$. With $M = 0.5I$, contracting was not enforceable while it is possible with $M = 0.25I$, as third party enforcement is feasible. The resulting contract surplus $\theta - I - M$ is equally shared by the processor and the supplier, who are thus both benefiting from cheaper third party enforcement in this case.

As a conclusion, we can state that both parties may benefit from cheaper enforcement where lower enforcement costs allow to overcome inefficient separation. However, perhaps surprisingly, improved enforcement institutions do not necessarily benefit both contracting parties in all circumstances. Indeed, for some values of θ, only one of the contract partners will gain, and the other will lose as cheaper third party enforcement will deprive the latter agent from his/her efficiency premium, and reduce his/her income. This is consistent with other literature (e.g. Anderson and Young, 2002), stating that better enforcement does

[22] Note that there is a status quo for $\theta \in [2.75I, 3.25I]$, where efficiency premium payment still remains cheaper than third party enforcement.

[23] Note that, as institutions develop, trade tends to be more formalized. People will rely less on social capital or on peer monitoring techniques. If reputation costs ϕ^p and ϕ^s decrease, efficiency premia get more expensive, reenforcing the former effect.

[24] However, the processor's gain is not enough to fully compensate for the supplier's loss: total contract surplus decreases as well.

not necessarily benefit contracting agents.

7 Conclusion

This paper analyzes how weak contract enforcement institutions and imperfect factor markets are affecting contract arrangements between agricultural suppliers and buyers in development, and what the implications are for income distribution and growth.

Our main findings are that factor market imperfections induce interlinked contract arrangements, and that the extent of inefficient separation (absence of socially efficient interlinked contracts) is proportional to the size of the enforcement costs and the relationship specific investment. The distribution of the gains from contracting depend on the overall rent that can be created by it.

Transfers from one agent to the other, which we call "efficiency premia", play a crucial role. With positive enforcement costs in contracting, an efficiency premium may have to be paid by one agent to the other in order to enforce the contract. The size of the efficiency premium depends on the enforcement costs and on the rents created by the contract. We find that the higher the enforcement costs, the higher the efficiency premium.

Moreover, we find that "development", i.e. an exogenous improvement of enforcement institutions and of the functioning of credit markets has non-linear effects on both equity and efficiency, and may hurt some of the contracting parties under some conditions.

More specifically, the analysis shows that with factor market development, interlinked agreements will be less needed. Moreover, as enforcement institutions develop, it will be cheaper to enforce contracts through third-party enforcement and efficiency premia are less likely.

In general, efficiency will increase. First, because the incidence of inefficient separation is expected to diminish; second, because third party enforcement is becoming cheaper and therefore has a less depressing impact on the contract surplus.

Nevertheless, for some values of θ, efficiency rather decreases, as third party enforcement is substituting for efficiency premium payment.

Further, especially for lower values of θ, the share of total income that accrues to the supplier may go down with development, as he misses out on his efficiency premium.

On the other hand, especially for intermediate to higher values of θ, the supplier may as well gain from cheaper third party enforcement as it decreases the cost of inhibiting opportunistic behaviour by the processor.

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Figure 1: Basic decision tree

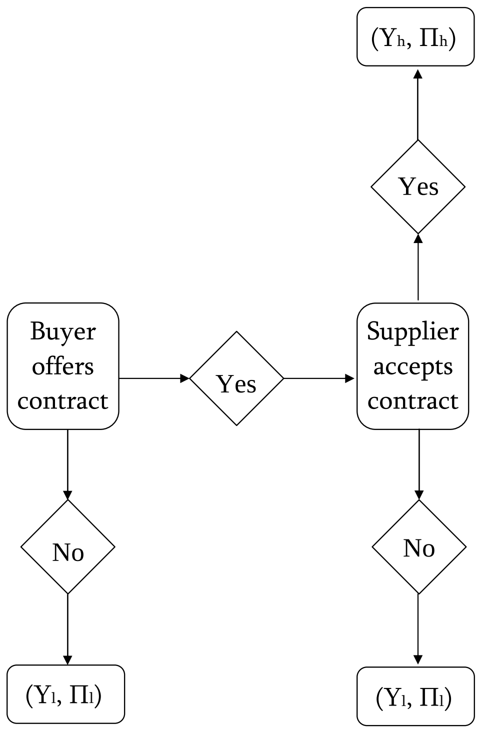


Figure 2: Interlinking with hold-up opportunities for the supplier

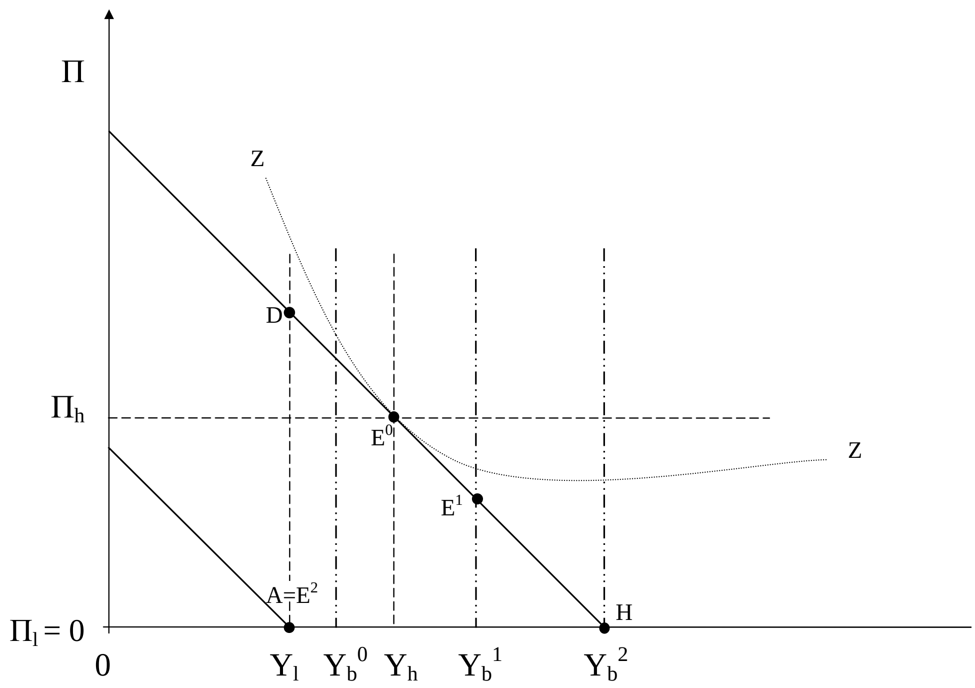


Figure 3: Game tree with various Hold-Up Opportunities

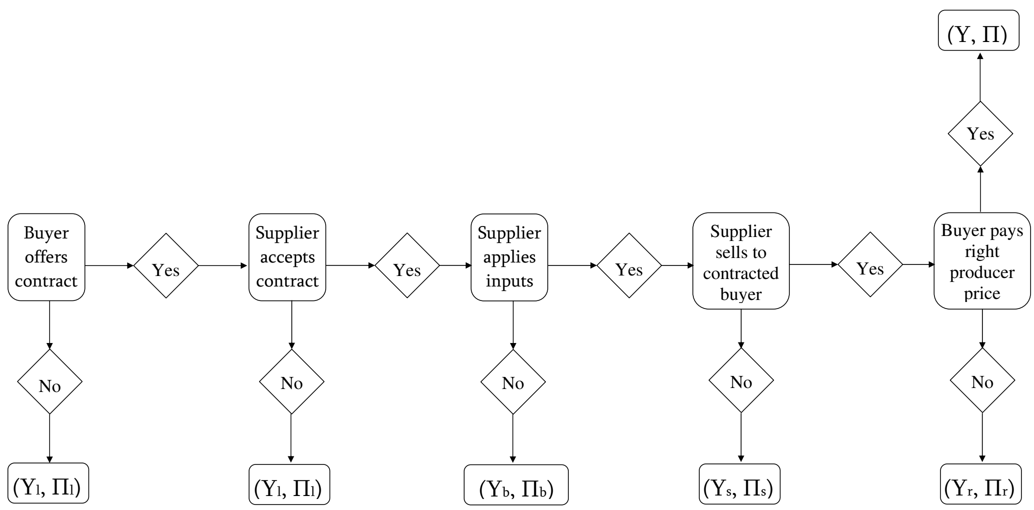
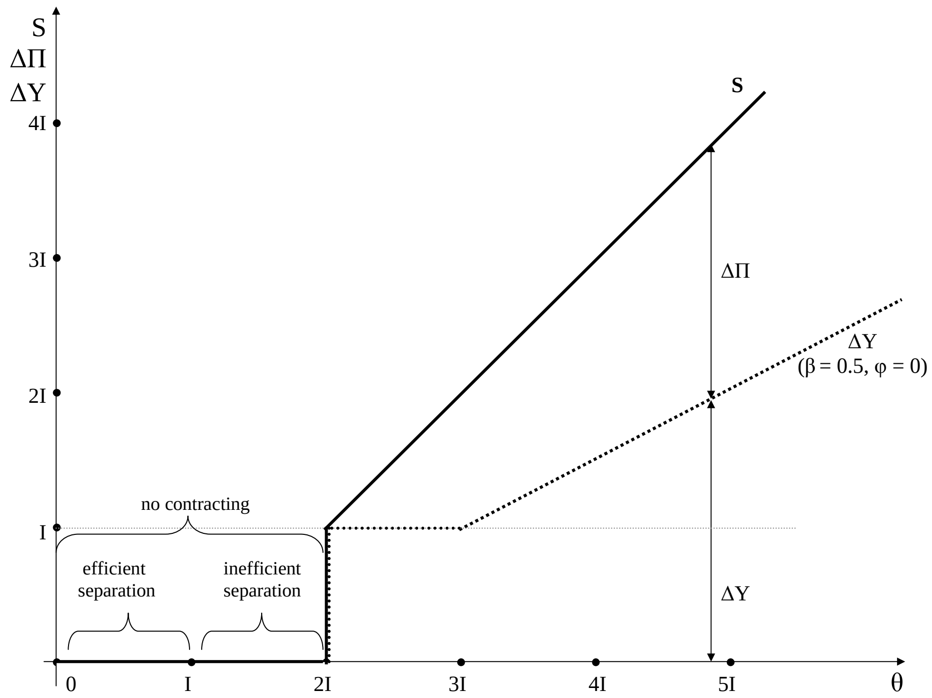


Figure 4: Surplus sharing under One-sided Hold-up for $\phi^s = 0$



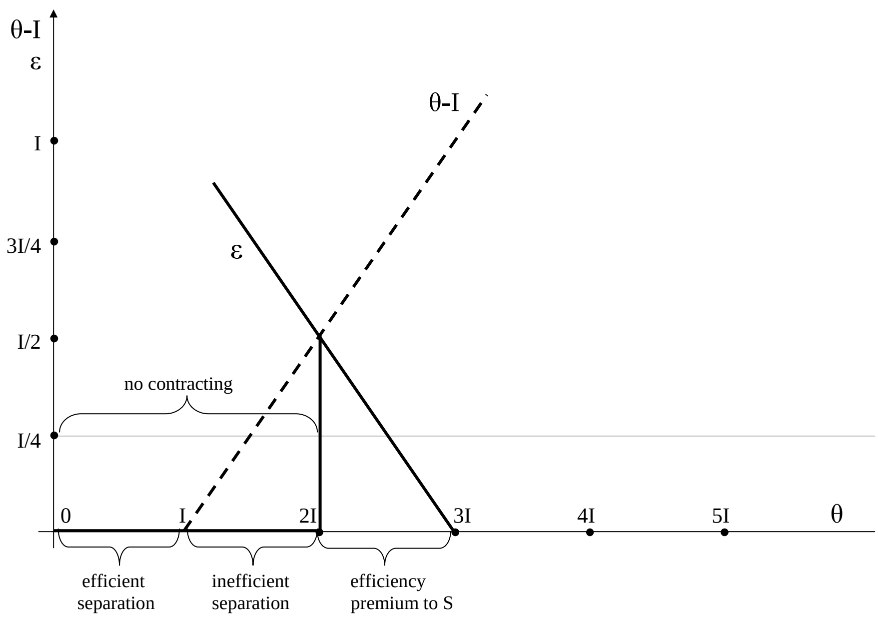


Figure 5: Surplus sharing under One-sided Hold-up with $\phi^s = I/2$

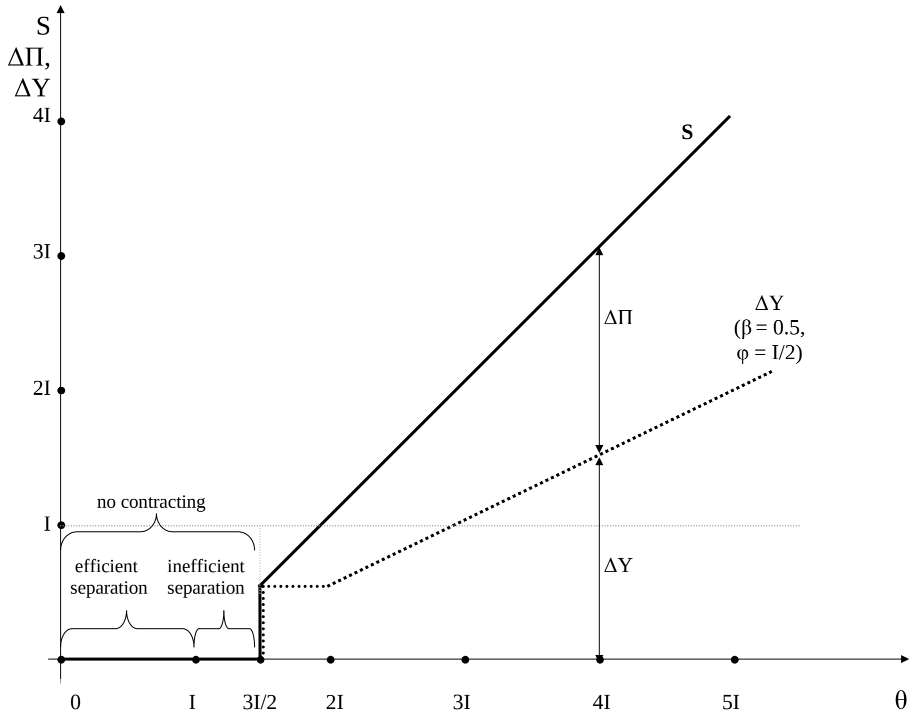


Figure 6: Surplus sharing under Two-sided Hold-ups

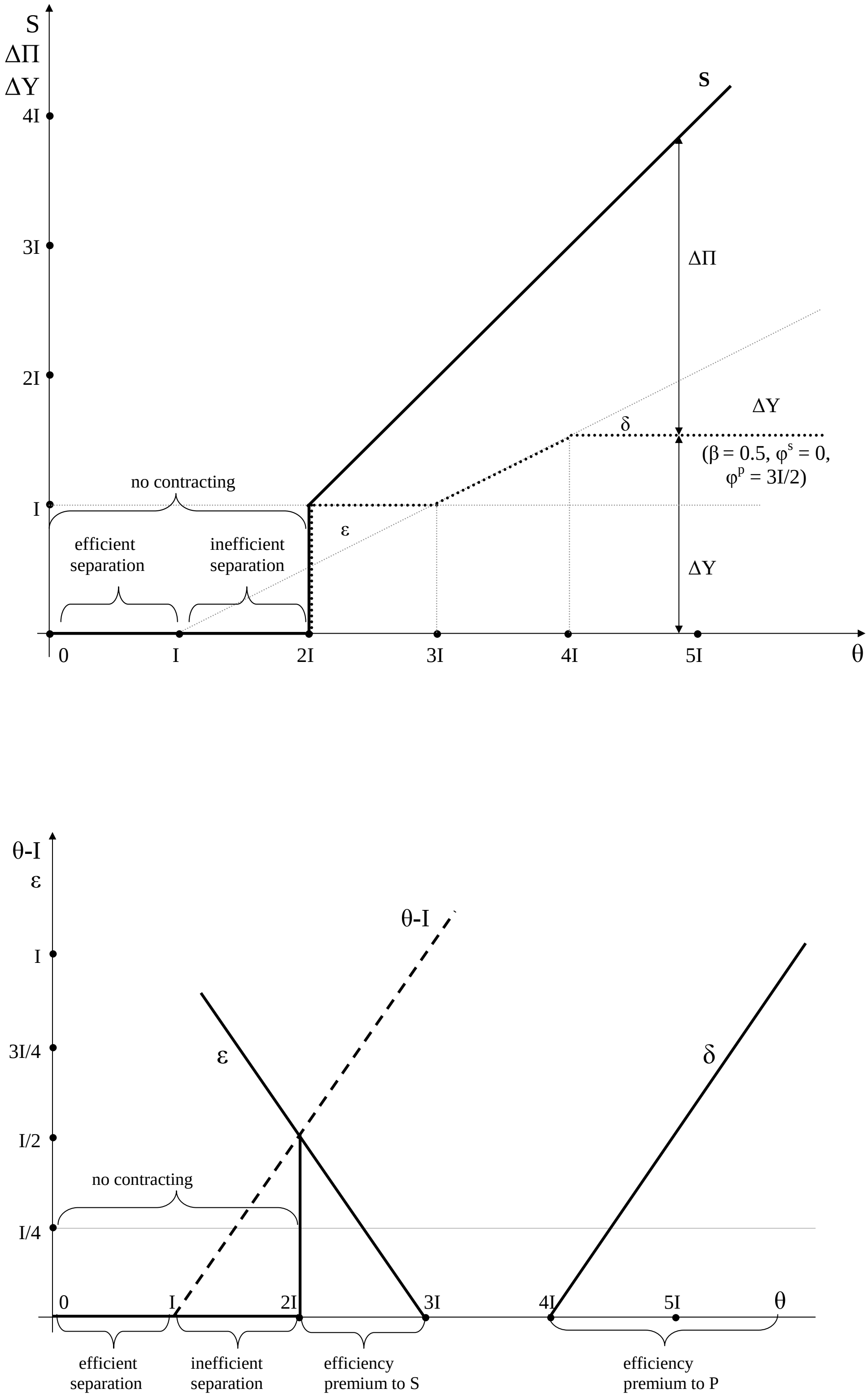
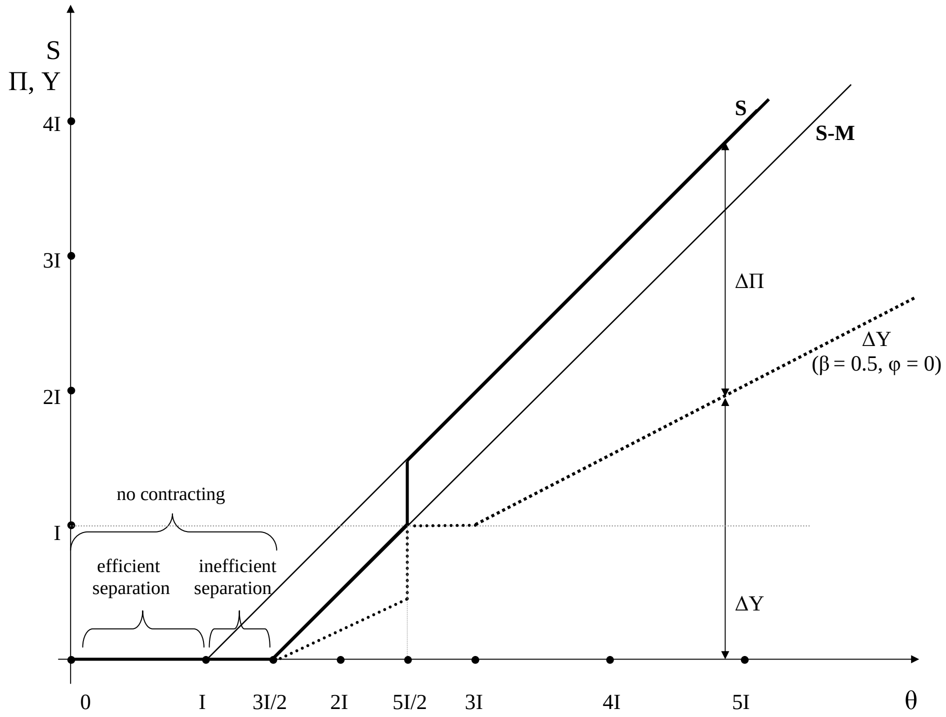


Figure 7: Enforcement Mechanism Choice and Surplus Sharing; One-Sided Hold-up



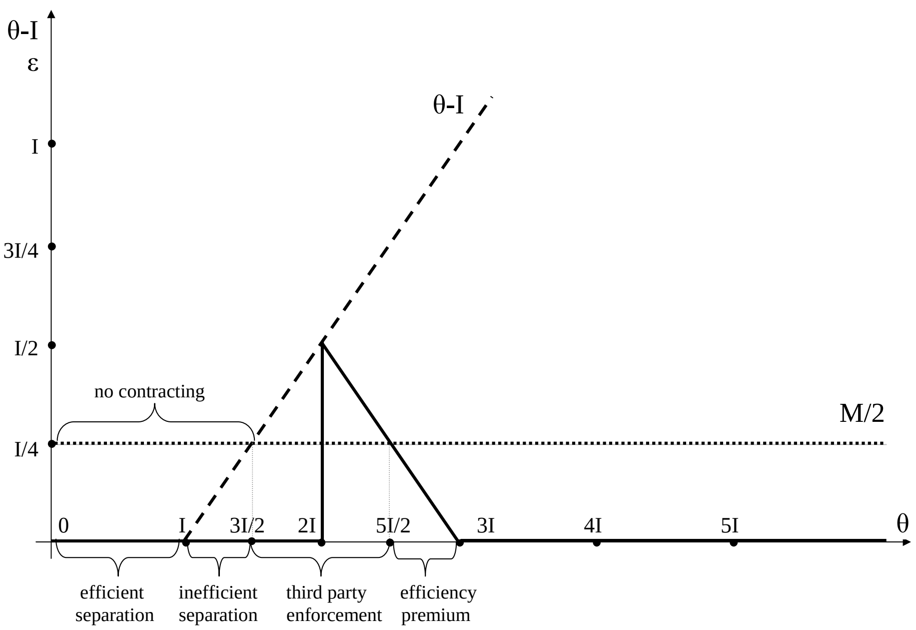


Figure 8: Enforcement Mechanism Choice and Surplus Sharing; Two-Sided Hold-up

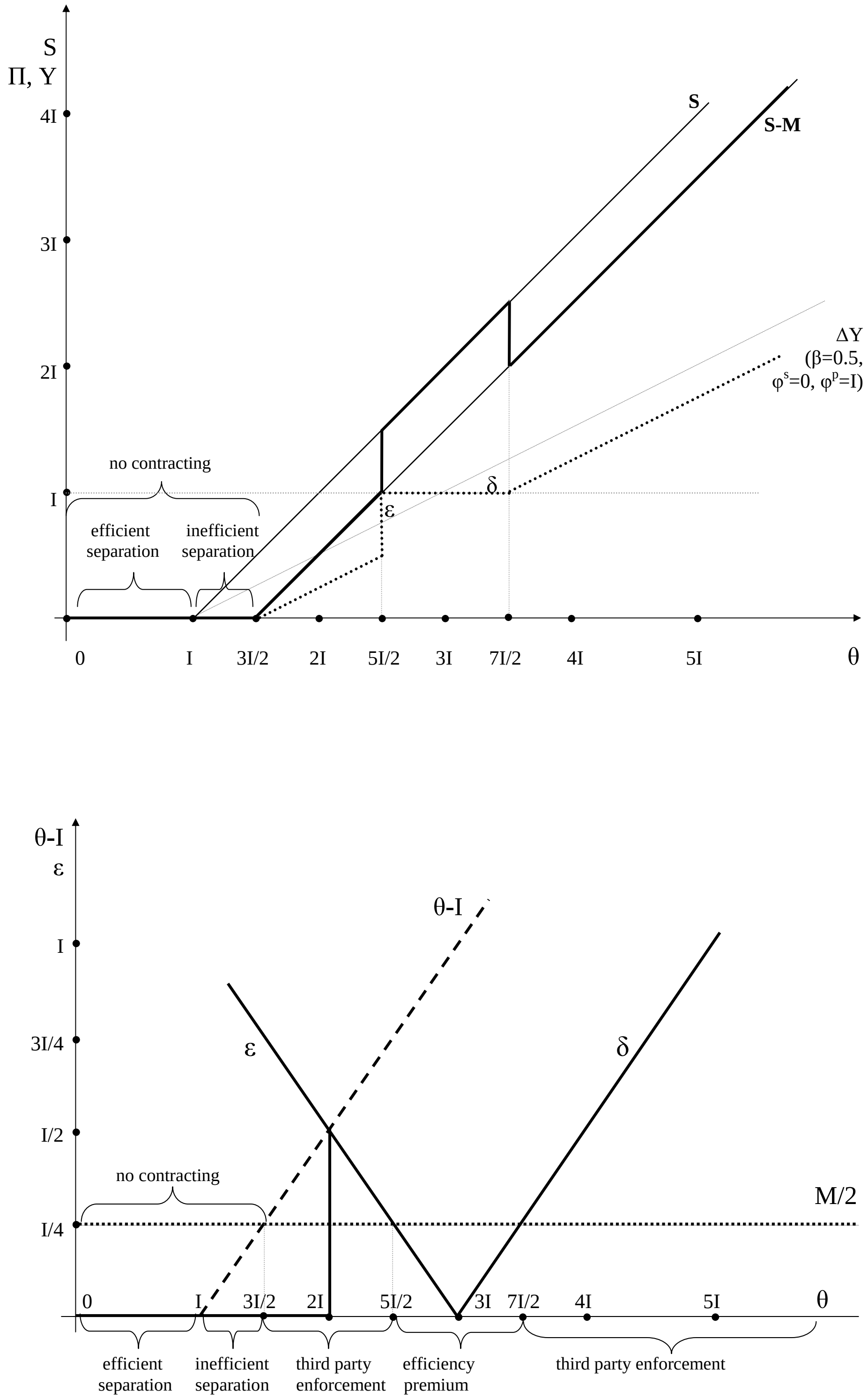
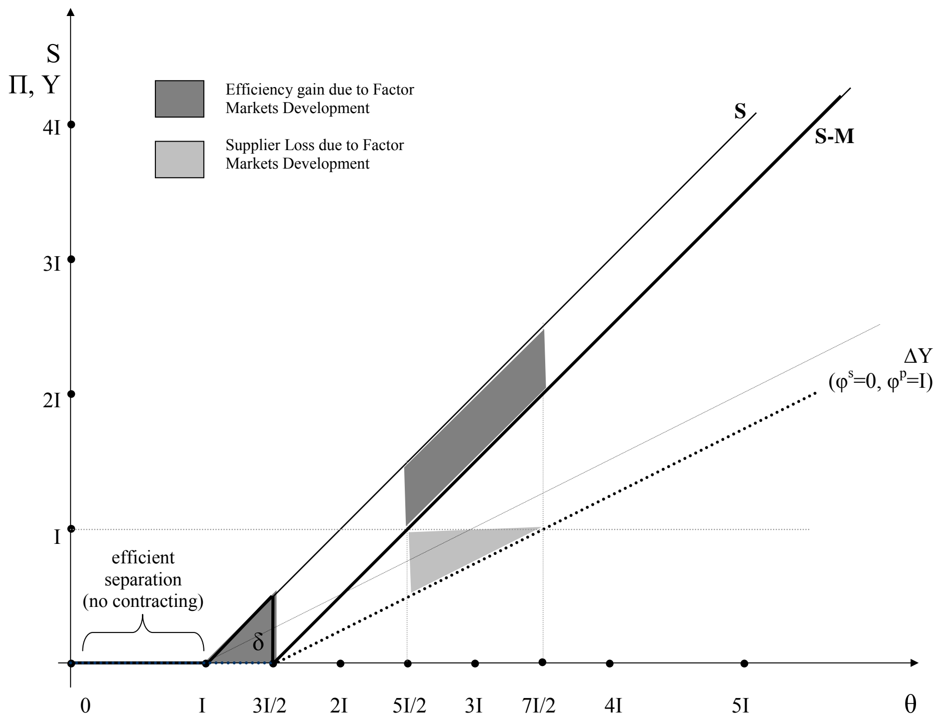


Figure 9: Enforcement Mechanism Choice and Surplus Sharing; Effect of Factor Market Development.



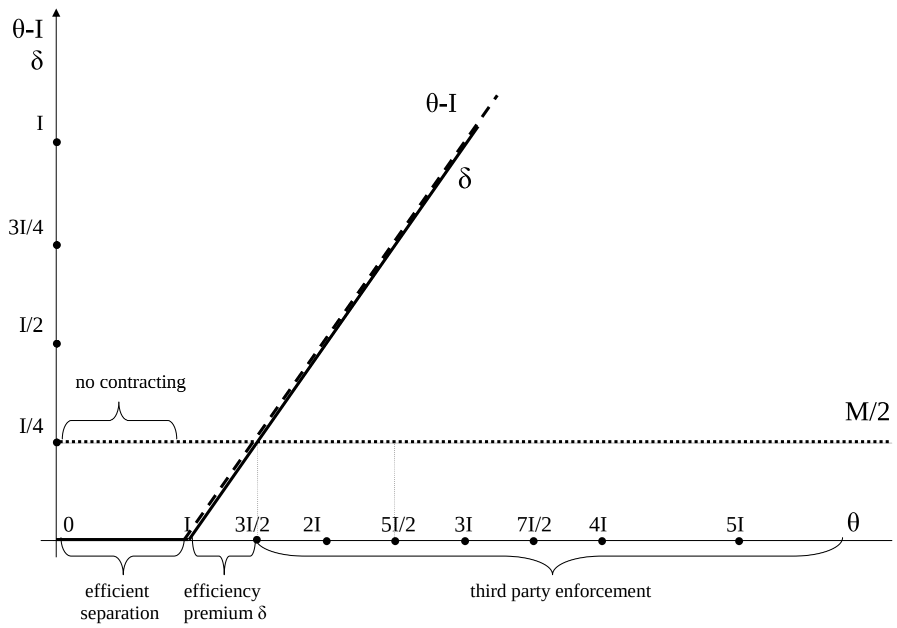


Figure 10: Enforcement Mechanism Choice and Surplus Sharing; Effect of Development of contract enforcement institutions (Decreasing M)