

Contracts, Hold-Up, and Exports: Textiles and Opium in Colonial India

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Abstract: Trade and export are often argued to be key to economic development and growth. This paper studies the microeconomics of export procurement. We build a heuristic model of transactions between exporters and local producers and relate the model to the well-documented ventures of the East India Company in colonial Bengal. The historical record, and our model, highlight two problems in the procurement process: the exporter and its agents may not uphold pricing agreements and local producers may not honor sales contracts. The model shows when procurement will succeed or fail, highlighting the tension between these two hold-up problems and the difficulties in solving them simultaneously. We use the model to analyze a variety of cases, including the East India Company's textile ventures in Bengal, its opium monopsony in the 19th Century, the putting-out system in pre-industrial England, and present-day contract farming.

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I. Introduction

Many economists and policy makers hold that exports and trade are key to economic development. As globalization accelerates, there is growing potential to export goods to far-off markets, and indeed, many see trade as a way to substantially raise the incomes of the poor in the developing world.¹ Yet how can this export be accomplished? How can local production actually reach the global marketplace? What contractual problems do exporters face? This paper examines these questions.

We consider the microeconomics of export procurement. The paper builds a heuristic model of transactions between exporters and local producers. We relate the model to the operations of a large multi-national company, the East India Company (EIC), whose records provide a rich source of information on problems of contracting for export. We focus on one of the Company's ventures that is especially well-documented: textile procurement in Bengal in the second half of the 18th Century.² Textiles, which were produced at home by weavers dispersed across the countryside, were the Company's most important export to Europe.³ The primary method used by the Company for procuring these textiles was called the "Agency System," where the EIC hired local employees – agents – to execute contracts with weavers. Typical contracts specified a loan amount for working capital, the quality and quantity of cloth a weaver would produce, and quality-contingent prices. The EIC would give agents the loan funds to advance to the weaver. After production the agent was supposed to pay the weaver the quality-contingent price, take the cloth, and deliver it to the EIC. But the system did not work so well. Enforcement of long-term contracts was difficult, and the system was fraught with what contemporaries called "corruption" - what we would call "opportunistic behavior" - on the part of the agents, the weavers, and officials of the EIC itself.

We build a model of this procurement system and highlight two problems we see throughout in the historical record. The EIC was able to solve some contractual problems, but was constantly

¹See, for example, Collier & Dollar (2002).

²Our sources include Jones (1918), Marshall (1976), Sinha (1965), Verelst (1772), Wright (1961) and, especially, Hossain (1988) and Mitra (1978).

³By the 1750's textiles accounted for more than 80% of the value of British exports from Bengal. (Chaudhury 1995, p. 194).

plagued by two: the agents often did not uphold the pricing agreements and "cheated" the weavers, and the weavers often sold output to other buyers and thereby did not repay their debts. Our analysis shows that indeed it would be very difficult to prevent both problems at the same time. If the EIC gave the agent a greater ability to prevent the producer from selling output to another buyer and, thus, recover the debt, it simultaneously gave the agent a greater ability to hold-up the weaver and not pay the specified price. We find that the EIC struggled to find the right balance in the amount of power it should allow the agent: too little and the agent could not prevent outside sale, but too much and the agent would take advantage of his position and cheat the weaver. The model shows how the right balance depends on the market structure, the specialized nature of the good, and variability in local conditions affecting bargaining between the local agent and producer.

The model provides lessons for historical and contemporary procurement. The EIC's procurement process should look familiar. It is a typical procurement system: there is an advance of working capital or inputs, then goods are produced and delivered at a later date when final compensation is given. When long-term contracts on future terms of trade are not enforceable, the basic setting falls within the Grossman-Hart-Moore theory of incomplete contracting: the outcome of future bargaining determines incentives to make specific investments [Grossman and Hart (1986), Hart and Moore (1990)]. We see this theory come to life in the EIC records. Two parties make specific investments: the agent makes an investment in a producer, and the producer makes the cloth to the buyer's specifications. The terms of the contract are difficult to enforce, hence there is potential for opportunistic behavior on both sides: the producer can abscond with the capital advance or use it to produce for another buyer; the agent can pay the producer different prices than specified in the contract. While the general consequences of hold-up are well-known, the closest paper we know to our model is Edlin and Hermalin (2000), which explicitly gives the producer property rights over the output and allows the producer to sell to another buyer.⁴ The development literature has considered the problem that the producer can renege on a debt agreement and describes various possible ways to enforce debt contracts, such as interlinked contracts

⁴A complementary theoretical literature on procurement and trade studies problems that arise due to hidden characteristics on the part of the local producer [e.g. Rauch and Watson (2003)].

and reputation mechanisms.⁵ The problem that the buyer can renege on an agreement with a producer has received very little attention in the development literature, with Banerji and Duflo (2000) being a notable exception. To our knowledge there is no analysis of the situation, likely to be quite common, where there are two problems: the producer can renege on a debt repayment and sell to another buyer and the original buyer can hold up the producer.

We present a highly stylized (one could say reduced form) model of one-time interaction where an exporter contracts with a local producer, and we ask when the exporter, its agent, and the producer all have the incentive to uphold the terms of the contract. Our goal is to provide a heuristic framework to study export procurement. An alternative approach would be a model of repeated interaction between the exporter and producer. Such a model would yield the familiar result that if the producer and exporter are sufficiently patient, gains from trade can be consistently realized. However, while this may be an accurate description of interactions in some settings, we do not see such cooperative behavior in our study of export procurement in Bengal. We will describe contract violations by producers, agents, and exporters who do not fear future retaliation and do not seem to be thinking long-term. We elaborate reasons for this outcome in the context of textiles in Bengal in section V, and return to these issues in the conclusion.

We use our model to study several cases of procurement. Beyond the EIC's textile venture, we study the Company's (in)famous opium operations in eastern India in the 19th Century, the putting-out system in pre-industrial England, and present-day contract farming. Our model indicates that successful procurement requires maintaining a balance of bargaining power between the agent and the producer. In the textile case, the EIC faced two difficulties in maintaining this balance. First, it faced competition from other exporters, which gave weavers greater ability to abscond with the capital advance and sell output to another buyer. Second, the EIC faced uncertainty regarding the agent's ability to enforce the contract. Hence, the EIC was caught between increasing the agent's power, to counter the effect of competition, and decreasing agents' power, to prevent them from abusing their positions when conditions were favorable. In the EIC's

⁵McMillan and Woodruff (1999), Biggs et al. (2002), and Fafchamps (1997) discuss trade credit. There is also an extensive literature on interlinkage as a solution to moral hazard and enforcement problems in credit contracts in agriculture. Bardhan (1980, 1989) provides overviews of this literature.

later opium operations, both of these problems were less salient. By the 19th Century, the British had consolidated control of eastern India, and the EIC largely dominated the export of opium.⁶ Facing a virtual monopsony, local producers had fewer outside options and it was more difficult to escape their obligations (though there remain reports of producers taking advances from the EIC, then diverting their output). To check the power of agents, the EIC invested in a large institutional apparatus, where EIC's representatives worked along local agents and monitored their behavior. We argue these two features were complementary; the monopsony mitigated the hold-up ability of the producer, and the rents from selling a highly lucrative product provided the funds to invest in a monitoring system.

In the putting-out system, which was especially widespread in England before the Industrial Revolution, we see the interplay of the procurement method and formal, but imperfectly enforced, legal codes. Putting-out was like the agency system, with one difference: raw material, rather than cash, was advanced. There was opportunism by merchants and their agents, which took the form of arbitrary reductions in the final price. But the problem that threatened the viability of the system itself was large-scale embezzlement of raw materials by producers. Though many laws were passed to discourage this, implementation was generally weak.⁷ While the Bengal textile agency was imperiled by the excessive power of the procurers, in the putting-out system they may have had too little power.

Finally, we consider present-day contract farming. Many multinationals and parastatals use contract farming to procure agricultural products such as coffee, fruit, and other export crops. They advance funds to farmers, and often provide technical assistance. In return, the farmer is supposed to sell the crop to the exporter. We again see that procurement often breaks down where there are many competing buyers: producers take advances from one company and sell to another. Export companies, therefore, prefer to be in locations where they are monopsonists. As our model indicates, however, this position gives the exporter too much power, and they have the opportunity to hold up the producers. We discuss examples of this outcome as well.

⁶In the early 19th century Bengali textiles could not compete with cheap manufactured cloth from Britain, and the EIC's textile exports were virtually eliminated. By the 1820's the Company's cloth establishments were closed.

⁷We discuss reasons for this in section VI B.

This paper contributes to the study of the role of institutions in economic growth and development.⁸ Following Douglass North, economic historians have explored how institutions can foster expanding trade. Greif (1993), a prominent example, shows how groups of traders can successfully transport goods from one shore to another, despite agency problems. Our study considers how goods make it to shore in the first place. Several papers study the internal management of the EIC and other trading companies [e.g. Carlos and Nicholas (1990) and Hejeebu (2005)]. None of this work focuses on the Company’s contractual relations with local producers, which is our main interest.

The rest of the paper is organized as follows. In the next section we discuss the historical background and institutional features of the EIC’s textile procurement in Bengal. Section III presents a model of the Agency System. Section IV draws on the model and discusses the evolution of the EIC’s textile procurement policies. Section V considers alternative policies the Company could have adopted, such as vertically integrated production. Section VI discusses the EIC’s opium monopoly, the putting-out system, and contract farming. Section VII concludes.

II. The EIC’s Textile Procurement in Bengal

The English East India Company was founded in 1600, and in its charter, Queen Elizabeth gave it a monopoly on all English trade with Europe east of the Cape of Good Hope to the Straits of Magellan. The EIC operated in many parts of the world, including the American colonies, India, and China. By the end of 17th Century, Bengali textiles were very popular in Europe, the “India Craze” of the 1680’s being one manifestation. While EIC was the only English company, other European companies including the Dutch, French and Danish, were active in the Bengali textile market. The total volume of trade was large; Prakash (1976, 173) has estimated that in the early 18th century Dutch and English exports of textiles created 75,000-100,000 jobs.⁹

Local politics are important to our story. There were continual tensions between the EIC and the Nawab of Bengal, who, at least in a formal sense, governed the province as part of the

⁸The *World Development Report* of 2002 provides a comprehensive overview of the role of institutions in development.

⁹Prakash provides lower and upper bounds of 75,620 and 99,804. The workforce in Bengal province at this time is estimated at 10 million, one million of whom were in textiles and raw silk taken together.

Mughal empire. The disagreements, often over customs duties,¹⁰ came to a head in 1757, when, in the famous Battle of Plassey, the EIC defeated the Nawab's forces and installed a pliable client ruler. Over the next decade the EIC intensified its hold, and, after the Battle of Buxar in 1765, became Diwan of Bengal and the de facto political power.¹¹ The EIC gained statutory authority, and this authority will play a role in our model.

Textiles in Bengal were made by weavers, using hand-loom in their homes. Weaving was often not a sole occupation, but was combined with agriculture. Production was dispersed throughout the countryside. Working capital, which was typically advanced by buyers, was needed to acquire necessary inputs, yarn in particular. Though the British introduced western-style courts in the 1770's, "traditional" methods for enforcing credit contracts persisted, including various forms of coercion and dunning. After gaining statutory authority, the EIC's coercive powers increased, compared to those of its rivals.

Bengali textiles had several outlets: local consumers, markets in upper India to which Bengal is connected by major rivers, and exports to various regions outside South Asia.¹² By the first half of the 18th century, Europe was the major export market.¹³ Besides local Bengali merchants and European companies, private traders from Europe, merchants from other parts of India and even from Armenia sought to buy cloth. One source was the spot market, where a "ready money" [*khush khareed*] purchase could be made. But it was common for a buyer to advance capital to a weaver who committed to produce for him – a system called *dadan*. This system was advantageous to the weaver in two ways: he received capital that could be used for inputs or for consumption, and he was guaranteed (in principle) a buyer for his product. The buyer in turn was guaranteed supply (again, in principle). Timely and assured procurement of goods was particularly important for the European companies, whose ships made journeys lasting several months. They used two methods for advancing capital. In the "Contract System" the company

¹⁰The Company had obtained a *firman* (decree) from the Mughal emperor exempting it from customs duties after payment of a lump sum. The Company and the Nawab differed in the interpretation of the *firman*; the more generous the interpretation, the more taxes the Nawab would lose.

¹¹In the Mughal structure, the Diwan was in charge of finances, especially collection of land taxes and payment of tribute to the emperor.

¹²Chaudhury (1995, 147) lists the following regions: South-East Asia, West and Central Asia, the Persian Gulf and Red Sea areas, and North Africa.

¹³See Chaudhuri 1978, p. 247.

did not have any direct contact with weavers: it signed contracts with local merchants. Capital was advanced and quantities and quality-contingent prices were specified. The alternative was the "Agency System" under which the company dispensed with the merchant. Its salaried employees contracted directly with the weavers, who received advances and agreed to produce specified amounts of cloth in exchange for remuneration based on quality.

The EIC predominantly used the Agency System in the period we study, and we describe it here in further detail. To procure textiles, the EIC established "factories" in major towns. These factories were not the places of production in the present-day sense of the word. They were more like administrative offices.¹⁴ Each factory linked to several collection centers (*aurung, arang*) headed by a salaried employee, called a *gumashta*. The *gumashtas* served as the EIC's agents in dealing with the weavers. They were given funds, in exchange for security, and these funds were to be advanced to weavers. The EIC would specify the amounts and types of cloth needed and a price schedule for different qualities of cloth. The *gumashta* would contract with the weaver, advancing the capital in return for specified cloth. The *gumashta* was authorized to enforce the contract. For example, he could use personnel (*peons*) to monitor the weaver and physically punish him and compel him to produce. He could try to prevent the weaver from selling to another buyer. The extent of the *gumashta*'s coercive power was a policy decision of the EIC, given its position as de facto political authority. If the weaver returned the cloth to the *gumashta*, the quality was appraised. The *gumashta* paid the weaver. The cloth was then sent onward to the EIC's factory and the *gumashta* recovered the security for the capital advance.¹⁵

There is much evidence that this system was plagued by opportunistic behavior by agents and weavers. Reporting on corruption among the *gumashtas*, a contemporary observer noted:¹⁶

The roguery practiced in this department is beyond imagination, but all terminates

¹⁴Chaudhuri (1978, p. 573) writes: "The term 'factory' at this time merely signified an establishment for the merchants to carry on business from within a foreign country and it is derived from the word 'factor' meaning an agent employed by the principal merchant."

¹⁵The Company began to use the Agency System in 1753, at which point its policy was formulated as follows: "The substantial gomastahs approved of by the Board should be employed at the aurungs, giving sufficient security...that they undertake no other than the Honourable Company's business on forfeiture of their wages and allowance, that each gomostah have different musters delivered to him for his guide...that no gomostah...be entrusted with more than Rs. 20,000 at one time..." (Hossain, 1988, p. 88)

¹⁶Bolts (1772) cited by Mitra (1978, p. 50). Though Bolts was viewed by some as being biased against the EIC, his views on this matter were widely shared, as we will see in section IV.

in defrauding the poor weaver; for the prices which the company’s gomastas and in confederacy with them, the jassendars [appraisers] fix upon the goods are in all places at least fifteen percent and in some forty percent less than the goods so manufactured would sell in the public bazaar or market upon free sale.

The European companies, including the EIC, also constantly faced the problem of producers taking their advances but selling to other buyers. Indeed, Prakash (1998, p. 71) asserts that “the problem of bad debts...plagued all the commodities the Europeans procured in India”. According to Marshall (1976, p. 36) the practice of taking an advance from one merchant but selling to another was especially prevalent among weavers. The reader will see in section IV that the EIC’s reports and contemporary discussions contain numerous references to this problem.

The EIC experimented with various policies to address these issues. Our model provides insight into why solving both problems was a difficult task. The *gumastha* needed to be given coercive power to prevent the weaver from misappropriating the capital, but this in turn gave him the ability to hold up the weaver; the solution to one contractual problem created the other.

We show the workings of the transaction in a simple model. We begin with a stark model that yields first best outcomes and incrementally work towards a more realistic framework that depicts the EIC’s procurement process. This approach clarifies, sequentially, the reasons for the EIC’s use of an agent, the problems caused by opportunistic behavior on his part, and the consequences of the EIC’s uncertain control over his actions.

III. A Model of the Agency System

There is an export good that is produced using capital, k , and labor, l . The producer has the skill to produce the good, but no capital. The exporter has the capital to produce the good, but no skill. We normalize the opportunity cost of capital to zero, and we assume the producer’s labor costs are simply equal to the quantity of labor used. Production takes place in a single (indivisible) unit, and there is fixed proportions production technology. If the producer uses capital $k \geq \bar{k}$ and $l \geq \bar{l}$, he produces a unit of the good. If lower levels of either input are used, no good is produced. The exporter’s value of a good is \bar{v} . We assume that $\bar{v} - \bar{k} - \bar{l} \geq 0$ so that

it is efficient to produce the good.

We will examine the interaction between a single producer and a single exporter, under the assumption that there are many producers of the product and potentially other buyers. We suppose, for simplicity, that outside buyers would pay $m\bar{v}$ for the product, where the parameter m , $0 \leq m \leq 1$, represents the extent of outside competition. For example, m could represent the extent to which the good is specific to the exporter who advanced the capital. For $m = 1$, the good is homogeneous, and there are other buyers willing to pay \bar{v} for the output. We sometimes call $m\bar{v}$ the "spot market price."

We begin with an analysis of a contract between the exporter and the producer, with no agent. The timeline is as follows: The exporter announces a price P that it will pay for the good and an amount of capital k to advance the producer. The producer decides whether or not accept the contract, then decides whether or not to use his own labor combined with the capital advance to produce a good. If production takes place, the producer decides whether to sell the good to the exporter or to another buyer.

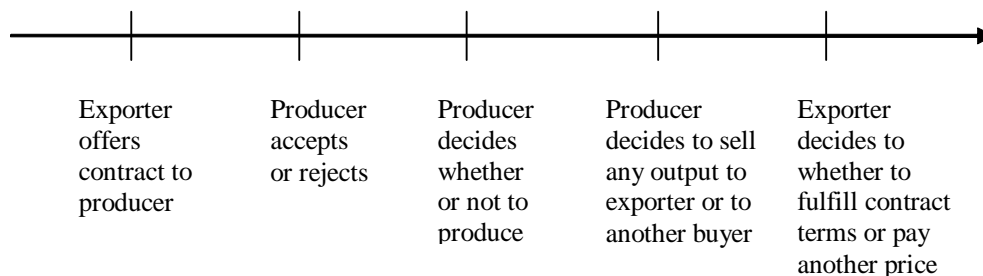


Figure 1. Timing of Interaction between Exporter and Producer

We consider interaction between the exporter and the producer under various assumptions about the enforceability of different types of contracts. Our choices are guided by the history of the EIC textile venture in Bengal. Past and present exporting ventures face similar contracting problems. In our analysis we will assume that the exporter sets the contract terms. We make

this assumption because there were few buyers of the product and many producers. Our main results concerning the enforceability of the contract would be qualitatively the same under other specifications.

A. Complete Enforcement of Contracts

If all terms of the contract are enforceable, it is easy for the exporter to procure goods. Consider a contract that specifies a price P that the exporter will pay for the product, a capital advance of \bar{k} , and the requirement that the producer sell the goods to the exporter rather than another buyer. When this contract is enforceable in court (e.g., with arbitrarily large punishments for contract breach), the exporter will set a price P to maximize his profits $\Pi = \bar{v} - \bar{k} - P$, subject only to the producer's "individual rationality constraint," $P - \bar{l} \geq 0$, which guarantees the producer a return on his labor. As long as it is efficient to produce the good, which we have assumed, exchange can take place. The price $P = \bar{l}$ satisfies the producer's individual rationality constraint and gives the exporter all the surplus from exchange.

B. Non-Enforceable Debt/Sales Contracts

Of course, such long-term contracts might not be enforceable and indeed problems with contract enforcement are now the bread and butter of industrial organization research. We first consider the inability to enforce the debt/sale terms of the contract, which is the typical problem studied in the literature on developing countries. The exporter must pay the price P , but the producer need not repay his debt. He could simply abscond with the capital advance or use the funds to produce but sell to another buyer. In this case, the contracted price must satisfy two incentive constraints: (1) The price P must cover both the cost of labor and the producer's opportunity cost of using the funds for a purpose other than production: $P \geq \bar{l} + \bar{k}$, and (2) the price P must give the producer the incentive to sell any output produced to the exporter. Since the producer would receive a price $m\bar{v}$ from another buyer, the producer must receive at least this amount from the exporter: $P \geq m\bar{v}$. The exporter will now set a price P to maximize his profits $\Pi =$

$\bar{v} - \bar{k} - P$, subject to the following incentive compatibility constraint:¹⁷

$$P \geq \max\{\bar{l} + \bar{k}, m\bar{v}\}$$

We immediately see that exchange might not take place in this environment. There are two cases.

(1) If competition is high enough, $m > \frac{\bar{l} + \bar{k}}{\bar{v}}$, so that the exporter must set a price $P = m\bar{v}$, the exporter's profits are negative when $m > (\bar{v} - \bar{k}) / \bar{v}$. That is, the possibility of outside sales can destroy procurement. In this case, the producer can essentially "hold-up" the exporter. Hence, exchange only takes place in the range $\frac{(\bar{v} - \bar{k})}{m} \geq \bar{v} \geq \frac{\bar{l} + \bar{k}}{m}$. (2) When m is small so that the exporter pays price $P = \bar{l} + \bar{k}$, there could still be a problem because the price must cover the producer's opportunity cost of using capital for an alternative purpose. The exporter would earn negative profits when $\bar{v} < 2\bar{k} + \bar{l}$. In this case, in order for exchange to take place, the exporter must place a large enough value on the good, $\bar{v} \geq 2\bar{k} + \bar{l}$, and exchange only takes place in the range $\frac{\bar{l} + \bar{k}}{m} \geq \bar{v} \geq 2\bar{k} + \bar{l}$.¹⁸ Combining the cases we have the following result:

Proposition 1. *When the exporter can commit to a price agreement but the producer can renege on the debt agreement, export procurement occurs if and only if the exporter's value of the product is sufficiently high relative to the capital and labor cost, and the extent of the competition is sufficiently low: Procurement occurs if and only if $m \leq \frac{(\bar{v} - \bar{k})}{\bar{v}}$ and $\bar{v} \geq 2\bar{k} + \bar{l}$.*

C. Exporter Hires an Agent to Enforce Debt/Sales Contract

We now consider an exporter who hires an employee to execute the contract and ameliorate the debt enforcement/outside sale problem. Unlike the exporter, this employee has the capability to

¹⁷The incentive compatibility constraint is stronger than the individual rationality constraint. Hence, we need work only with the incentive constraint.

¹⁸In principle, we could consider two more constraints for the producer, arising from the following possibilities. First, the producer can contract upfront with another buyer, accepting a capital advance in exchange for a commitment to provide a finished good. This buyer would face the same enforcement problems, and would have to pay a price (say, P^*) high enough to discourage the weaver from consuming the capital or selling elsewhere. If $P^* \leq \max\{\bar{l} + \bar{k}, m\bar{v}\}$, our analysis above would be unchanged. Otherwise, we would have to introduce an additional (binding) constraint, $P \geq P^*$. Second, the producer might take the capital advanced by the buyer and, instead of producing according to his specifications, produce for sale in the spot market, where a price P^{**} is available. Again, if P^{**} is high enough, we will have an additional binding constraint $P \geq P^{**}$. Introducing these two additional constraints will complicate the exposition without changing the basic message of the paper.

monitor the producer and enforce the sales contract. The downside is that this employee now has control over the amount paid to the producer and might not pay the price specified by the exporter. That is, while the contract specifies a price P , the agent might not pay the price. By hiring an employee, the exporter can ameliorate one enforcement problem, but introduces a second. Following the historical case, we call this employee the exporter's "agent."

We model the interaction between the agent and the producer as follows. We posit a reduced form "bargaining" outcome. We suppose the agent is able to procure cloth from the producer at a price $(1 - \beta)m\bar{v}$, where $0 \leq \beta \leq 1$. We call β the "power" of the agent. It summarizes, in reduced form, the agent's ability to prevent the producer from selling to another buyer. When β is low, the agent has little power, and must pay the producer close the spot market price to obtain the cloth. When β is high, the agent has much power, and can obtain the cloth from the producer at much lower than the spot market price. In this case, the agent, for example, has greater ability to monitor the producer and prevent him from selling to another buyer, or the agent has a greater ability to harass and coerce the producer. From any of these mechanisms, the producer's "outside option" from spot market sales has less value. The agent can then pay less for the output.¹⁹

The power of the agent could derive from several sources. The agent could derive his power from public policies that grant him greater rights in enforcing contracts, e.g., by allowing him to enter homes and seize output. Some sources of power would be independent of the exporter and involve the agent's ability to sanction a producer through social connections, dunning, or violence. In the case of the EIC, because it controlled the state, it could substantially affect β by changing the statutory authority of the agent. Other exporters, who do not have state power, could affect β through their influence on public policy or through the choice of more or less powerful agents.

It is also likely, and we consider this scenario below, that the exporter does not precisely

¹⁹We could further specify that the agent can extract some amount of capital/cash from the producer. This would allow the agent to recover not only cloth from the producer, but also capital. We choose not to use this specification, because we do not often see this capability on the part of the agents in the historical accounts. Such a specification would change the producer's and agent's incentive constraints (the producer's individual rationality constraint could be binding, for example). Hiring the agent could also be more valuable to the exporter. The qualitative results of our analysis, concerning the balance between the producer and the agent, would be the same.

know an agent's power and the power could depend on the relationship between an agent and a particular producer. We begin by considering the simplest case when β is exogenous and it is a known constant value. We later turn to the cases where β is random and unknown to the exporter, but the exporter can affect its distribution. In all cases we assume that an agent can earn an amount U in an alternative occupation, and we assume that $\bar{v} - \bar{k} - \bar{l} - U \geq 0$ so that production of the good generates enough surplus to cover production costs as well as the agent's opportunity cost. To compare our results to the previous case, we sometimes set $U = 0$.

Case 1: The Agent's Power is Exogenous and Fixed

The interaction between the exporter, the agent, and the producer proceeds as follows (see Figure 2 below). The exporter announces the terms of procurement contracts with the producer - the capital advance the producer should receive and the price P the producer should be paid. The exporter offers the agent a wage w to execute this contract. If the agent accepts, the exporter gives the agent capital, \bar{k} , in return for a security Q , where $Q > \bar{k}$. The agent then chooses how much capital to advance to the producer. The producer then chooses how much capital and labor to use in production, and thereby chooses whether or not to produce. If the product is made, the agent obtains the cloth, and the producer receives $(1 - \beta)m\bar{v}$. The agent delivers the output to the exporter and receives the amount P , and recovers his security. Notice that the agent, as executor of the contract, receives the contracted price P , out of which he has paid an amount to the producer.²⁰ If the agent did not advance the capital, the agent simply returns the capital to the exporter and recovers his security.

²⁰It is possible that the agent could choose to sell the cloth on the spot market, rather than sell to the exporter. The returns from the sales would have to cover the original capital amount in order for the agent to recover the security. To ensure that the agent sells to him, the exporter must set the price P to at least $m\bar{v}$. The analytics of the problem are just slightly more complicated, as we must consider this additional constraint. The outcome, however, is identical, as the exporter ultimately adjusts the wage to extract rents from the agent (see below). The problem of outside sales by the agent is mentioned by Jones (1918, pg. 38), but is not prominent in the literature.

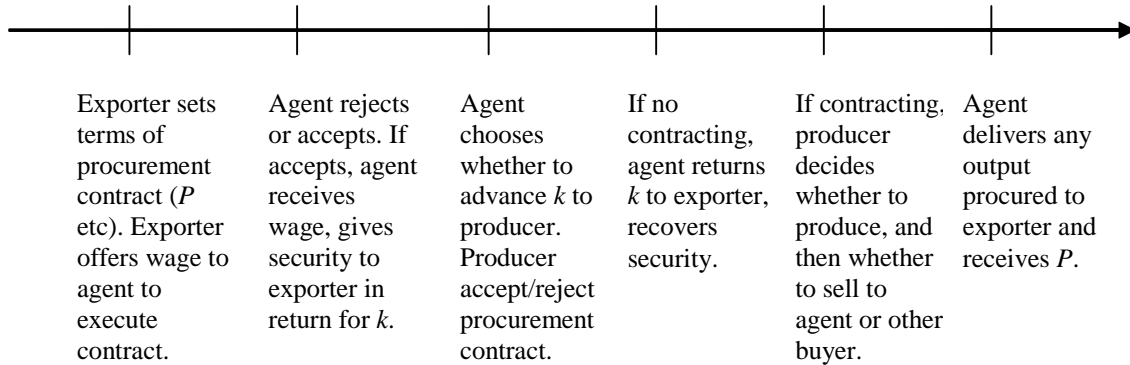


Figure 2. Timing of Interaction between Exporter, Agent, and Producer

We ask whether the exporter can increase procurement and profits by hiring an agent to execute the contract, when the agent has a power level of β . We must consider incentive and individual rationality constraints for the agent, as well as new incentive and individual rationality constraints for the producer. Working backwards, the producer will produce, rather than "eat" the working capital if and only if the revenues he receives exceed the opportunity cost of capital and labor input:

$$(1 - \beta)m\bar{v} \geq \bar{k} + \bar{l}$$

which becomes

$$1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} \geq \beta \tag{1}$$

This incentive constraint is stronger than the producer's individual rationality constraint, hence we will work only with the incentive constraint. The agent will have an incentive to advance the working capital if and only if he anticipates earning more from advancing the capital and procuring the cloth than simply returning the capital to the exporter:

$$P - (1 - \beta)m\bar{v} \geq 0.$$

This constraint becomes

$$\beta \geq 1 - \frac{P}{m\bar{v}} \quad (2)$$

Finally, the agent must earn higher returns from accepting the contract than in an alternative occupation.

$$P - (1 - \beta)m\bar{v} + w \geq U. \quad (3)$$

Let us now consider the exporter's problem. When all constraints are satisfied and procurement occurs, the exporter's profits are

$$\Pi = \bar{v} - \bar{k} - P - w.$$

The exporter will set P and w to maximize profits, subject to (1), (2), and (3). First, the exporter will set the lowest price that satisfies the agent's IC constraint, (2); this price is $P^* = (1 - \beta)m\bar{v}$. Given this price, the exporter will pay the lowest wage that satisfies the agent's IR constraint, which is simply $w^* = U$. The exporter's profits are then

$$\Pi^* = \bar{v} - \bar{k} - (1 - \beta)m\bar{v} - U, \quad (4)$$

and the problem now depends only on the level of the agent's power β . The power must be high enough so that the exporter earns positive profits, $\Pi^* \geq 0$, and low enough so that the remaining constraint, the producer's incentive constraint (1), is satisfied. Setting $\Pi^* = 0$ gives us a lower bound on β , and setting (1) as an equality gives us an upper bound on β . We thus require

$$1 - \frac{\bar{v} - \bar{k} - U}{m\bar{v}} \leq \beta \leq 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}}$$

We can see immediately that $\bar{v} > 2\bar{k} + \bar{l} + U$ is a necessary condition for trade to take place. When $U = 0$, this is the same condition as in the previous case; the value of the product must be sufficiently high so that the exporter earns profits despite that fact that the producer can abscond with the funds.²¹ We also have a second condition, because the producer's returns

²¹That is, for $\bar{v} - 2\bar{k} - \bar{l} - U > 0$, the left-hand side of the inequality is strictly less than the right-hand side, and

are not contractible. We must have $m > \frac{\bar{k} + \bar{l}}{\bar{v}}$; competition must be sufficiently high so that the producer is guaranteed his opportunity cost of capital and labor. Only under these conditions does there exist a range of β , such that $0 < \beta < 1$, in which procurement occurs. Hence, procurement will occur only if there is enough outside competition, the exporter places a high-enough value on the good, and the coercive power of the agent is neither too high nor too low:

Proposition 2. *When the exporter hires an agent to execute contracts and thus cannot guarantee a sales price, if outside competition is too low ($m \leq \frac{\bar{k} + \bar{l}}{\bar{v}}$), the producer is not guaranteed a return on his labor and capital investment, and no transactions take place. When the producer has enough opportunities for outside sales (i.e., $m > \frac{\bar{k} + \bar{l}}{\bar{v}}$) and the exporter places a sufficiently high value on the output ($\bar{v} > 2\bar{k} + \bar{l} + U$), procurement will occur if and only if the coercive power of the agent is neither too high nor too low.*

When will an exporter want to hire an agent? There are two key differences between the cases when the exporter uses an agent and when the exporter contracts directly with the producer: (1) with no agent, the exporter can commit to a sales price, but with the agent, the producer is no longer guaranteed a sales price; (2) with no agent, the exporter cannot prevent the producer from making an outside sale and must pay at least the spot market price to procure cloth, but an agent can make outside sales less valuable to the producer, and hence the exporter ultimately can pay less than the spot market price for cloth. (1) implies that an agent is not useful at low levels of competition, and (2) implies that an agent is useful at high levels of competition. Comparing profits, we see that for $m \leq \frac{\bar{l} + \bar{k}}{\bar{v}}$, an agent would not only harm profits but would shut down procurement altogether. Without a guaranteed price, the producer will not have any incentive to produce. When competition is high, $m \geq \frac{\bar{l} + \bar{k}}{\bar{v}}$, the exporter earns profits $\Pi = \bar{v} - \bar{k} - m\bar{v}$ when it does not employ an agent and earns $\Pi = \bar{v} - \bar{k} - U - (1 - \beta)m\bar{v}$ when it does employ an agent. Hence, the exporter will gain from hiring an agent as long as procurement occurs and $\beta m\bar{v} > U$. The agent has greater ability to enforce contracts and the exporter can benefit from hiring an agent if the agent's opportunity cost is not too high.

there is an open interval of values within (0,1) that satisfy this inequality. Note that, in the previous case (without an agent), we could not both satisfy the producer's incentive constraint and give the exporter positive profits for $\bar{v} < 2\bar{k} + \bar{l}$. Hence, we require \bar{v} sufficiently large to make our problem interesting.

Case 2: The Agent's Power is Uncertain

In a procurement process like that of the EIC in Bengal it is likely that the bargaining terms between the producer and the agent are not constant. For any contract it may depend on, for instance, the availability of peons (enforcers) and their capacity to coerce the weaver, the agent's ability to detect and prevent an outside sale, as well as the Company's ability to monitor the weaver-agent interaction. Thus, we can conceive of the agent's power as being a random variable $\tilde{\beta}$ which is the sum of a mean value B (which lies between 0 and 1) and a shock $\tilde{\mu}$, with mean zero and standard deviation σ . For simplicity, we assume $\tilde{\mu}$ has a uniform distribution. We assume that if the realization of $\tilde{\beta}$ is greater than one, the agent can pay the producer nothing and obtain the good. If the realization is less than zero, we assume the agent must pay the full spot market price to obtain the good. And for intermediate values, the agent pays a proportion $(1 - \tilde{\beta})$ of the spot market price.²²

When is the shock realized and who knows its value? We make here three modeling choices. First, we assume that agent and producer observe μ , but the exporter does not. It is realistic to think that the agent and the producer are much better informed than the exporter about the "facts on the ground" that affect their bargaining. Second, we assume that the shock is realized after the exporter has contracted with the agent, but before the agent has advanced the capital to the producer. The shock could be realized at other points in the agent-producer interaction: before the exporter contracts with the agent, or after the agent and weaver contract but before production takes place, or after production. In reality, there are probably many shocks, realized at different points in time. In any case, the timing is not critical to our results.²³ Third, we assume that the distribution of $\tilde{\beta}$ is known to all parties. It is conceivable that a foreign company without extensive local knowledge would not even know the distribution of $\tilde{\beta}$. We abstract from this consideration here, though we do discuss it when we return to the historical account. In

²²Note that, because we have restricted B to be between 0 and 1, for $B \geq 1/2$, as B gets larger, the exporter is both more certain about the amount the agent can extract, and the agent can extract more. For $B \leq 1/2$, as B gets smaller, the exporter is more certain about the amount the agent can extract, and the agent can extract less.

²³In our model, with risk neutral agents, the exporter need not be concerned with the variance of the shock if the shock occurs after production takes place. The agent and producer would then only be facing the expectation of the agent's power. But we would simply recover all our results by supposing, as is likely, that the producer is risk-averse. This specification would just complicate the analysis slightly. Procurement would be even more difficult than our current analysis suggests.

our representation, the variance of the distribution represents the extent of the exporter's lack of control over the agent's power.

The interaction between the exporter, the agent, and the producer proceeds as follows. The exporter announces the terms of procurement contracts with the producer - the capital advance the producer should receive and the price P the producer should be paid. The exporter offers the agent a wage w to execute this contract. If the agent accepts, the exporter gives the agent capital, \bar{k} , in return for a security Q , where $Q > \bar{k}$. The producer and the agent learn μ . The agent then chooses how much capital to advance to the producer. The producer accepts or rejects the contract, then chooses how much capital and labor to use in production, and thereby chooses whether or not to produce.

The analysis of this scenario is similar to the case without uncertainty - except that now when the exporter sets the contract terms, there is uncertainty as whether or not the two incentive compatibility constraints will be satisfied - this will depend on the value of μ . The realization of the shock cannot be too high or too low in order for both the producer's and the agent's incentive constraints to be satisfied. Combining the incentive constraints (1) and (2), procurement will occur only if μ falls between two bounds:

$$1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B \geq \mu \geq 1 - \frac{P}{m\bar{v}} - B.$$

For notational simplicity we call the lower bound $A \equiv 1 - \frac{P}{m\bar{v}} - B$ and the upper bound $D \equiv 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B$. We define $\varphi(P, B, \sigma) \equiv \frac{\min\{D, \sigma\} - \max\{A, -\sigma\}}{2\sigma}$ as the probability that the shock falls within the bounds and hence both incentive constraints are satisfied given P, B , and σ . In this case, the agent advances capital. Otherwise the agent does not advance the capital and returns it to the exporter. We call $\varphi(P, B, \sigma)$ the "probability of procurement." The exporter's expected profits are then

$$E\Pi = [\bar{v} - P - \bar{k}] \cdot \varphi(P, B, \sigma) - w \tag{III.1}$$

The agent's expected returns must also exceed his opportunity cost:

$$\int_A^D [P - (1 - \min\{1, \max\{B + \mu, 0\}\})m\bar{v}] f(\mu)d\mu + w \geq U \quad (6)$$

With the agent's and the producer's incentive constraints incorporated in $\varphi(P, B, \sigma)$, the exporter's problem is to maximize expected profits, $(??)$, subject to the agent's individual rationality constraint (6).

In the most basic case, the exporter chooses P and w , taking as given the underlying distribution of the agent's power (that is, taking as given B and σ). Following the historical record, we will consider the case where the exporter pays a strictly positive wage to the agent (implying that (6) is binding).²⁴ In this case, the agent is always earning exactly his opportunity cost U . The exporter can raise the price to increase the probability of procurement and then adjust the wage to keep the agent at his reservation value.²⁵ Since the price only affects the agent's incentives, the exporter will set $P' \equiv m\bar{v}[1 - B + \sigma]$, which just satisfies the agent's incentive constraint for the lowest realization of μ . No matter what the value of μ , the agent will have the incentive to advance the capital.

With this result, we can see how the price P responds to the level of uncertainty. For higher σ , the exporter must pay a higher price. Greater variance implies that the agent is more likely to have less power to extract rents from the producer. Hence, the exporter must pay a higher price to the agent for retrieving the cloth in order to induce the agent to advance capital to the producer.

Proposition 3. *When U is high enough so that the exporter pays the agent a positive wage ($w > 0$) and the exporter takes the agent's power as given, the exporter will set a price high enough so that the agent always has an incentive to advance capital to the producer. The greater*

²⁴The constraint must bind, else the exporter can lower the wage and increase its profits.

²⁵We can see from the equation that, in this case where $w > 0$ and hence the agent's IR is binding, the exporter's profits now depend on P only through the probability of procurement. We can also argue this point directly: We show that when $w > 0$, the exporter is setting P such that the agent's incentive constraint is always satisfied. We have just argued that when $w > 0$, (6) is binding. Now suppose that P is such that the agent's incentive constraint is not always satisfied. Consider the exporter setting $w = 0$ and raising the price. There is a higher price that will keep the agent exactly at utility level U , and a higher price strictly increases procurement probability.

the uncertainty in the agent's power, the greater the price.

In a more complex case, as we see in colonial India, the exporter could affect the distribution of the agent's power. We suppose now that the exporter can choose both the price P and B , the agent's average level of power. The exporter now can adjust two instruments. We ask how the exporter would adjust B according to different levels of σ . The EIC in Bengal experimented with different statutes, some that increased the agent's power, and some that decreased the agent's power. Our analysis yields this outcome and indicates that the optimal average level of power will depend on the level of uncertainty.

We show that the exporter will choose a lower level of B when there is greater uncertainty. By choosing a lower B , the exporter reduces the likelihood that the agent can exploit his position and extract excessive rents from the producer. The exporter's profits are maximized by choosing the highest level of B at which the producer's incentive constraint is always satisfied: $B = 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$. If B is any higher, profits fall because procurement probability falls. If B is any lower, profits fall because the producer earns more of the surplus with no increase in procurement probability, because the exporter is also adjusting the price P .

Hence, we have a straightforward relationship between the optimal mean level of coercive power B and the level of uncertainty. When uncertainty is high, the exporter will choose a low B . It needs to protect the producer from large positive shocks to the agent's power. When uncertainty is low, the exporter can choose a higher B . The exporter sets $B^* = 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$. Solving for the corresponding optimal price and wage, we have $P^* = \bar{k} + \bar{l} + 2\sigma m\bar{v}$ and $w^* = U - \sigma m\bar{v}$, and the exporter's expected profits are:

$$E\Pi^* = \bar{v} - U - \bar{k} - \bar{l} - (\bar{k} + \sigma m\bar{v})$$

That is, expected profits are the value of the good minus the cost of production (including the agent's services) and the producer's rents. The producer's rents consist of \bar{k} , the additional payment necessary to induce him to produce the good rather than consume the capital, and $\sigma m\bar{v}$, which is due to the exporter's uncertainty over the agent's power. We record these results in the following proposition:

Proposition 4. *When U is high enough so that the exporter pays the agent a positive wage ($w > 0$) and the exporter can affect the agent's power, the exporter will choose the highest B at which the producer's incentive constraint is always satisfied, $B^* = 1 - \frac{\bar{k} + \bar{l}}{mv} - \sigma$. The exporter sets the lowest price at which the agent's incentive constraint is always satisfied and adjusts the agent's wage accordingly to give the agent exactly his opportunity cost. Hence, when uncertainty is higher, the exporter reduces the average level of an agent's power.*

How does uncertainty itself affect profits? Would the exporter be willing to make investments to reduce the level of uncertainty? This is clearly the case. When the exporter can adjust the level of B according to σ , it would always benefit from lower levels of uncertainty. We can see this in the case $w > 0$ which we analyzed above. The exporter's expected profits rise as σ falls. When $\sigma = 0$, there is never slack in the producer's incentive constraint, and his rents are reduced to \bar{k} . While we have focused above on the case when U is high and the wage is positive, we show in the appendix that in general the exporter's profits are decreasing in σ . We summarize in the following proposition.

Proposition 5. *When the exporter can adjust the expected level of the agent's power, B , a decrease in the uncertainty of the agent's power, σ , leads to an increase in profits.*

IV. The Evolution of the EIC's Textile Procurement Policy

Here we return to the East India Company in Bengal and relate its experience to our model. As suggested by our model, the Company used an agent to address problems of debt recovery and outside sales – we will document this at some length below. But there were also other reasons why an intermediary was required. The EIC in Bengal was a "young" regime: a small group of Englishmen were governing a large, newly acquired area; they usually did not know the local language; and crime and banditry were rampant. The Company was dependent on its agents' local knowledge.²⁶ Given these conditions, as one might expect, the EIC was unable to monitor

²⁶The reliance on intermediaries can be seen in other areas also. The EIC authorized a small number of *zamindars* to collect land taxes. The Company did not even attempt to regulate the amount they collected; *zamindars* were made residual claimants – they owed the Company a fixed sum and could pocket any surplus.

these agents well. The price paid by an agent was then determined by his bargaining with the weaver. The nature and outcome of this bargaining would (i) be variable for a given agent-weaver pair, and (ii) be different across agent-weaver pairs. For instance, if the EIC allowed agents to post peons outside the weavers' houses, the impact on a particular agent-weaver interaction might depend on the distance from the *arang* to the weaver's home, the number of peons at the disposal of the agent, the extent of their diligence, and the proximity of other potential buyers. In terms of our model (i) corresponds to $\sigma > 0$, possibly high and (ii) is a situation in which the distribution of $\tilde{\mu}$ itself varies across agent-weaver pairs. The Company could not have been well-informed about the behavior(s) of $\tilde{\mu}$. Procurement would be difficult in such an environment: any level of coercion (B) allowed might be too harsh or too lenient for some subset of weavers. It is not surprising that procurement often failed, and that the EIC struggled to find the right policy.

After 1757, and especially after 1765, as the Company gained political control, its agents were given much power to enforce debt and sales contracts. We see that the agents were able to extract returns from producers. Jones (1918, p. 38) reports that the *gumastha* and his valuer would combine to offer the weaver a low price when he brought the cloth to the Company warehouse. If, in an effort to avoid this, he tried to sell elsewhere, "the Company's authority was employed, peons were set over him to watch the progress of the work and prevent such a sale, and the gomastah would even cut the piece out of the loom when it approached completion, and carry it off to the 'khattah' or warehouse." After the famine of 1770 the price of yarn rose by 25%, and the EIC raised its rates. However, the weavers of Santipore complained that they were getting the same price as before, because the *gumasthas* were undervaluing their products thereby appropriating the price increase. (Mitra 1978, p. 64). Such complaints were widespread. The consequence was lower procurement, and in 1769 Governor Verelst voiced concern:

Plenty has succeeded to famine and security has induced the natives to apply themselves again to labour and commerce, but the manufacturers are scarcely increased, the aurungs are not so well-peopled as they were twenty years before.^{27,28}

²⁷See Mitra (1978), p. 52.

²⁸The Court of Directors in turn communicated its unhappiness to the EIC's management in Fort William, in 1771, comparing the "once flourishing state of commerce with its present gradual decline." As Marshall (1976, p.

His explanation for this outcome exactly follows the lines of our model. In trying to solve the problem of enforcement, the Company had given too much power to the agent (Verelst 1772, p. 85):

[I]t was thought expedient by the governor and council . . .to make. . . advances to such manufacturers as would otherwise have lain idle. Contracts thus in part executed on one side, afforded a temptation to fraud on the other; and the workman, unless strictly watched, often resold his goods for their full price to a stranger. The gomastas or agents of the Company were necessarily therefore entrusted with powers which they frequently abused to their own emolument; and an authority given to enforce a just performance of engagements became notwithstanding the vigilance of the higher servants, a source of new oppression.

The scenario described above is consistent with the case where realizations of the agent's power are high: The agent can extract much surplus from the producer, and the agent's incentive constraint is always satisfied. But for the same reason, for many producers, their incentive constraint is often violated, and procurement often does not occur.

To rectify the situation, the Company considered two alternatives: reining in the power of the agent (in the language of our model, reducing B) and switching to the Contract System. In a 1773 act guaranteeing "freedom of trade" the Company announced its intention to sign contracts with "native merchants" (but see below). It also restricted the agent's powers.²⁹ Regulation IV of this "freedom of trade" act stated (Sinha 1965, p. 170):

Whoever shall attempt, directly or indirectly, to force advances upon the weavers or make them enter into engagements against their will or in any way exercise an undue influence on them, shall be immediately suspended from the Company's service.

This "freedom of trade" was reinforced by a legal notice in 1775 warning *gumasthas* and their agents that weavers' freedom to deal with other buyers should not be restricted and that they

156) has pointed out, one might worry that such generalizations, applied to Bengal's large and complex economy, were much too broad. However, the narrower claim, that the gumasthas were abusing their powers, thereby hurting procurement, is not in dispute.

²⁹This was also in part due to pressure from the Dutch and French companies.

would be punished for violations (Hossain 1988, p. 112). In terms of our model, these regulations reduced B and hence would lower the probability of high realizations of the agent's power. The producer's constraint is then violated less frequently, but the agent's incentive constraint is more frequently violated.

And indeed now it was the agents' turn to complain that weavers were not delivering cloth after having taken advances (Wright 1961, p. 203; Mitra 1978, p. 55; Hossain 1988, p.113). In response to these complaints, yet another set of regulations was introduced in 1775, with the aim of increasing the agents' power. The agents were authorized to post a peon at a defaulting weaver's house to compel him to work. Weavers who secretly sold to other merchants while they were still in arrears to the EIC could be taken to court and punished (Mitra 1978, p. 56).

The EIC's next step was to gradually make a transition to the Contract System between 1775 and 1788, before returning to the Agency System (Sinha 1965, p. 151; Mitra 1978, p. 134). Under the Contract System the Company would not deal directly with weavers. It would engage contractors, who would receive advances and would commit to provide textiles for quality-contingent prices. The contractor would, in turn, advance capital to the weaver via his own employees, take delivery of the cloth after production, pay the weaver, and convey the cloth to the EIC for the agreed-upon price. The Contract System can be understood in the framework of our model. The intermediary receives a zero wage ($w = 0$) and receives a high price (P) to meet the incentive compatibility and individual rationality constraints. Under the Agency System, the intermediary receives a salary ($w > 0$). Thus the essential difference between the Agency System and the Contract System is a difference in remuneration for the intermediary. This difference will not, by itself, have any impact on the producer's incentives, which depend on the intermediary's coercive power, B . If B is the same, the producer's incentive constraint will continue to be violated with the same probability, and procurement problems will remain. This is what happened, for reasons we explain below.

The Contract System involved another set of agency issues. There was "corruption" in the allocation of contracts. The EIC, as a company, was not able to effectively oversee the local allocation of contracts. The local Commercial Residents had shared in the gumastha's illegal profits under the Agency System and would not easily let go of them. Contracts were then given

to Commercial Residents themselves or to merchants in cahoots with them.³⁰ The contractors, then, acted in virtually the same manner as the company's agents, with the backing of the local company: "[They] regarded themselves as the Company's representatives and the Company also let them freely use the power of coercion in the Company's name (Sinha 1965, pg. 163)." So *B* remained high, and procurement problems persisted. For instance, in 1780 the contractor of Sonargang increased the number of quality gradations to twenty-four (!) thereby creating "so many openings to defraud the weavers" (Sinha (p. 174)) Sinha concludes (p. 22) that the two systems ultimately worked - or did not work - in exactly the same way: "Agency or Contract did not matter much as far as Indians were concerned."³¹

This history tells us that contractual problems do not rest only between intermediaries and producers. The exporter itself may not be able to enforce its own policies and prices. We will return to this issue in our discussions below of the EIC's opium monopoly and present-day contract farming.

In Bengal, throughout the late 18th Century, further regulations were passed to give intermediaries greater coercive power. In 1782, a rule allowed punishment of buyers who had knowingly purchased cloth produced under an EIC contract.³² In 1786, this rule was reiterated, and the weaver was warned that if he was in default to Company he should not sell to other merchants "by himself, any of his family, journeymen or by any agent."³³ Regulations passed in 1787 and 1789 defined punishments and fines for weavers failing to meet delivery schedules. With this backing, the EIC's representatives - either the official agents or the merchants - continued to siphon off rents. The weavers protested. In 1787 weavers of Narainpur and Savar complained of fraud, and

³⁰Traditionally the Company had allowed its British employees to engage in private trade, but only within Asia, not between Europe and Asia (Hejeebu 2005; Cases-Arce and Hejeebu 2002). In the case discussed in the text the Company was contracting with its employees to obtain goods for its own trade with Europe.

³¹Wright (1961, p. 204) quotes an official from Patna who, in 1777, complained about both weavers and contractors: "I do not mean by this representation of the conduct of the weaver to insinuate that there are no faults on the side of the contractor. Far from it, for I ever had the idea that in all the business in this country where it is necessary to employ intermediate agents there must be some misdemeanours and which, whilst matters remain on their present footing, it will be out of the power of the most strenuous exertions entirely to prevent."

³²The Regulation of April 1782 announced that "the purchasers of the said cloths, apparently knowing them to be the property of the Company, by the secret and clandestine way manner which they take to procure them or by the notoriety of the weavers being in the Company's employ who offers to dispose of them, on proof of the fact, shall be liable to punishment by the Adaulat [court] according to the nature of their offence and the cloths so purchased shall be confiscated." (Mitra 1978, Appendix IA, p. 222)

³³Regulation XII, Mitra (1978, p. 223)

weavers of Sonargaon, Titabadi, and Bajitpur objected to a "strong and artful combination of gomostahs, the inferior arang servants and the principle [sic] weavers of every district" (Hossain 1988, p. 169). In 1794 the weavers of Dacca protested in a petition that the Commercial Resident had colluded with the appraisers and the *gumasthas* to undervalue their cloth: "Cloths of 2100 threads were taken as 2000 threads letter C and D..." (Mitra 1978, p. 81).

In their turn, *gumasthas* and officials continued to protest that weavers were defrauding the EIC: weavers used the Company's advances to buy low quality threads and produce cloth for sale to other buyers. One method of concealment was to weave the cloth in another home and sell through another weaver who had not contracted with the Company. When weavers did deliver to the Company, it was said to be often of lowest "letter" and of little value to the EIC.³⁴³⁵

Thus, the contractual problems continued to the very end. It is conceivable that, over time, as the EIC's administrative capacity improved, it would have streamlined the textile procurement process. But we will never know. In the early 1800's, cloth manufactured in England eliminated the EIC's Bengali cotton textile trade. To see a "mature" EIC in operation we will have to study its Opium Monopoly, which we do in Section VI.

V. Alternative Institutional Arrangements and Policies

If the Agency System had so many problems, why did the EIC persist with it in its textile operations? Could other institutional arrangements have worked better? This section discusses this issue. In theory, at least three alternatives were available to the EIC. First, production could have been organized in a vertically integrated firm, where the exporter (EIC) owned the fixed capital (the loom), bought the inputs (yarn), and hired the producer (weaver) as an employee. Second, the EIC could have contracted with merchants, as it did prior to 1753, rather than contract with the weavers through its employees. Third, repeated interaction between the EIC's agents and the weavers could have allowed them to overcome the enforcement problems and achieve a higher volume of trade. We have already discussed the option of contracting with

³⁴Mitra (1978, p. 66) drawing on the Programs of the Board of Trade, 15th July, 1783.

³⁵In 1786 the Resident of Malda complained of "the unfair practice of selling clandestinely to individuals cloths manufactured for the Company." (Hossain 1988, p. 118).

merchants in the previous section. Below we consider the other two possibilities.

Vertical integration would have been difficult for several reasons. The weavers were typically part-time agriculturists and were scattered over a huge area.³⁶ It would have been quite a challenge for the EIC to have weavers leave their homes and farms to work in a centralized location. In addition, a vertically integrated structure would have involved a different set of agency problems. Weavers and supervisors would all have to be monitored or given incentive contracts in order to perform their work well.³⁷ In the decentralized production system, the weavers were residual claimants. It is possible that a decentralized system, with its faults, ultimately provides better incentives than a vertically integrated system.

Why did not repeated interaction between the EIC's agents and the producers result in consistent high volume trade? The possibility of successful "relational contracting" that relies on repeated interaction to enforce contracts is now standard stock in the industrial organization and development literatures. A possible explanation for why such cooperation did not emerge in our setting is that Bengal in our period was a society in flux. Weavers and agents may have not been certain how long their relationships would continue. Bengal's economy was experiencing "shocks" of various kinds: a major political transition; a massive famine in 1770 which is reported to have killed as much as a third of the population; frequent changes of EIC personnel;³⁸ numerous policy changes, which we have documented; and law and order problems.³⁹ In such an environment it may have been rational for all parties to seek to maximize short-term profits. It is also important to remember that the Folk Theorem of repeated games shows that, even when agents are sufficiently patient, any outcome is possible. A cooperative equilibrium where agents fulfill contract terms is as likely as a non-cooperative equilibrium where agents act opportunistically and take advantage of their positions of power.

³⁶ K.N. Chaudhuri (1978 p. 241) writes: "There were few villages and towns in Coromandel and Bengal, as Orme aptly observed, where at least a few families of weavers could not be found." He attributes this regional dispersion in Bengal (as compared to say, Western India) to the availability of easy transport via inland waterways.

³⁷ Mitra (1978, p. 41) reports that the weavers in the royal workshops were under "incessant inspection."

³⁸ Life expectancy among the EIC's civil servants was not high. Marshall (1976, p. 219) reports that 59% of those entering in the period 1756 to 1766 died in India, compared to "only" 44% entering in the period 1767-1775. Hejeebu (2005) reports that the median length of service was 9 years. Death was the reason for 75% of departures in the first five years and 66% of departures in the second five years.

³⁹ The Company had taken away police authority from the zamindars (landlords) and its own force was ineffective well into the early nineteenth century. Crime and 'dacoity' (banditry) were rampant. See Marshall (1987, p. 130).

The problem of outside sales could have been ameliorated by cooperation among exporters. The EIC and its rivals could have divided the markets geographically and promised not to poach each other's weavers. Indeed, the Dutch Company did suggest this. The EIC did not agree – after gaining political hegemony it was looking to dominate the market, not share it. The weavers could have decided to collectively boycott the EIC if it cheated one of them. It is possible that geographic dispersion obstructed such cooperation. More likely, as Hossain (1988, p. 177) argues, weavers feared prosecution and litigation by the EIC and persecution by social superiors who were in cahoots with the arang hierarchy. We will discuss the possibility of cooperation among exporters and among producers further in the Conclusion.

VI. Other Examples

In this section we apply the analysis to three more cases: the EIC's Opium Monopoly in colonial Bengal, the putting-out system in England before the Industrial Revolution, and contract farming in today's developing world. In each case we see our model's emphasis on the balance between enforcing a debt/sales contract and controlling the actions of the procurement agent.

A. The Opium Monopoly in Colonial Bengal

Readers familiar with the literature on 19th century India might recall another of the East India Company's ventures: its famous Opium Monopoly. The EIC established a monopoly on the production and sale of opium in eastern India in 1797. It used an Agency System similar to that in textile procurement. Via agents, the Company gave capital advances to peasants who were required to grow poppy on a specified area, harvest poppy juice and prepare raw opium, and deliver the output to the agent for final payments, minus the advance and deductions for defects in quality. Huge amounts of opium were thus procured, most of which was auctioned in Calcutta to private traders, who sold it in China. The EIC and, after 1858, the Crown, earned enormous profits, which constituted as much as 17% of governmental revenues in 1858-59. Opium was a highly lucrative commodity; the EIC's sale price could sometimes be as much as 10 times its cost. On various occasions the Company was, like a textbook monopolist, able to adjust the quantity

procured, depending on the level of demand, all the while maintaining the high quality for which its opium was famous.⁴⁰ The Opium Agency remained in place for more than a century, until 1913. Why was it so successful?

The Opium Agency was vulnerable to the same contractual enforcement problems as the EIC's textile ventures. Especially in the early part of the 19th century there were many complaints about contractual violations by peasants and agents. In 1832 the Deputy Opium Agent of Futtehpore wrote to the Board of Customs, Salt, and Opium: "It appears to me that two principal circumstances form the chief obstacles to an extensive poppy cultivation in this district, viz., the inadequate price the cultivators receive for their opium and the oppression to which they are subjected from the gomastahs." Chowdhury (1964, p. 55) reports on the findings of a government report published in 1820 which showed that "the peasants got hardly anything from poppy, almost the whole amount having been misappropriated by the zillahdars [intermediaries]." He also (p. 28) quotes the head of the Opium Agency in Bihar who claimed, in 1817, that "more than half of those who take advances receive them with a view of smuggling a certain portion of the produce." There was also the problem of adulteration of opium with sugar, poppy rubbish, earth, or flour (Von Trocki 1999, p. 62).

Then how was the EIC able to meet higher and higher procurement targets? In part by simply offering higher prices, and extending opium cultivation to newer areas. But we speculate that two other factors also played a role. The first is that, with the passage of time, there was marked improvement in the quality of the EIC's administrative apparatus. This improved quality would reduce σ , allowing the EIC greater certainty over its agents' power. As we have argued earlier, in the late 18th century, when the textile agency was in place, British rule in Bengal was of recent vintage, and the EIC had limited control over its own bureaucracy and local management. Over time, as British rule in India was consolidated, the bureaucracy improved. Indeed, in the Crown period British officialdom earned a reputation for honesty, and was considered the "steel frame" of British rule in India. This likely had an impact on its Indian agents as well. One

⁴⁰In 1831, facing competition from opium produced in the western Indian region of Malwa, the EIC decided to flood the market. Within five years it had tripled the output, compared to the previous decade. In the early 1850's when prices were beginning to fall, it maintained revenues by reducing production from 50,000 chests to 21,000 chests. (Owen 1934, p.108, 183).

indication of this is that in the Opium Agency the Company did not demand a security from the agent.

It also appears to be the case that, precisely because opium was so lucrative, the Company invested in creating systems of authority and supervision. There were two main Opium Agencies, one in Patna and the other in Benares. Each was managed by a member of the civil service and had numerous sub-agencies (15 for Benares and 11 for Patna), which were also manned by British officials (the Sub-Deputy Opium Agent and his assistant). Each sub-agency was in turn linked to 3-4 *kothis* or sub-divisional offices, which were handled by an Indian officer titled *gumastha*, or agent. The *gumastha* had a support staff of twenty-five clerks, soldiers, and “opium patrol officers.” The *gumastha* dealt with a village intermediary, often the village headman. At the start of the Opium Year (September 1), the *gumastha* and the Sub-Deputy Opium Agent negotiated with the village intermediary who drew up a list of peasants who would grow opium. A license was issued in the name of each peasant. When the intermediary returned with the signed acceptance by the peasant (occasionally the peasant might come in person) an interest free-advance was given, usually in 2-4 installments. Around April the intermediary notified the peasant to appear at the *kothi* where the opium was weighed, graded, and examined for adulteration, in the presence of the British Assistant Sub-Deputy or another officer (Richards 1981, p. 86). By the 1860’s chemical tests were being used for adulteration, which would have further reduced the agent’s discretion (Von Trocki 1999, p. 98).

Another feature of the Opium Agency has also been widely commented on by historians: the high price of opium did not translate into substantial gains for the peasants. Indeed, even the most favorable assessment of the allocation of gains from the opium trade (Richards 1981, p.79) is that peasants’ incomes were stabilized, rather than increased. Thus, it appears that the EIC, because it could better regulate the coercive power of its employees, was able to procure consistently, even as it extracted a lion’s share of the economic surplus. This scenario approximates σ low and B high in our model.

B. The Putting-Out System in 17th and 18th Century England

We have argued that successful procurement requires a balance between checking the opportunism of agents and producers. The EIC tried through its statutes to achieve such a balance. But suppose an arrangement like the Agency System was used by buyers who did not have state power; what outcomes would we expect? The level of coercion available to buyer/agent could be low, hence the problem of opportunistic behavior by producers would be more severe. This would then create an incentive for buyers to cooperate to enhance their coercive power.

We see both these outcomes in the history of the "Putting-out System," an arrangement quite like the Agency System, that was widespread in Europe, especially in England, prior to the Industrial Revolution. The reader will recall, of course, that after the Industrial Revolution, the factory system began to spread. Our focus is on the putting-out system in 17th and 18th century England.

Like the Agency System, the Putting-out System was particularly prevalent for products that were sold in distant markets, required significant working capital, and had a long gestation period (Supple 1977; Kellenbenz 1977). The main difference between the two systems was that in the putting-out system the advance consisted of inputs rather than cash. The other features were the same: the producers worked in their homes that were scattered across the countryside, often at considerable distance from the buyers; the advance was made via an agent; the final product was received and evaluated by the agent who paid the producer. The literature on putting-out does discuss hold-up by the agent; deductions ("abatements") could be made for quality defects, which led to abuses. Far more prominent was a problem that is held to have contributed to the demise of the putting-out system: the "burning question of embezzlement of material" (Heaton 1920, p. 352). In the manufacture of woollen, cotton, linen and various other products, "filching of material was widespread" (Ashton 1948, p. 54). This occurred to such an extent that by the end of the 18th century there was a substantial secondary market in stolen inputs; "the traffic in embezzled materials became a trade" (Wadsworth and Mann 1931, p. 399). Also, unlike the EIC, which took security from its agents (for textile procurement), English merchants also faced a substantial problem of embezzlement by their agents.

A natural response from merchants was to seek legal remedies. An act passed in 1610 allowed public whipping and imprisonment of embezzlers. A 1703 law required a fine of twice the damages or public whipping and fourteen days of imprisonment. An act passed in 1745 treated a receiver of stolen material as equivalent to an embezzler. Punishments for workers were further increased in 1749 to "immediate imprisonment with hard labour and a public whipping" (Wadsworth and Mann 1931, p. 396). However, implementation of these laws was weak and by the second half of the 19th century, merchants began to form associations with the explicit purpose of curbing embezzlement. The most prominent example of this was the "Worsted Committees." The Worsted Acts (1777) authorized the merchants to form committees that would oversee an arrangement that was a mix of state and private enforcement. Merchants were given the power to enter and search producers' homes. The committees also hired inspectors who were appointed and supervised by Justices of Peace. After obtaining a warrant, the inspector could search any location that he suspected contained stolen goods; the accused was presumed guilty if he could not provide adequate accounting. Despite some reluctance by magistrates to enforce these laws, the problem of embezzlement was significantly curtailed (Heaton 1920, p.430).

The success of the Worsted Committees however seems to have been exceptional. Some similar associations were formed in other industries. For instance, Wadsworth and Mann (1931, p. 398) report that in 1772 a group of manufacturers in Manchester proclaimed their objective to be "the Detection and Prosecution of Felons and Receivers of stolen or embezzled goods" and published advertisements offering rewards for informers. But, by and large, the various laws were weakly enforced. Historians offer different explanations for this. Some have suggested that merchants were reluctant to prosecute, fearing the collective wrath of their producers (Wadsworth and Mann 1931, p. 396). Heaton (1920, p. 428) argues that class resentments of a different sort played a role even in the relatively successful worsted industry; describing the leniency of magistrates he suggests that "they objected to being taught their duty by an upstart industrial organization." Landes (1998, p. 208) invokes England's liberal traditions to explain the reluctance to allow merchants and their agents to enter and search the homes of suspected embezzlers without warrants: "An Englishman's home was his castle, sacred." With the difficulties in ensuring that producers honored contracts, a few merchants tried to vertically integrate the production.

However, as argued earlier, factories bring their own set of incentive problems and infrastructure costs. Vertical integration became common in some industries after the innovation of powered machinery led to economies of scale in production.⁴¹

C. A Present-Day Example: Contract Farming

Agency systems and similar contractual arrangements are found in many parts of today's developing world. Multinationals and parastatals often use such contracting to procure agricultural commodities for export, such as coffee, cotton, and fruit. Credit or inputs are advanced to the grower, and repayment is deducted from the quality-contingent final price. The buyer might also provide technical assistance. In some instances, concerns about nationalization and union activity have contributed to the preference for such "contract farming" schemes, as opposed to plantation farming.

In contract farming, the enforcement problems we have modeled are widespread: producers default on advances often by engaging in outside sales, and buyers renege on price commitments often by manipulating quality criteria. We argue below that a variant, indeed a simplification, of our model captures the essence of the enforcement problems in contract farming.

An important distinction between the EIC and today's buyers is that the latter do not control state power. The multinationals are, of course, private entities, but even the parastatals are unable to exercise coercive power along the lines of the EIC. In our framework this can be seen as the agent having low B . The allocation of surplus and the likelihood of efficient trade will depend on the parameter m , which captures the extent of market competition. On the one hand, when m is high, the producers will be tempted by outside sale opportunities, and the buyer who initially advanced the capital will incur losses. On the other hand, when m is low the buyer will be able to pay a very low price, discouraging the grower from producing.⁴²

⁴¹With power-driven machinery, a single power source could be used to run equipment used by many workers. This new technology was central to the emergence of the factory system in the British cotton textile industry. Factories first spread in spinning and slightly later in weaving. In 1782 there were only two cotton mills in Manchester; there were 52 in 1802. In 1813 there were 2,400 power looms in Britain; the number grew to 100,000 by 1833. (Ashton 1949, 74, 109; Landes 1998, 209).

⁴²In his analysis of contract farming in Thailand Siamwalla (1978) provides an intuition similar to ours, using the term "shifting costs:" when costs are low, markets are competitive and buyers will be reluctant to advance capital; when costs are high, markets are monopsonistic and buyers will capture most of the surplus.

A good example of the enforcement problems in competitive environments (high m) is Jaffee's (1994) account of the travails of Kenya Horticultural Exports (KHE), which exported fresh produce in the 1980's. KHE's contract farming scheme "fell apart" in 1985: prices increased because of a drought and farmers sold their crops to other exporters at higher prices. The KHE was unable to recover many input loans. Attempts to rescue the scheme were unsuccessful, as more than a dozen exporters were operating in the area, ready to poach on KHE's efforts. Jaffee (p. 125) reports that eventually "the lesson learned by KHE managers from this experience is that in the competitive trading environment that characterizes Kenya's fresh produce trade, contract farming arrangements are not sustainable." In a similar vein, Brambila and Porto (2005) report that in Zambia, after agricultural liberalization in the 1990's, contract farming in cotton faced increasing problems of default following entry by new firms.

On the other hand, lack of competition (low m) allows buyers to behave opportunistically. Hightower (1975, p. 17) reports that Del Monte paid American asparagus growers almost nothing (0.0005 cents per pound) for rejected produce. The company alone had the right to decide what was sub-standard. With no alternative, farmers had to accept these prices. Clapp (1994, p. 94) describes a case in Guatemala when, faced with a surplus of production, ALCOSA, a subsidiary of Birdseye, exploited an escape clause which the illiterate farmers were unaware of, and unilaterally suspended purchase in a village named Chimachoy. Two-thirds of the farmers found no other buyer and one-third did not even bother to harvest the crop.

VII. Conclusion

The message of this paper thus far may seem excessively bleak to some readers. We have argued that successful procurement requires a balance between the abilities of the merchant/agent and producer to hold up each other. In only one case we study, the Opium Monopoly, is this delicate balanced achieved. However, one might wonder, given the ubiquity of arrangements like the Agency System and putting-out, surely there must be more instances where opportunistic behavior is checked. Therefore, we conclude this paper with a discussion of two examples, each of which illustrates a class of solutions to the problems we have highlighted.

One approach to discouraging opportunism is for the two contracting parties to be from the same social group, within which there are institutions for dispute resolution, mechanisms for social sanction, and a strong shared sense of identity. Tirthankar Roy's (1997) description of the Sourashtras in the South Indian town of Madurai is one example. The Sourashtras are a successful and close-knit migrant community, quite aware of their distinct origins. Their traditional occupation is the production and sale of textiles, and the community includes both weavers and merchants. There is a norm of transacting within-group: most Sourashtra weaver families work in "stable putting-out contracts with Sourashtra merchants" (p. 44). In Roy's study, which spans the late nineteenth to the late twentieth centuries, there is no mention at all of the types of opportunistic behavior we have examined. This absence of discussion of contract breach is consistent with his emphasis on the cohesion of the Sourashtras. Roy quotes an early 20th century monograph that holds the Sourashtras were "very keen to stick to truth in their dealings". He himself concludes that "common identity ensured that trust was not betrayed" and that agency costs were thereby avoided (p. 462). Of course, there is now a literature in economics that explains how repeated interactions within a closed community can facilitate cooperation and contract enforcement.⁴³

Our model indicates another way to address the dual problems of opportunism. Parties on both sides of the transactions could act collectively to punish opportunism: if a producer defrauds a buyer, other merchants could refuse to deal with him, and if a merchant pays a producer less than the agreed price, other producers could boycott him. All parties interact repeatedly - not only a single producer and buyer, but the set of producers and buyers. So, rather than poach each other's producers, buyers can cooperate. And producers can share information and act collectively to punish any buyer that behaves opportunistically.

Such strategies were feasible given the social organization of successful manufacturing towns in Gujarat (in Western India) in the late nineteenth and early twentieth centuries. Consider the following description of the city of Ahmedabad provided by Mehta (1984), using late 19th

⁴³For prominent examples see Greif (1993) and Clay (1997). See Kandori (1992), for the general theory of repeated games and community enforcement.

century sources.⁴⁴ Producers in a given occupation (weavers, potters, etc.) lived and worked together in distinct neighborhoods; merchants also lived close to each other, in a different part of the city. Each occupational group had its own association. Caste and religious ties facilitated cooperation. Members of each group agreed to act collectively to punish transgressions by their own members and to retaliate against members of other groups when necessary. Merchants often advanced either raw materials or cash to artisans. But they could not "exploit" the artisans "beyond a point" because the artisans "could always act through the powerful mechanisms of the Panch [their association]." Merchant associations were also vigorous in defending their members' interests^{45,46} In such a setting hold-up problems may be infrequent because of fear of collective retaliation, and procurement should occur smoothly.

In this paper we have studied the microeconomics of export procurement. We have examined the problems of contracting between exporters and local producers, problems that must be overcome for globalization to fulfill its promise of raising incomes of the world's poor. Of course, the best situation would be the establishment of a well-functioning legal apparatus to enforce contracts and check opportunism on both sides. Our model indicates that, in the absence of formal contract enforcement, the market structure and a balance of bargaining power are critical to the success of procurement operations. Without proper legal enforcement, export efforts are likely to be most successful when (1) production and export both take place within the same community that mobilizes the various forces that sustain cooperative behavior, (2) producers and exporters work as collectives to reduce outside sales and punish opportunism on both sides, and (3) a monopoly exporter, like the EIC in its opium ventures, invests in an enforcement apparatus that checks its own opportunistic behavior.

⁴⁴Hopkins (1902) and Gazetteers produced by the colonial government describe a similar social structure in towns like Bharuch and Surat.

⁴⁵Haynes (1996, p. 306), describing the *jari* (gold thread) industry in the Gujarati town of Surat in the early twentieth century describes how artisan families formed long-term relationships with merchants, and could "change patrons only when a new bidder for their services offered to pay their old debts."

⁴⁶An interesting example of cooperation among merchants in the silk industry comes from another region. According to the Report of the Bihar and Orissa Provincial Banking Enquiry Committee, 1929-30 (p. 92) the mahajans (moneylenders), who had given advances to weavers, had "a sort of trade combination to protect their unsecured debts. No weaver can go to another mahajan without a certificate of discharge from his old mahajan."

VIII. Appendix

Proof of Proposition 4.

We show here that $B = 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$ maximizes the exporter's expected profits.

Suppose $B > 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$, so that the producer's constraint is violated with positive probability ($D \equiv 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B < \sigma$). From equations ?? and 6, because the agent's constraint is always satisfied, we have

$$\begin{aligned} E\Pi^*(B, \sigma) &= [\bar{v} - \bar{k}] \left[\frac{D + \sigma}{2\sigma} \right] - U - \int_{-\sigma}^D [(1 - B - \mu)m\bar{v}] f(\mu) d\mu \\ &= [\bar{v} - \bar{k}] \left[\frac{D + \sigma}{2\sigma} \right] - U - \frac{1}{2} [(1 - B + \sigma)m\bar{v} + (1 - B - D)m\bar{v}] \left[\frac{D + \sigma}{2\sigma} \right] \end{aligned}$$

Differentiating with respect to B we have

$$\frac{\partial \Pi^*(B, \sigma)}{\partial B} = \left[\frac{1}{2\sigma} \right] [m\bar{v}(1 - B + \sigma) - \bar{v} + \bar{k}]$$

Above we showed that the price the exporter sets in this case ($B > 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$) is $P' \equiv m\bar{v}[1 - B + \sigma]$. Substituting, we have

$$\frac{\partial \Pi^*(B, \sigma)}{\partial B} = \left[\frac{1}{2\sigma} \right] [P' - \bar{v} + \bar{k}]$$

This must be negative, for the exporter's profits to be non-negative. Thus, if $B > 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$, lowering B will increase profits.

The exporter will also never choose $B < 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - \sigma$; this would mean there is always slack in the producer's incentive constraint. The intuition for this claim is straightforward. If there is always slack in the producer's incentive constraint, the exporter can raise B without lowering procurement probability. This will make the agent better off. The exporter can then lower the wage and increase its profits.

Proof of Proposition 5.

We will show that the exporter's profits are decreasing in σ ; the less uncertainty in the ability

of the agent to enforce the contract, the greater the exporter's profits. It is convenient in our analysis to summarize the incentive constraints as follows. From the agent's incentive constraint let $A \equiv 1 - \frac{P}{m\bar{v}} - B$, and, from the producer's incentive constraint, let $D \equiv 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B$. By subtracting the coercive power term, we can evaluate the probability the incentive constraint is satisfied by directly looking at the distribution of the shock $\tilde{\mu}$. Procurement occurs when μ lies between D and A .

We first show that, for a given σ , the exporter will never set B such that there is slack in the weaver's incentive constraint, i.e. he will never choose B such that $D > \sigma$. The intuition is as follows: if B were high enough so that $D > \sigma$, the producer's constraint is always satisfied. The exporter could raise B so that $D = \sigma$, and the producer's incentive constraint is still always satisfied. This higher B increases the agent's expected returns from procurement. Hence, the EIC can lower the price P , without lowering the procurement probability, thereby raising its profits.

We then show, by the same logic, a decrease in σ allows the exporter to increase its profits.

Claim 1: The exporter will never choose B such that $D > \sigma$.

Proof:

Suppose $D > \sigma$.

Case 1: The agent's incentive constraint is violated with positive probability. The agent's profits are:

$$\int_A^\sigma [P - (1 - (B + \mu))m\bar{v}] f(\mu) d\mu + w \quad (\text{A1})$$

Let the exporter raise B to B' such that $D' \equiv 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B' = \sigma$. A declines to $A' \equiv 1 - \frac{P}{m\bar{v}} - B'$.

Now the agent's profits are:

$$\int_{A'}^\sigma [P - (1 - (B' + \mu))m\bar{v}] f(\mu) d\mu + w \quad (\text{A2})$$

Compare (A2) to (A1). The agent's returns are higher for two reasons: the procurement probability is higher because $A > A'$, and the agent's rents are higher since $B' > B$. Hence, the agent's incentive and participation constraints continue to be satisfied. Since the procurement probability risen, the exporter's expected profits have increased. This proves that $D > \sigma$ was not

profit-maximizing.

Case 2: The agent's incentive constraint is violated with probability zero. When $D > \sigma$, expected profits for the agent are

$$\int_{-\sigma}^{\sigma} [P - (1 - (B + \mu))m\bar{v}] f(\mu) d\mu + w \quad (\text{A3})$$

since $A < -\sigma$. Raise B to B' such that $D' \equiv 1 - \frac{\bar{k} + \bar{l}}{m\bar{v}} - B' = \sigma$. A decreases to A' , and agent's profits become

$$\int_{-\sigma}^{\sigma} [P - (1 - (B' + \mu))m\bar{v}] f(\mu) d\mu + w \quad (\text{A4})$$

Compare (A4) to (A3). The agent is clearly better off, since $B < B'$. Since there is slack in the agent's participation constraint (he is better off than before) and the incentive constraint, there exists a $P' < P$, which will keep procurement probability at 1 and satisfy both constraints for the agent. Exporter's profits would increase. This proves $D > \sigma$ was not profit-maximizing.

Claim 2: Consider the exporter's optimal expected profits as a function of σ : $\Pi^*(\sigma)$. When the exporter can adjust the mean of the agent's power, B , $\Pi^*(\sigma) < \Pi^*(\hat{\sigma})$ for $\sigma > \hat{\sigma}$.

Proof of Claim: Consider an initial variance σ , and the exporter's corresponding optimal value B that gives us values A and D . By the previous claim, B must be such that $D \leq \sigma$. There are two cases to consider: For the initial variance, either (1) the agent's incentive constraint is violated with positive probability ($A > -\sigma$), or (2) the agent's incentive constraint is violated with probability zero ($A \leq -\sigma$). Within these two cases there are two subcases: For the lower variance $\hat{\sigma} < \sigma$, either (1) $D \leq \hat{\sigma}$, or (2) $D > \hat{\sigma}$.

A. Suppose that $A > -\sigma$. The agent's profits are

$$\int_A^D [P - (1 - (B + \mu))m\bar{v}] f(\mu) d\mu + w$$

which become

$$\frac{1}{2} [2P - (1 - (B + A))m\bar{v} - (1 - (B + D))m\bar{v}] \cdot \frac{D - A}{2\sigma} + w \quad (\text{A5})$$

(Note that $\frac{D-A}{2\sigma} < \frac{D-(-\sigma)}{2\sigma} = \frac{D}{2\sigma} + 1/2$). Consider now $\hat{\sigma}$ where $\sigma > \hat{\sigma}$.

Suppose, first, that $D \leq \hat{\sigma}$. So we have $D \leq \hat{\sigma} \leq \sigma$. We show that the procurement probability increases for the same B, P and w , thus raising the exporter's profits. With the decreased variance, either $A > -\hat{\sigma}$ or $A \leq -\hat{\sigma}$. Since we have assumed $A > -\sigma$, the probability of procurement under the larger variance is $\frac{D-A}{2\sigma}$. Under the smaller variance when $A > -\hat{\sigma}$, the probability of procurement is $\frac{D-A}{2\hat{\sigma}} > \frac{D-A}{2\sigma}$. Under the smaller variance, when $A \leq -\hat{\sigma}$, the probability the agent's incentive constraint is satisfied is equal to one. Since it was less than one under the larger variance, it has increased. As for the producer's constraint, when $A \leq -\hat{\sigma}$ and $D \leq \hat{\sigma} \leq \sigma$, the probability it is satisfied is equal to $(D + \hat{\sigma})/2\hat{\sigma}$ which is larger than $(D + \sigma)/2\sigma$. (To see this, differentiate the expression with respect to σ).

Suppose now that $D > \hat{\sigma}$. So we have $\hat{\sigma} < D \leq \sigma$. In this case, the exporter would raise B to a level \hat{B} yielding $\hat{D} = \hat{\sigma}$. This will lead to higher profits as shown below. When B increases to \hat{B} , A declines to a corresponding level \hat{A} . With the decreased variance, either $\hat{A} > -\hat{\sigma}$ or $\hat{A} \leq -\hat{\sigma}$. If $\hat{A} > -\hat{\sigma}$, the agent's expected profits are:

$$\frac{1}{2} \left[2P - (1 - (\hat{B} + \hat{A}))m\bar{v} - (1 - (\hat{B} + \hat{D}))m\bar{v} \right] \cdot \frac{\hat{D} - \hat{A}}{2\hat{\sigma}} + w \quad (\text{A6})$$

Compare (A6) to (A5). We know $\hat{B} + \hat{A} = B + A$, $\hat{B} + \hat{D} = B + D$, and $D - A = \hat{D} - \hat{A}$. But $\hat{\sigma} < \sigma$, hence (A6) $>$ (A5). Thus the agent is better off. Since procurement probability has gone up at the same price, the exporter's profits have also increased. If $\hat{A} \leq -\hat{\sigma}$, since $\hat{\sigma} = \hat{D}$ procurement probability has risen to 1. The agent's expected profits are:

$$\frac{1}{2} \left[2P - (1 - (\hat{B} - \hat{\sigma}))m\bar{v} - (1 - (\hat{B} + \hat{D}))m\bar{v} \right] + w \quad (\text{A7})$$

Compare (A7) to (A5). $\hat{B} + \hat{D} = B + D$. But $B + A = \hat{B} + \hat{A} \leq B - \hat{\sigma}$. And $\frac{D-A}{2\sigma} < 1$. So procurement probability is higher at the same price. The exporter is better off. So is the agent.

B. Suppose that $A \leq -\sigma$.

The agent's profits initially are:

$$\frac{1}{2} [2P - (1 - (B - \sigma))m\bar{v} - (1 - (B + D))m\bar{v}] \frac{D + \sigma}{2\sigma} + w \quad (\text{A8})$$

Now suppose σ falls to $\hat{\sigma}$. Suppose $D \leq \hat{\sigma}$, so we have $D \leq \hat{\sigma} < \sigma$. Then for the same levels of B, P , and w , procurement probability is $\frac{D+\hat{\sigma}}{2\hat{\sigma}} > \frac{D+\sigma}{2\sigma}$. The exporter and agent are both better off. Suppose now that $D > \hat{\sigma}$, so we have $\hat{\sigma} < D \leq \sigma$. In this case, the exporter can increase profits by raising B to \hat{B} such that $\hat{D} = \hat{\sigma}$. Procurement probability becomes 1 (The producer's incentive constraint is satisfied with probability one at $\hat{D} = \hat{\sigma}$. Under the initial condition $A \leq -\sigma$, the agent's incentive constraint is satisfied with probability one. At the lower variance, we have $A \leq -\sigma < -\hat{\sigma}$. Since $\hat{A} < A$, the agent's incentive constraint is still satisfied with probability one after the decrease in variance and the change in B . The agent's profits are now:

$$\frac{1}{2} \left[2P - (1 - (\hat{B} - \hat{\sigma}))m\bar{v} - (1 - (\hat{B} + \hat{D}))m\bar{v} \right] + w \quad (\text{A9})$$

Compare (A9) to (A8). $B + D = \hat{B} + \hat{D}$. But $\hat{B} - \hat{\sigma} > B - \sigma$ and $\frac{D+\sigma}{2\sigma} < 1$. Hence, (A9) > (A8). The agent is better off, and there is slack in his incentive constraint. The exporter can lower the price and raise his profits, while still keeping procurement probability at one. ■

IX. References

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