PRODUCTION RELATIONS IN AGRICULTURE

by

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Discussion Paper #105

Research Program in Development Studies

Woodrow Wilson School
Princeton University
Princeton, New Jersey

June 1982

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In recent years there has been a rapid growth in the number of theoretical and empirical contributions to the study of rural labor markets by economists and other social scientists.¹ This literature contains many important insights and partial explanations of numerous aspects of rural factor markets, particularly in the area of land tenancy relations. One major contribution has been the identification of the problems which arise when market mechanisms for risk diffusion are incomplete and information is costly. Except for some markets such as that for insurance, standard competitive economics has only recently attempted to formally introduce risk cum information costs into the analysis of markets. Attention to such phenomena provides, however, new insights into the roles of tenancy, sharecropping and probably many other rural institutions, namely as welfare-augmenting arrangements developed to reduce the costs of market failures. Production inefficiencies² and such pervasive rural institutions are thus viewed as joint consequences of costly information, risk and incentive problems.

The existing theoretical literature has some serious shortcomings, however. First, it consists of a plethora of partial models of specific aspects of production relations. What is attempted in most models is the revelation of the standard or nonstandard assumptions which will be consistent with a single observed (or assumed) phenomenon such as the coexistence of open employment and rigid wages, discrepancies in factor ratios across farms of different

1) A review of this literature and some examples are contained in Binswanger and Rosenzweig, forthcoming.

2) The key aspect of competitive efficiency is that no rearrangement of factors of production among or within any of the firms would lead to an increase in aggregate output. If firms use factors of equal quality, they use them in the same proportion.
sizes, sharecropping or interlinked contracts in several commodities or services. 3
Much of the focus is on the implications for economic efficiency of the assumptions
and thus of the individual phenomena which are explained by the assumptions.
Many of the models are also used to obtain comparative static results and policy
implications which are unfortunately highly model-specific.

Second, the literature has been excessively concerned with issues of
interest to the macro development analyst, such as the appropriate assumptions
about rural labor supply behavior for macro-economic models. This emphasis
often rests on apparently intense desires to rationalize various aspects of
the "labor surplus" hypothesis. 4 The list of neglected aspects of the rural
economy is thus quite long. In particular, few of the models are concerned with
purely rural issues which are important for the welfare and development of
rural people, such as the efficiency of the rural economy to cope with season-
ality in labor demand or with the special problems of financial intermediation
among spatially dispersed producers.

As a consequence of the preoccupation with individual phenomena, the
set of models make mutually exclusive assumptions which cannot possibly pertain
to a single rural area at the same time. The efficiency wage approach to wage
determination, for example, initially attempted to explain a rigid rural wage
rate at which rural labor supply to urban areas was to be infinitely elastic;
the contractual choice literature dealing with tenancy and interlinked
markets, generally assumes that labor supply to the agricultural sector is
infinitely elastic at a fixed wage (the supply coming from nonagricultural

3) Interlinked contracts are defined by Braverman and Srinivasan (1980) as
"transactions in more than one commodity or service made between the same
pair of individuals and linked in an essential way... so that declining
the contracts would be infeasible or costly for at least one party (p.4).

4) These include the coexistence of rural open unemployment and positive wages
and the coexistence of positive wages and zero marginal product of laborers.
For a detailed discussion of the "labor surplus" hypothesis, see Binswanger
and Rosenweig (1982).
sectors of the economy) and the literature focusing on labor supply and endogenous wage determination has assumed away tenancy choice.

A third general shortcoming of the literature is the attempt to account for observed rural phenomena with reference to market imperfections invoked in an ac\textit{ hoc} manner, rather than explained as consequences of more fundamental phenomena associated with basic technological features unique to agricultural production.

Finally, many of the models applied to agriculture have failed to distinguish between the general behavioral and technological characteristics governing production and the more specific features of a particular region or time period. As a consequence, many models have been misapplied to settings different from those for which the model was developed.

The purpose of this essay is to analyze the set of technological and behavioral factors which determine production relations—the relations of people to factors of production in terms of their rights of ownership and use in production and the corresponding relations of people among each other as factor owners and renters, as landlords, tenants, workers, employers, creditors and debtors. Among the specific goals of our analysis are 1) to assist in explaining the diverse set of actual production relations observed in a particular rural environment in an internally consistent way and 2) to assist in predicting the impact on production relations, productivity and income distribution, for any given technological and institutional environment, of institutional and legal changes, state interventions, and technological change.

In section I we set out the general behavioral risk and informational assumptions of our analysis and discuss their implications for credit and insurance markets. Section II describes the unique technological features of agricultural production including risk characteristics. In section III the consequences of the general assumptions for rural credit and insurance markets are discussed.
Sections I through III thus present a general foundation of production relations with which to discuss specific rural environments, characterized by their factor endowments, technology and infrastructure.

The general foundations of our analysis that we focus on here are largely based on specifications of the production or technological side of the agricultural economy. On the consumption side we only consider the preferences of individuals for leisure and work and risk aversion, but not the preferences among different consumption goods and services or more subtle aspects of human happiness such as companionship and recognition. As we proceed we may well find that links between consumption choices (the composition of final demand) and production relations are so strong that a more precise delineation of consumer preferences is necessary to make progress on the production side. However, in the meantime we will proceed without being more specific about consumption.

In addition to the foundation, the study of a particular agricultural region requires facts on the agroclimatological conditions and endowments of the region. Furthermore, one needs to know the salient impact of history on the production relations themselves via technology, institutions and laws, state intervention, human endowments and physical capital. These are the specific set of existing preconditions which influence the expression of the foundations in any specific regional analysis. Sections IV and V of the paper use the foundation established to attempt an integrated and internally consistent explanation of the main features of land-scarce agricultural economies with poorly developed transport and communication networks and stagnant

5) Our epistemological approach is similar to that of cultural materialism. The cultural materialists theories proposed so far are, however, deficient in their description of the material side of agricultural production. Furthermore, they emphasize energy costs at the expense of many other cost considerations. The theories are fairly precise about the preferences of individuals for (1) food as source of energy, (2) animal protein, (3) sexual activity as sources of pleasures, and (4) the need for companionship and recognition.
technology. We discuss the following topics in this context: the distribution of operational and ownership holdings, tenancy, factor rental and sales markets, plantations, the relationship of farm size and productivity and the impact on factor markets of different forms of technical change (dry season irrigation, and labor-saving and yield-increasing technologies). Other diverse phenomena which have received attention and partial explanation in the literature that are discussed and linked in this paper are the following: absence of crop insurance and deposit banking; the absence of animal rental markets; the importance of land as collateral; the coexistence of plantations and small farms for some crops and not for others, the interlinking of contracts, the dominance of "distress" sales in the land sales market, the rental out of land by small land holders, and the dominance of the "family" farm.

We confirm some of the partial explanations for some of these phenomena in our broader setting. Other explanations are either rejected as inconsistent with other observed phenomena or are reinterpreted. Some of the implications we derive have not been well-studied and many were not known to us in advance and thus represent testable hypotheses. In these cases, present data or analysis either does not exist or we have not yet looked at existing data for confirmation or rejection. It is precisely the testing of such hypotheses which will confirm or reject the robustness of our approach and which, in some instances, may lead us back to the drawing board about the foundations. We will summarize these predictions as testable implications at the end of the paper.

Finally, in this essay we do not use mathematical derivations in formalized models to prove our assertions, but instead rely on verbal expositions of the logical sequence of steps involved. We recognize the dangers inherent in such
an approach of not ensuring full consistency between the explicit assumptions and explicit conclusions. We hope in the future to remedy this situation by formalizing or assisting in formalizing the crucial logical steps. However, since our goal was integration, the sheer effort of formalizing the complex structure proposed would have ended in exhaustion before anything useful was accomplished.
I. THE GENERAL CONSEQUENCES OF RISK AND INFORMATION COSTS.

Fundamental to our inquiry is the incorporation of risk and information costs in the analysis of behavior of all participants in production processes where there are at least some transactions between individuals. The existence of these conditions in turn importantly determine, along with the specific technologies and factor endowments characteristic of an economic setting, the number and nature of transactions occurring. The general assumptions we make are:

Risk: R-1. Individuals face risks from many different sources — from the production process, from the market or from health factors.

Information Cost R-2. The acquisition and transmission of information involves costs in terms of time and resources. Information is often acquired most cheaply as a byproduct of the production and consumption activities in which one is engaged.

Behavioral:
B-1. Self Interest: In the first instance individuals are interested in their own utility.

B-2. All individuals value consumption.

B-3. All individuals dislike effort at least to some extent. Supervisory activities also require effort.

B-4. Individuals are risk averse whenever gains and losses exceed trivial levels of income. Risk aversion may vary among individuals and for the same individual with wealth.

These six assumptions have the following general consequences:

G-1. Asymmetric information: Information has value and is costly to acquire (R-1). Since individuals are selfish (B-1),
they will not part with information they possess unless it is to their advantage. For example, high quality workers will want employers to have accurate information about worker quality while inferior ones would prefer that worker quality be unknown to the employer, (unless the employer can penalize them once he finds out). The same applies to borrowers and lenders or to insurers and insured. Sellers of seeds and animals know more about their quality than do the buyers, and may have incentives to misrepresent seed quality. Such problems of asymmetric information arise in virtually all economic transactions to some extent.

G-2. Incentive Problems: (Moral hazard, adverse selection and screening effects). When information is costly (R-1) and asymmetrically distributed (G-1), incentives problems arise in most economic transactions. A daily paid laborer has no incentive to work hard, unless supervised closely via direct observation of his effort or via monitoring or inspection of his output. Incentives to work hard may be improved by providing share contracts (piece rates at harvesting or for earth digging, or crop sharing tenancy contracts). Since the worker receives only a share of the full marginal product of his effort he will still not work as hard as an owner-cultivator, unless again he is supervised or monitored in other ways, and/or is penalized in terms of loss of future repeat contracts. A person who rents a bullock pair has little incentive to feed it beyond the minimum required to elicit the work effort which he desires. He may return the animal in underfed or damaged condition. A farmer whose crop is
insured against all risks relative to a "normal" level of output will usually not apply as much care, precaution or inputs as if his crops were uninsured.6

G-3. Imperfect enforcement of property rights

Where acquisition of information is costly and asymmetrically distributed (G-1), property rights cannot be perfectly enforced. This follows from the fact that there is some positive incentive for theft that will be realized when it is easy to conceal the identity of the thief, i.e. when costs of ascertaining the culprit are very high. We note here that many legal and cultural institutions are adaptations to this problem, i.e. they, inter alia,

6) It is in the context of insurance markets that incentives problems were first called moral hazard problems. Unless the insurance company can stipulate input and/or care levels, and observe or monitor them at very low cost, insurance contracts may lead to inefficient resource use. Many contracts anticipate this and include coinsurance clauses, i.e. insure only a fraction of the shortfall in production, or of the damage. With such clauses the insured has again a partial incentive to use proper care and input levels, a situation very similar to share contracts or piece-rate payments. When it is hard for one partner in a transaction to distinguish among potential partners of high and low quality, screening problems arise. They were first noticed in the insurance case, where they are called adverse selection. Among a group of potential insurance clients, those with a high exposure to risk will find insurance more attractive. The insurance company will attempt to distinguish high risk from low risk individuals and charge higher premiums to the high risk ones. If it cannot distinguish very well, it will use more easily observed variables such as age, sex, race, caste etc. which are perceived to be correlated with risk. (Discrimination according to age, sex, caste or sexual preference is deeply rooted in the potential value of easily observed characteristics as screening devices). If it cannot distinguish at all, it will set the premiums so high that only high-risk individuals find the insurance attractive and apply; the insurance market fails to exist for the low risk ones. The presence of undistinguishable high risk individuals (1) imposes a cost on persons of low risk and (2) forces the insurance company to use the terms of the contract to screen individuals into homogeneous groups. Similar situations have been hypothesized in other markets. What is now known as the screening literature provides examples of the means by which employers (Weiss, 1980) or landlords (Newbery & Stiglitz, 1979) or creditors (Stiglitz and Weiss, 1981) can structure employment, tenancy or credit contracts which will lead employees (tenants, debtors) to reveal information by their choice of contracts. The most important finding of the screening literature is the same as that for insurance. The presence of indistinguishable low quality applicants imposes a cost on the high quality ones and/or may lead to the disappearance of the market.
reduce costs of information or increase penalties for theft. Furthermore, other things equal, the costs of information are lower, and the penalties in terms of future opportunities higher, in small, immobile communities than in large ones with a high degree of mobility.

G-4. Desirability of a broad spectrum of insurance contracts and insurance substitutes follows directly from risk and risk aversion (8-4). Most individuals should be willing to pay some positive amount to reduce their exposure to any one of the risks they face. Where insurance is unavailable they would be willing, at cost to themselves to alter their behavior in other ways to reduce exposure to risk (self insurance, self protection). Such behavior includes the holding of reserves, diversification of prospects, conservative input levels, investment in "creditworthiness" and family ties.

G-5. Collateral requirements.

A collateral requirement, the form of which we will discuss in Section III, affects borrowers' and lenders' utility in complex ways. First we consider the case where a borrower has every intention to pay back. Default can then only be a consequence of bad luck and is involuntary. Equation (1) shows that for a given interest rate \( i \) or loan size \( L \), raising the collateral value from zero to some positive amount raises the expected return \( E \) to the lender:

\[
E(L) = i(1- \pi) + (C-L-i) \pi \quad (1)
\]

where \( \pi \) is the probability of failure of the project and \( C \) the value of the collateral to the lender. With zero collateral
(i.e. C=0) the expected return is equal to the rate of
interest multiplied by the probability of success \( (1-\pi) \) of
of the project undertaken, i.e., the probability of repayment,
minus the value of the loan times the probability of the failure.
(assuming that loans are either fully repaid or fully defaulted).
As collateral is increased, the second term, starting from a
negative value, increases progressively since only the difference
between the collateral and the loan amount plus interest is lost.
Note that by raising the collateral value to levels larger than
the loan size plus the interest rate, the expected return can
be made larger than the rate of interest, a technique which
can be used to circumvent the impact of interest rate ceilings.

Thus it seems that, from the point of view of expected return,
interest and collateral act as substitutes. It is feasible to
achieve a given expected return on a loan by various combinations
of rates of interest and values of collateral. If the lender is
risk-neutral and the borrower is known not to default intention-
ally, and if both lender and borrower have the same information
about the probability distribution of the outcomes of the project
financed by the loan, the lender will be indifferent between the
two methods of achieving the desired expected rate of return.
If the expected return is sufficiently high, he will make the
loan despite the possibility of losing his entire capital in the

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7) Stiglitz and Weiss (1981) have first incorporated this aspect of collateral
with a formal analysis of credit markets. Virmani (1981) has also extensively
used it, with somewhat more complex repayment functions than those assumed
for equation (1).
event of (unintended) default.

A collateral requirement between zero and the amount of the loan shifts a portion of the potential capital loss from the lender to the borrower. If the borrower is risk-neutral he does not care whether collateral is or is not required: the expected value of the capital loss which he will bear in the bad-luck case is offset by the lower expected interest costs in the good-luck case. For the risk-averse borrower, however, the fact that the expected value of the capital loss is just equal to the expected value of the rate reduction in the good-outcome cases is not sufficient to make him indifferent to the imposition of a collateral requirement. The large potential capital loss implies a high utility loss for the risk-averse individual, who would therefore rather accept a high-interest contract which allows him to default (involuntarily) in bad-luck cases at no additional cost. With risk-neutral lenders there would therefore not be a collateral requirement for honest borrowers. Conversely, risk-averse lenders will insist on some collateral, even if they know borrowers' intentions to repay. We thus see that collateral is a risk sharing device, and that the way in which agents view collateral requirements depends on their risk aversion.

The most serious problem facing lenders, whether risk-neutral or risk-averse, is that normally they cannot know borrowers' intentions about paying back loans. Utility-maximizing borrowers will default if the utility of their wealth less loss of future earnings from default (D) exceeds the utility of wealth when the loan amount plus interest is repaid, i.e. $U(W-D) > U(W-L-i)$, where $W =$ initial wealth. The utility associated with default will be lower (D will be higher) the lower the mobility of borrowers, the easier it is to trace individuals and attach assets and the more easily information about their
default can be transmitted to other potential lenders. The following important implications follow immediately: Lenders, other things equal, are more likely to lend without collateral

(1) for small loans rather than for large ones,
(2) to owners who have invested in land and buildings rather than to tenant farmers, and
(3) to resident workers rather than migrant workers.

Some institutions specialize in lending without collateral or have specialized loan instruments which do not require collateral. In these cases they either attempt to select customers whose characteristics indicate that they have high repayment incentives (and the institution invests in the necessary information to do so), or they provide small loans relative to the incomes of the borrowers.

For large loans, lenders will almost never be certain that the utility under default will be less than the utility under repayment and collateral will be used to make up for the lack of incentive to repay. The default condition then becomes \( U(W-D-C) > U(W-L-i) \). When the utility under default, involving loss of collateral and D, is equal to the utility associated with repaying the loan plus interest, all the incentive for defaulting is removed. Thus when lenders compete and when there are no interest ceilings, collateral equal to principal plus interest will only be demanded if the lender believes that the borrower's own utility loss from default is negligible. For a given loan size the incentive effect of the same collateral amount thus varies with the personal characteristics of the borrower, which determine \( U(W-D-C) \). Thus, personal characteristics enter the loan market in an essential way which is simply irrelevant for sales transactions of
goods. We shall see below that the same is true of all rental markets:

An impersonal market in which an item is returned to the "lender" after a fixed period of use is not feasible.

To summarize, at a given interest rate, collateral has three effects or functions: (1) it increases the expected return of the lender and reduces the expected return for the borrower, (2) it partly or fully shifts the risk of loss of the principal from the lender to the borrower, and (3) it provides those borrowers who have high utility under default with additional incentives to repay loans. We now apply these insights to the issue of capital constraints for collateral-rich and collateral-poor borrowers.

G-6. Consequences of collateral for the existence of credit markets and for utility costs of credit.

Where suppliers of credit who are risk-averse insist on collateral, the credit market does not exist for groups of individuals who do not own assets which can be used as collateral, despite the fact that these collateral-poor borrowers may be willing to pay higher interest rates. Since the utility gain from default for the borrower increases with the interest rate charged, the expected utility for the lender may go down as the interest rate increases (Stiglitz and Weiss 1981). However, the market may also disappear for persons with no collateral from the demand side: The expected return of the investment may be lower than the interest rate.

In environments where insurance and forward markets are incomplete, credit acts as an insurance substitute. The utility cost of identical loan terms (quantity, interest, collateral requirement) therefore differs for individuals who own
different amounts of collateral: If such a loan is taken and exhausts the collateral of the collateral-poor borrower, he will be able to resort to additional credit (insurance) only at more adverse terms (i.e. a larger "insurance" premium than the collateral rich borrower who still has unused collateral sufficient for another loan on the prior terms). Thus, identical loan terms do not imply identical utility costs for different borrowers (relative to the utility of labor, for example).

G-7. **Forms of collateral**

Not all forms of assets are suitable for use as collateral. A collateral has to satisfy three conditions—appropriability, absence of collateral-specific risk, and accrual of the returns to the borrower during the loan period. These conditions are listed by asset type in Table 1.

1. **Appropriability:** It must be easy for the lender to appropriate the assets in case of default. As can be seen in Table 1, this condition can be satisfied in several ways: Financial assets and gold can be deposited with the lender. For land, real estate, motor vehicles, animals, slaves, and human capital embodied in the borrower, ownership rights must be well-defined. In the most formal systems titles exist which can be registered and deposited. Furthermore, the state has to be willing to enforce lenders' rights by evicting the borrowers or assisting the lenders in repossessing the mobile assets in case of default. Where ownership rights are not in the form of legal registered titles, other documentary evidence of the claim must be in the lender's hand and/or social norms or customs must be sufficiently strong to allow the lender similar assurance that he can appropriate the asset.
<table>
<thead>
<tr>
<th>Asset</th>
<th>Appropriability</th>
<th>Absence of Collateral-Specific Risk</th>
<th>Accruals of Return to Borrower</th>
<th>Overall Ease of Use as Collateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Assets and Gold</td>
<td>Deposit with Lender</td>
<td>Yes</td>
<td>Yes</td>
<td>Highest</td>
</tr>
<tr>
<td>Land</td>
<td>With Title Registration</td>
<td>Yes</td>
<td>Yes</td>
<td>Very High</td>
</tr>
<tr>
<td></td>
<td>and Enforcement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Estate</td>
<td>&quot;</td>
<td>Yes, with Fire Insurance</td>
<td>Yes</td>
<td>High</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>&quot;</td>
<td>Yes, with Theft, Accident Insurance</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Animals and Slaves</td>
<td>&quot;</td>
<td>No, Moral Hazard</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Human Capital</td>
<td>&quot;</td>
<td>Yes, with Accident, Health Insurance</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>Producer and Consumer Durables</td>
<td>Deposit with Lender</td>
<td>Yes, with Theft Insurance</td>
<td>No</td>
<td>For short-term pawn lending</td>
</tr>
<tr>
<td>including Jewelry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. **Absence of collateral-specific risk**: Lenders must be fairly sure that the collateral cannot easily become worthless because of theft, pretended theft (in which the borrower colludes with the thief) or damage by fire, accident, or in the case of animals, disease. Again, alternative ways of mitigating or eliminating these problems exist. The assets can be deposited with a lender (who in turn must assure the borrower that it is safe in his custody). Land, on the other hand, entails little risk because of its physical characteristics. For real estate, theft is not a problem and it becomes a desirable collateral when it can be cheaply insured against fire. Similarly, vehicles become attractive when they can be cheaply insured against theft, and accidents, including those caused by the owner himself. Indeed, where such insurance exists lenders routinely compel borrowers to buy this insurance. A strong case exists for such compulsion because, once an asset is used as a collateral, a portion or the entirety of the collateral-specific risk is borne by the lender, and the borrower has little incentive to buy such insurance. (Binswanger, 1982).

For animals, slaves and human capital embodied in the borrower, health risks arise in addition. Incentives problems make it extremely difficult to provide life insurance (for health-related death causes) for animals and slaves because owners who are relatively insensitive to the suffering experienced by animals and slaves might find it profitable to let a sick animal or slave die if fully insured. Such insurance for animals, for example, is almost universally absent. In the case of people who buy their own life insurance, this incentive problem does not exist because they care about their own life. Animal theft insurance has similar:
problems: owners may invest less in guarding the animals, may collude with the thief, and in the extreme, eat the animals and pretend they were taken.

3. Accrual of the returns of the asset to the borrower.

Most assets, including those listed in table 1, easily satisfy this condition. However, producer and consumer durables—including jewelry cannot be deposited—as they must be satisfy condition 1 without loss of use value to the borrower. These pawns are thus of little utility as collateral except for very short periods, or when the loss of use implies minimal production or utility loss.

The last column of Table 1 summarizes the ease with which an asset can be used or rather made useable as a collateral for longer-term lending. It is clear that collateral value is highly dependent on the legal and insurance environment within which it is to be used, and developed countries have managed to convert a wide variety of assets into collateral i.e., borrowers and lenders have wide collateral options.

C-8. Collateral substitutes

People living in economies which have few good collateral options, or borrowers who own few assets useable as collateral, either will not borrow much or resort to inferior or more problematic forms of collateral in which the conditions are not easily met. They can also, however, attempt to move to collateral substitutes. One such substitute is third party guarantees: A borrower who owns few assets with collateral value and whose own repayment incentives appear to be low to the lender may ask a third party who is perceived as less of a risk by the lender to guarantee repayment in case the borrower defaults. The third party may do so if it has better
information about the borrowers repayment incentive/capacities, or
gain from the relationship with the borrower in other
than the borrowing transaction.
A second substitute is the threat of loss of future borrowing oppor-
tunities. For immobile populations, traditional money-lending systems
transmit default information quickly to all potential borrowers and
substantial lending can occur on this basis alone. Modern credit
bureaus provide the same service and are an important institution
facilitating hire purchase transactions involving smaller consumer
durables which can be used by the borrower rather than be pawned.
The third form of collateral substitute is a tied contract in which
credit is given in association with another transaction. Examples
are when a landlord provides credit to the tenant as part of the
tenancy contract; indentured servitude, debt bondage and various forms
of temporary debt sharing are tied contracts in which the labor worth
of the bonded person accrues to the lender. Rentals of land, cars
etc. in which payment is received in advance for the temporary use
of the asset are also examples of combined payments of interest and
principal. We will discuss these examples in the context of agricul-
ture in detail below. 8

8) The legal enforcement, insurance and information environment
which widens collateral options or supports collateral substi-
tutes is not an exogenous creation but something which societies
do in response to perceived needs for increased borrowings and
lending. But civil disturbance or misguided policy can easily
prevent or destroy valuable institutional innovations which
support the collateral value of an asset.
TRADE, CAPITAL MOBILITY AND SOVEREIGN IMMUNITY

by

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Discussion Paper #108

Research Program in Development Studies

Woodrow Wilson School
Princeton University
Princeton, New Jersey

September 1983

NOTE: Discussion papers of the Research Program in Development Studies are preliminary material circulated to stimulate discussion and critical comment. Please do not refer to discussion papers without permission of the author.

* I thank G.M. Grossman for comments.
ABSTRACT

International capital mobility is limited by the possibility of expropriation or debt repudiation. This paper examines the nature of equilibrium when these hostile actions are deterred by interference with the host country's trade, possibly through the sovereign immunity laws. Both investors and hosts are rational, calculating agents. An outcome of perfect capital mobility, while optimal, may be time inconsistent for the host. The time-consistent, imperfect-capital-mobility equilibrium is analyzed. Characteristics of countries affecting capital mobility are discussed: tariffs, domestic factor endowments, factor-intensity of trade, income elasticities of demand, saving propensities, and uncertainty.
1. Introduction

International capital mobility is limited by the fear of investors that physical capital may be expropriated or loans may be repudiated. A capital importing government may wish to make a binding promise to foreign investors that it will not undertake these hostile actions with the goal of attracting investments. But such binding promises are not generally feasible since there is no international forum in which this type of contract can be enforced. Once the investments have taken place, the strategy of allowing a return to investors may be time inconsistent (Kydland and Prescott, 1977). It will be optimal for a government to renge on its promise. Rational investors, anticipating this situation, will invest less than otherwise or possibly not at all depending on a number of circumstances.

If governments of capital importing countries (the hosts) weigh costs and benefits in deciding on these hostile actions, the nature and extent of the sanctions that investors can use to increase these costs critically determine their willingness to invest abroad. These sanctions are likely to be quite indirect because international property law hardly exists and so international enforcement of contracts is severely circumscribed.

A potentially very important class of actions that may be available to foreign investors experiencing a loss of their capital involves the disruption of the foreign trade of the host country. This type of interference may be effected in any of several ways: through legal actions, by limitations on trade credit and the international transfer of funds, and on behalf of investors by their governments.

It may be hopeless to take legal action in courts located in the host country, and therefore under its control. There may, however, be scope for legal action in the courts of the investors' home country or even in the courts of
third countries. The prospects for this strategy depend in part on the doctrine of sovereign immunity prevailing in these jurisdictions. In some countries or for some types of claims, foreign governments may be exempt from legal liability. In other circumstances it may be possible to attach exports or imports of a country that has taken hostile actions, if this trade activity is undertaken by entities that have some government affiliation. A good target for this type of suit would be the expropriated enterprise when it attempts to export abroad. Moran (1973 p. 202) describes the strategy of Kennecott in dealing with the Allende government, which even included the attachment of Lanchile's airplanes when they landed in New York. The potential for ensuring the safety of investments in this way depends on the value to the host of its continued access to foreign trade as well as on the legal environment. Any country that finds the loss of trade less costly than meeting its obligations can simply withdraw from trade and make itself invulnerable to these claims.

Action under sovereign immunity laws does not involve investors in game-theoretic decision making as in some other actions to preserve the value of foreign investments (see fn. 1). If the host's valuation of its trade and the legal system make a suit to obtain compensation a meaningful option, the individual investor can obtain redress. It is not the same as a retaliating action which punishes the host without directly helping the investor. By contrast in the case of retaliation the issue of credibility arises: one must analyze whether the retaliation will be viewed as desirable by the investor after the fact. Further, there are often questions of coordination among investors. For instance, a refusal by one lender to lend in the future to a repudiating debtor may mean little if other lenders step in. If no retaliation
is credible, and investors are rational, foreign investment will disappear entirely in the absence of any other mechanisms for ensuring the safety of investments.

The threat of legal action even if of uncertain success can pose problems for a country in undertaking international exchange until the case is resolved. To the extent, however, that legal recourse is limited this paper may be viewed as an investigation of the implications of adopting legislation that would limit sovereign immunity and expand the legal options of investors. The recent tendency of legislation, for instance the U.S. Foreign Sovereign Immunities Act of 1976 (USCA, 28§1602-1611, 1982, pp. 105-127), has been to improve the position of claimants (Delaume, 1977).

A second type of interference with foreign trade that aggrieved investors can undertake involves the disruption of international payments mechanisms. The efficient conduct of foreign trade requires the transfer of funds abroad, frequently in conjunction with the use of short-term trade credit. Since these arrangements must often be made with the same banks that are long-term lenders to LDC's, it may become necessary for a defaulting borrower to engage in international barter to avoid these banks. Here again, the issue of the credibility of the lender's reaction to a hostile action does not arise. If the host were to try to effect a transaction through its creditor, it would always be in the creditor's interest to seize the payment (to offset it in financial terminology). International banks often try to design contracts among themselves to ensure that they share equally in such offsets, thereby enhancing their cohesion in dealing with defaulters. Iran has been a recent prominent example of a country that found its opportunities for international trade severely circumscribed by problems in effecting transactions.
Finally the governments of investors may retaliate on their behalf against hostile hosts. One feasible form for these actions to take is the restriction of trade with the host. For instance, the U.S. Trade Act of 1974 automatically excludes countries taking certain hostile actions against U.S. investors from the generalized system of trade preferences (Eaton and Gersovitz, 1981b, p. 32). But this type of retaliation certainly runs up against the credibility issue. After-the-fact, the home country as a whole may be reluctant to give up the gains from trade with the host. To what extent the home country is irrevocably bound by such laws as the Trade Act is then of critical importance.

Of course, all these actions are only plausible remedies to the extent that foreign trade is an option that countries value. In what follows, I investigate the scope for capital mobility when the deterrent to hostile acts is a complete loss of the opportunity to trade. While this characterization is a stark representation of the varied situations discussed above, the qualitative propositions derived from this model provide a first step to understanding a wide range of issues. In the next section I describe equilibrium in this type of model. The third section presents the effects on foreign investments of: tariffs, the levels of domestic capital, the proportion of foreign debt used for physical investment, the rate of return on capital abroad, the levels of non-capital factors, and other additional penalties unrelated to trade.

In this way the theory is seen to provide an explicit framework for assessing how much capital investors can safely make available to hosts with different characteristics. A structural model of this type has the advantage of being able to determine endogenously the ultimate deterrence available to
investors. It contrasts in this respect with other models that postulate as a primal assumption a fixed disutility of hostile action based on moral or other vague grounds. In the concluding section, these results are used to analyze when the deterrent of a loss of access to trade may break down leading to repudiations and expropriations.
2. Description of the Equilibrium

In a two-good, two-factor model, free trade leads to factor-price equalization under certain assumptions, and there is consequently no incentive for international factor mobility. The two-good, three-factor model with one factor specific to each sector provides an alternative formulation that opens up a larger set of possibilities for behavior, and is an attractive simplification for studying international factor mobility. In particular, if one good is produced using capital as its sector-specific input, the country can export either good while importing capital.

In this model, two goods, manufactures (M) and food (F), are produced with a constant returns to scale technology using inputs of labor (L_m) and capital (K), and labor (L_f) and land (T), respectively. The value of the marginal products of labor, capital and land in the domestic economy are w, r and ρ respectively and the world return to capital is \( \bar{ρ} \).³ (The variables \( ρ \) and \( \bar{ρ} \) should be interpreted as gross rates of return including the restoration of capital to its owners).

It is convenient to represent the economy in the notation used by Jones (1965 and 1971). The log differential of a variable is denoted by a "\(^\circ\)". Unit factor requirements for the production of the goods are denoted by \( a_{ij} \), I = L, K, T and J = M, F. The production structure of the economy is given by:

\[
\begin{align*}
(1) & \quad a_{LM} M^i + a_{LF} F^i = L \quad i = n, s \\
(2) & \quad a_{TF} F^i = T \quad i = n, s \\
(3) & \quad a_{KM} M^i = K \quad i = n, s \\
(4) & \quad L = L_M + L_F \\
\text{and} & \\
(5) & \quad K = K_f + K_o
\end{align*}
\]
where a superscript \( i \) denotes whether foreign capital (\( K_F \)) is seized (s) or not seized (n), and \( K_0, T \) and \( L \) are initial domestic endowments given exogenously.

If foreign capital is not seized, then the value of national income is

\[
(6a) \quad Y^n = p^n_M M^n + p^n_F F^n - \bar{\varphi} K_F
\]

where \( p^n_M, p^n_F \) are international prices, given exogenously. To fix the nominal price level, \( p^n_F \) is assumed given at some level. Indirect utility in this case is

\[
(7a) \quad U^n = U (Y^n, p^n_M, p^n_F)
\]

On the other hand, if foreign capital is seized, the value of national income is

\[
(6b) \quad Y^s = p^s_M M^s + p^s_F F^s
\]

where \( p^s_M, p^s_F \) are domestic prices. As a normalization convention, \( p^s_F = p^n_F \).

Indirect utility is

\[
(7b) \quad U^s = U (Y^s, p^s_M, p^s_F)
\]

The domestic price ratio is determined by the autarky condition that the demand for each good equals its supply. (Demand functions are derivable via Roy's identity from (7b)).

The country chooses to seize \( K_F \) if \( U^s > U^n \), and not otherwise. Rational foreign capitalists know about this behavior rule, and provide capital only if \( U^s < U^n \). The borderline condition is another equation of the equilibrium:

\[
(8) \quad U^s = U^n.
\]
The equilibrium can usefully be illustrated in two diagrams. In figure 1, a traditional trade-theoretic depiction, AB represents the production possibility frontier for the equilibrium level of $K_f$. The curve $A'B'$ is shifted in horizontally by an amount $\bar{\rho}K_f/P_f^n$. This amount is the payment to foreign capital in terms of food if the capital is not seized. (The good used to measure $\bar{\rho}K_f$ is of no significance since free trade can occur at fixed prices from any point on $A'B'$.) The point $P^n$ represents domestic production less the servicing of capital in the n case, and $C^n$ is the consumption point after trade. The level of $U^n$ reached is given by the indifference curve $U^sU^n$. A case where the M good is imported is illustrated, but this is only one possibility. In the s case, the production bundle is the same as the consumption bundle at point $P^s/C^s$. The indifference curve is also tangent to AB at this point, on the assumption that an equilibrium with $U^s=U^n$ is illustrated.

The second diagram, of a type first used in Eaton and Gersovitz (1984), is less structural but illustrates the constraint on capital mobility posed by the possibility of seizure more directly. The curve nn shows $U^n$ as a function of total capital $K$. Assuming $K_0$ to be fixed, a rightward movement along the x-axis implies an increase in foreign capital, $K_f$. The nn curve reaches a maximum at $K = K^*$ where the value of the marginal product of capital is $\bar{\rho}$. The unimpeded mobility level of capital is $K^*$.

The curve ss shows that $U^s$ increases monotonically in $K$. Since foreign capital is seized under this regime, more capital is always desired. At point E, $U^s = U^n$ and the level of capital that can be sustained by the loss of trading privileges is determined ($K^E_e$). If the ss curve cuts the nn curve to the left of $K^*$, then foreigners will not provide $K^* - K_0$ and capital mobility is constrained to $K^E_e - K_0$. If the ss curve cuts the nn curve to the
right of $K^*, K = K^*$, capital mobility is perfect and $U^S < U^N$ so that equation (8) does not apply. In this case, the ss curve is irrelevant to the determination of equilibrium since the maximum utility is achieved at $K = K^*$. The country would never want more capital at rate $\rho = \bar{\rho}$.

Either an unconstrained or constrained case is possible. For instance, if the F good could not be produced domestically but was essential to consumption so that $U^S = 0$ in absence of trade, the ss curve would coincide with the horizontal axis and capital mobility would be unconstrained. On the other hand, if the indifference curves were straight lines with the slope of the internationally given prices, no foreign capital could be safely provided. In what follows, the discussion is restricted to cases where capital mobility is constrained by the threat of seizure and the equilibrium, determined with the help of equation 8, is as illustrated in Figure 2.
Figure 1

Traditional Trade Theoretic Depiction of Equilibrium
Figure 2
The ns Depiction of Equilibrium
3. **Comparative Statics**

The model of the preceding section provides a framework for understanding the determinants of capital transfer. A number of traditional conclusions on capital movements are reversed or modified when hostile actions are deterred by the loss of the trade option.

For instance, in a standard two-good, three-factor model a tariff increases the return to capital if the country imports the capital-intensive good. If foreign capital is safe from seizure, the increased return provides an incentive for capital inflow. As a result, trade and capital transfers are substitutes in this case.

In the ns model of section 2, however, trade and capital transfers are always complements as given by

**Theorem 1:** An increase in the tariff always lowers $K_f$.

**Proof:** A tariff lowers the benefits from trade. The nn curve is shifted down in Figure 2 since $\U^n$ falls for any level of $K$. The ss curve is unaffected.\(^4\)

This result suggests that outward oriented economies such as South Korea’s are able to sustain relatively more foreign investment than inward, import substituting economies.

Another contrast between a traditional approach and the ns model arises with respect to the effect of an increase in domestic capital ($K_o$) on foreign capital. When foreign capitalists do not need to consider the possibilities of hostile actions, an increase in domestic capital will generally lead to a one-for-one decrease in foreign capital, the total capital stock remaining constant. In the ns model, the response of total capital is always positive, and foreign capital can even increase as given by
Theorem 2: \[ \frac{dK}{dK_o} = \frac{\beta n^n \pi^n}{(n^s - n^n \pi^n K^n) + \beta n^n \pi^n} > 0 \]

Proof: The value of \( dK/dK_o \) is computed by total differentiation of the equations of section 2 with

\[ n^i = \frac{U^i}{y_i} \]

the income elasticity of utility,

\[ \pi^i_K = \frac{g^i_K}{y_i^i} \]

the profit share in national income and

\[ \beta = \gamma^o \eta^n. \]

The sign is determined from Figure 2 since an increase in \( K_o \) for a given \( K \) raises the nn curve but not the ss curve.

In the special case where the utility function is homothetic, \( \eta^s = \eta^n \) and a stronger result obtains:

Theorem 3: \[ 0 < \frac{dK}{dK_o} < 1 \text{ and } \frac{dK_f}{dK_o} < 0 \text{ iff } M \text{ is the importable} \]

while \( \frac{dK}{dK_o} > 1 \text{ and } \frac{dK_f}{dK_o} > 0 \text{ iff } F \text{ is the importable.} \]

Proof: As can be seen from Theorem 2, with \( \eta^n = \eta^s \) the magnitude of \( dK/dK_o \) relative to one is determined by the magnitude of \( \pi^n_k \) relative to \( \pi^s_k \).

To establish the relationship between \( \pi^n_k \) and \( \pi^s_k \), I construct a continuum of economies indexed by \( p_M \) so that the n-economy and the s-economy are both members of this set.
By varying $p_M$, one can move from the $n$-economy to the $s$-economy and observe the conditions under which $\pi_K$ rises or falls in the transition. In this way, I solve the problem of comparing two economies that appear to be separated.

Consider, then, all economies given by equations (1)-(5), $K=\bar{k}^E$ and $U=U^E$ with $\bar{p}$ endogenized to maintain $U=U^E$ and $p_M$ exogenous but varied.

Three members of this family of economies are illustrated in Figure 3.

Let $\pi_K \equiv \rho K/Y$, $Y$ given by (6a).

When $p_M$ and $\bar{p}$ equal their world values, $U=U^E$ and $\pi_K = \pi_K^n$.

When $p_M = p_M^S$ and $\bar{p} = 0$, $\pi = \pi^S$.

Now $\pi_K = \beta - \hat{Y} = \beta - m\hat{p}_M$ where $m$ is the average propensity to consume the $M$ good, a result derived by setting the log differential of $U(Y, p_M, p_F)$ to zero.

It is easily shown that in absolute values, $\beta > \hat{p}_M$, a variant of the magnification effect of Jones (1971).

When $M$ is imported, $\pi_K^S$ is reached from $\pi_K^n$ by increasing $p_M$ (see Figure 1) and so $\pi_K^S > \pi_K^n$ and $dK/dK_0 < 1$ from Theorem 2. When $F$ is imported the result is reversed.

Like Theorem 1, this result suggests that countries pursuing import-substituting strategies will obtain small increases in total capital relative to outward-looking countries. In this case, import substitution is achieved through a domestic investment program that favors the import-competiting
Figure 3

A Family of Economies Traced by Varying $\bar{\rho}$ and $P_M$ to Maintain $U = U^E$
sector, as in Nigeria. By contrast, for a country like South Korea, additional domestic investment means increased export orientation that can crowd in foreign investment.

It is valuable to consider the intuition behind Theorems 2 and 3. Total capital always increases because a change in $K_o$ only affects the level of $K_f$ that can be sustained to the extent that the value of the trade option is affected. Consider for purposes of argument the case where $dK/dK_o = 0$. If this case were to occur, the value of the trade option would be untouched, but with $K_f$ lowered the gain to seizing capital would fall. Consequently this result is impossible and $dK/dK_o$ is strictly positive. Now consider increasing $K$ from its initial level by increasing $K_f$ toward its initial level. If an increase in $K$ lowers the value of the trade option (i.e. when $M$ is the importable), $K$ can never rise so far as to restore $K_f$ to its original value. On the other hand, when increases in $K$ increase the value of the trade option ($M$ is the exportable), $K_f$ can be increased safely above its initial level.

The ns model and these results allow a formal investigation of the often-made assertion [e.g. Sachs (1981), pp. 243-7] that countries investing loans are better credit risks than those using them for consumption. Consider a country that borrows $D$ in an initial period, chooses to invest $0 < \alpha < 1$ of this debt ($K_f = \alpha D$) and to consume the rest in the initial period. The loan is due in the second period when the economy will look like the model of section 1 except that

\begin{equation}
(6a)' \quad Y^n = P_M M + P_F F - \bar{\rho}D.
\end{equation}

In this case, the effect of $\alpha$ on total debt is given by
Theorem 4: \[ \frac{dD}{d\alpha} = \frac{dK_f}{dK_0} \]

Proof: By total differentiation of the model.

Thus, only if the effect of an increase in \( K_0 \) is to crowd in foreign capital rather than to decrease it does an increase in \( \alpha \) increase foreign capital. As shown in Theorem 3, when utility is homothetic, the conjecture obtains if and only if \( M \) is the exportable. The intuition is clear: an increase in \( \alpha \) is equivalent to an increase in \( K_0 \) at a given \( \alpha \) and \( K_0 \). This result does not mean that the hypothesis of a positive relation between \( \alpha \) and \( K_f \) is unlikely to obtain - merely that it requires a special type of situation, namely countries for which increased investment means increased trade orientation. For instance, it might apply to NIC's that import natural resource based goods (F the importable) and export manufactures, but not to natural resource exporters.

Finally, among the results relating to changes in parameters directly associated with the capital stock, is

Theorem 5: An increase in the world return to capital, \( \bar{\rho} \), decreases \( K_f \) and \( U \).

Proof: In Figure 2, an increase in \( \bar{\rho} \) lowers the nn curve for any level of \( K \) while leaving the ss curve in its original position.

Hosts that take hostile actions may suffer additional penalties. In this case the ss curve will be lowered for any level of \( K \) while the nn curve will remain fixed. The equilibrium level of capital and of the host's utility will rise.

The effect of an increase in land is given by
Theorem 6: \[
\frac{dK}{dT} = \frac{n \pi T^n - n \pi T^s}{s \pi K^n - n \pi K^n + \beta n \pi K^n} \frac{K}{T}
\]

Proof: Computed as in Theorem 2 with \( \pi^i_T \equiv r^i T / y^i \).

In the case of a homothetic utility function

Theorem 7: \( \frac{dK}{dT} > 0 \) iff \( M \) is the importable

Proof: Continuing the discussion of Theorem 3, let \( \pi^i_T = r^i T / y^i \)

Then \( \pi_T = \hat{\pi} - n \hat{\pi}_M \) and \( \hat{\pi} \) is easily shown to be negatively related to \( P_M \), again a result that is analogous to the Jones magnification effect.

Thus if \( M \) is imported, \( \pi^S_T \) is reached from \( \pi^n_T \) by increasing \( P_M \) and hence \( \pi^S_T < \pi^n_T \). The denominator of Theorem 6 is always positive, see Theorem 2.

The intuition for this result is straightforward, since if \( M \) is the importable, an increase in \( T \) makes maintenance of the trade option relatively more valuable.

The effect of an increase in labor is given by

Theorem 8: \[
\frac{dK}{dL} = \frac{n \pi L^n - n \pi L^s}{s \pi K^n - n \pi K^n + \beta n \pi K^n} \frac{K}{L}
\]

Proof: Computed as in Theorem 2 with \( \pi^i_L \equiv w^i L / y^i \).

In contrast to the corresponding results for \( K_0 \) and \( T \), the formula for \( dK/dL \) is difficult to sign even in the case where utility is homothetic. In particular, the analogy to the Jones magnification effects remarked on in the proofs of Theorem 3 and 7 breaks down, and the characteristics of demand enter into the determination of the sign of \( dK/dL \). Sufficient conditions are given by
Theorem 9: If the M good is the importable and \[
\frac{\lambda_{LM}^T F M}{\lambda_{LM}^T F M + \lambda_{LF}^T K M F} < m
\]
everywhere then \(dK/dL < 0\). If \(M\) is the exportable and \[
\frac{\lambda_{LM}^T F M}{\lambda_{LM}^T F M + \lambda_{LF}^T K M F} > m
\]
everywhere then \(dK/dL > 0\), where \(m\) is the average propensity to consume \(M\), \(\lambda = L_j/L\), \(\theta_{ij}\) is the share of the \(i\)th factor in the value of good \(J\), and \(\sigma_j\) is the elasticity of substitution.

Proof: Consider again the set of economies constructed in Theorem 3.

\[\hat{\pi}_L = \hat{w} - \hat{Y}\], where \(w\) is the wage. It can be shown that

\[\hat{w} = \frac{\lambda_{LM}^T F M}{\lambda_{LM}^T F M + \lambda_{LF}^T K M F} \hat{P}_M\], and that

\[\hat{Y} = \pi \hat{P}_M\].

Therefore, if \(M\) is imported \(\pi^S\) is reached from \(\pi^n_L\) by increasing \(P_M\) and if in addition the inequality condition of the theorem is everywhere positive then \(\hat{\pi}_L > 0; \ \pi^S > \pi^n_L\) and \(dK/dL < 0\). The other cases follow in a similar fashion.
4. Random Shocks, the Breakdown of Deterrence and the Occurrence of Hostile Acts

In a world without uncertainties, rational investors will ensure that foreign investment never occurs to a point that seizure becomes optimal. When various variables are random, however, investors may invest knowing that if certain eventualities occur the host may choose to seize capital. In this case, investors will require that they are compensated for the risk of loss by correspondingly high returns in situations where they retain control of their capital. A thorough investigation of this type of equilibrium is a complicated task beyond the scope of this paper. In what follows, I indicate some types of issues that arise.

Denote the random variable affecting seizure by \( \theta \), with \( \theta \in \Theta \) the set of events that do not lead to seizure while \( \theta \in \tilde{\Theta} \) are the remaining events that do lead to seizure. For instance, the country's terms of trade could be random or domestic production of either good could be subject to shocks. Depending on the type of investment and the structure of contracts, the return owed to foreigners could also be random. With syndicated bank loans, the interest rate on fairly long-term loans is recalculated at given intervals as a fixed markup over the prevailing LIBOR, a short-term rate. As is well-known, many current reschedulings are related to the particular interest-rate outcomes that this system has generated; whether some of these episodes will result in outright repudiations is an open question. In the case of direct investments, the investor's return depends on the success of the project, and hence on production and price shocks.

What are the characteristics of states of nature that result in seizure? Assume a given value of \( K_F \), implicitly chosen if investors are risk neutral so that their expected returns taking into account the probability of seizure just equals the expected return on alternative investments. Sections 2 and 3
can be used to provide an analysis. If the only variable that is random is $\tilde{\sigma}$, then clearly relatively high values of $\tilde{\sigma}$ will lead to hostile acts. In the case of the terms of trade, or production shocks, however, extreme values in either direction will lead to a relatively high valuation of the trade option and so intermediate values of these variables will be associated with hostile acts.

This last observation leads to the result that mean-preserving increases in uncertainty can increase the amount of foreign capital provided to the economy, possibly making a risk-averse host better off. For instance consider the model of section 2 in which the terms of trade are fixed, yielding a particular value of $K_F$. Compare this to a situation of an uncertain $P_M$ with the same mean, but taking a high value in which the country exports the M-good and a low value in which it exports the F-good. The country may value trade more in each case in comparison to the mean $P_M$, thereby making a higher value of $K_F$ possible.
5. **Conclusions**

This paper has provided a framework for analyzing impediments to capital mobility arising from hostile actions taken against foreign investors by host countries when these actions are deterred by trade retaliation. Both countries and investors have been assumed to be rational, calculating agents. The implied characteristics of countries that lead to greater foreign investment have been identified. The processes involved can be rather complex. For instance, an increase in domestically owned capital decreases foreign investment if the country imports the capital-using good but actually increases foreign investment if the capital-using good is exported.

In the future I hope to extend the observations in section 4 to a formal theory of the determinants of the probability of hostile actions as well as the quantity of foreign investment in situations of uncertainty.
NOTES

1. Other sanctions include a loss of access to capital in the future arising from the acquisition of a bad reputation. For a detailed examination of this mechanism see Eaton and Gersovitz (1981a and 1983). In the case of direct investments, investors may be able to withdraw irreplaceable managerial or other specialized factors that are foreign owned and cannot be seized. This penalty can also support a certain amount of foreign investment; see Eaton and Gersovitz (1984).

2. On the doctrine of sovereign immunity see Brownlie (1979, chs XV and XVI) and Stevenson and Browne (1980).

3. Note that foreign investors are assumed to receive their opportunity cost of capital, rather than the domestic marginal product (see equation 6a). The latter is higher if capital mobility is constrained. A host facing many competitive investors is always in a position to ensure only a return of \( \delta \) by taxing capital. Further, this tax on capital actually increases the amount of foreign capital the country can obtain. Without this tax, the \( n = n \) curve of Figure 2 would be lower for any given \( K \) since the return to \( K_f \) would be higher. Consequently, without the tax, the equilibrium value of country welfare and foreign investment would also be lower. For a longer discussion of this point, see Eaton and Gersovitz (1984).

4. Note that there is no need to consider the possibility of immiserizing foreign investment in the proof of this proposition. For instance, Brecher and Diaz (1977) show that tariff-induced foreign investment in a two-good, two-factor model always decreases welfare relative to free trade. In the same way, in the model of this paper, once a tariff
is imposed the \( n \) curve need not be monotonically increasing up to \( K^* \), the perfect capital mobility level of capital. But if one considers a family of \( nn \) curves, each indexed by a tariff, it is still true that, for a given level of \( K \), \( nn \) curves corresponding to successively higher tariffs are lower. Since the \( ss \) curve is upward sloping and invariant to the tariff, this property of the \( nn \) curves ensures that the result of Theorem 1 holds.

5. It is easily shown that the value of \( \eta \) decreases along an indifference curve like \( U^S U^R \) of Figure 1 as \( p_M \) falls iff the \( M \)-good has an income elasticity less than one. That is, \( \eta^R < \eta^S \) if \( M \) is the importable and is income inelastic. Since \( \pi^S_K > \pi^R_K \) if the \( M \)-good is the importable, Theorem 3 part 1 holds for income inelastic \( M \). If, on the other hand, the \( M \)-good is highly income elastic, the results of Theorem 3 part 1 could be reversed. If \( F \) is the importable and \( M \) is income elastic, the result of Theorem 3 part 2 could also be reversed, with \( dK/dK_0 < 1 \) possible. The expectation is that \( M \), the capital-intensive good, is indeed elastic, so that demand factors do work to reverse the results of Theorem 3.

The intuition is that when \( M \) is income elastic and \( M \) is the importable, the increase in income consequent on an increase in \( K_0 \) makes trade proportionately more valuable, while if \( M \) is the exportable it makes trade less valuable.

6. In the model of Eaton and Gersovitz (1984), mentioned in fn. 1, foreign capital is crowded in if capital and managerial labor are Hicksian complements. In the reputation-based model of Eaton and Gersovitz (1983),
an increase in domestic capital always lowers foreign capital. Thus there would seem to be no strong presumption that increased domestic investment improves a country's credit rating in the sense of increasing foreign investment.

7. For similar conclusions in the context of very different models of imperfect capital mobility see Eaton and Gersovitz (1981a and 1984).
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