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# FOREIGN DIRECT INVESTMENT AS A COMMITMENT MECHANISM IN THE PRESENCE OF MANAGED TRADE

Joshua Aizenman

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## ABSTRACT

The purpose of this paper is to evaluate the degree to which the threat of managed trade leads to foreign direct investment (FDI) in a time-consistent manner. We study the role of capital mobility in a two-countries world economy characterized by monopolistic competition. Investment decisions are implemented ex-ante, prior to the realization of productivity shocks. International trade among the countries is the outcome of either free or managed trade. An endogenous switch from free to managed trade may occur ex-post as the outcome of a cost-benefit assessment of the two countries. Under managed trade, the patterns of international commerce are determined as the outcome of costly bargaining. We identify time-inconsistent patterns of managed trade in the absence of capital mobility. Ex-post, one country will have the incentive to induce a switch to managed trade, the outcome of which is to reduce the expected welfare ex-ante. We demonstrate that capital mobility and the diversification of production achieved by the FDI alleviates this time inconsistency by reducing (potentially eliminating) the ex-post incentive of one country to switch to managed trade. Our analysis suggests that FDI induced by the threat of managed trade benefits ex-ante both the host country and the multinationals, explaining the relative tolerance toward FDI.

Joshua Aizenman
Economics Department
Dartmouth College
Hanover, NH 03755
and NBER

The phenomenal growth of foreign direct investment (FDI) observed in recent years is a key ingredient in the growing integration of countries. Figure 1 summarizes the evolution of FDI in the last twenty-five years, describing the world flows of FDI in the reporting economies as a fraction of merchandise exports. While this ratio was stable throughout the twenty years preceding 1985, it almost doubled throughout the second part of the eighties. Concurrently, global FDI flows are matching the magnitude of portfolio investment.[1] These developments raise important questions that deserve further economic scrutiny: will the increased importance of FDI be reversed in the future? What accounts for the dramatic expansion of FDI? Are these developments welfare enhancing? An explanation advanced in the literature is that FDI serves to protect multinationals against the possibility of future adverse commercial policy.[2] While this motive may provide a valid interpretation for some FDI, it opens a Pandora's box of intriguing issues regarding the dynamic consistency of this argument. If multinational corporations are expanding FDI to reduce the prospect of adverse future commercial policies, and if governments are inclined to use these policies, why do governments tolerate FDI ? After all, they may preempt the multinationals by restricting their ability to engage in FDI. If FDI is implemented in the interests of multinationals, does that imply that it works against the interests of the host governments, suggesting a rationale for restricting capital mobility? An assessment of these issues requires the use of

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1. The data used in Figure 1 draws on various issues of the IMF yearly balance of payments statistics. The average FDI/merchandise trade ratios between 1965 and 1985 and between 1986 and 1990 are .0297 and 0.054, respectively. FDI is the world direct investment in the reporting economics, Mer. is world merchandise F.O.B. credit, and Por. is the world portfolio investment liabilities flows. The portfolio flows/merchandise trade curve starts from 1985 due to data availability constraints. I am thankful to Kellett Hannah for providing me with the data.

2. See, for example, Williamson (1986), Brander and Spencer (1987), Bhagwati et. al. (1987) and Wong (1987). For further research modeling the behavior of multinationals see Helpman (1984) and Ethier (1986). For empirical studies explaining FDI, see Horst (1971) and Lipsey and Weiss (1981) and Klein and Rosengren (1990).

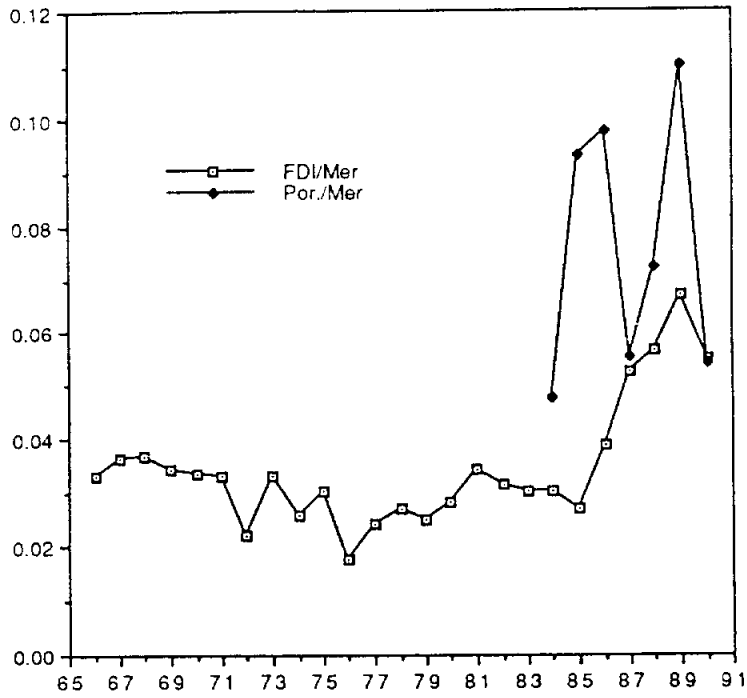


Figure 1

World FDI inflows/ Merchan. Export, 1966-1990, and
World Portfolio inflows/ Merchan. Export, 1984-1990

an intertemporal framework to deal with the incentives that determine the investment strategies of the multinationals, as well as government policies toward the multinationals and managed trade.

The purpose of this paper is to focus on the degree to which FDI is incentive compatible from the point of view of the host nation as well as the multinational, in a model where the regime switch from free trade to managed trade is endogenously determined. We consider a two-countries model, where investment decisions are implemented ex-ante, prior to the realization of productivity shocks. Ex-post, countries engage in free or managed trade. In a managed trade regime the international terms of trade are determined as an outcome of a costly bargaining. The notion of managed trade refers to the reliance on special protective measures as instruments of international trade policy.[3] These instruments include sectorial non-tariff barriers whose magnitude and duration is the outcome of negotiations, e.g. voluntary export restraints, orderly marketing arrangements, etc. While managed trade has many faces, a common feature of it is that it involves frequent negotiation. In our framework we model it as international trade determined by costly bargaining. The ex-post identity of the trade regime is determined as the outcome of a cost-benefit assessment of the two countries. We solve the model to identify the multinationals' incentives to engage in FDI, and the governments' incentives to tolerate or to interfere with the FDI.

The key message of our framework is that FDI may serve as a commitment device that solves time inconsistency problems associated with commercial policy. Ex-post, in the absence of FDI, frequently we will observe managed trade initiated by one of the countries, whose impact is to redistribute income. Ex-ante, the prospect of managed trade may reduce the expected welfare of both countries. FDI is a commitment device that solves this time inconsistency: the presence of FDI reduces (and potentially eliminates) the ex-post incentives to engage in managed trade. Hence, this paper supports the view of FDI as a commitment mechanism, reducing the chances of a future protectionist policy. A novel aspect of our analysis is the demonstration that FDI serves ex-ante the interests of *both* multinationals and the host countries in a world where the regime switch is endogenously determined.

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3. For further details on managed trade see Page (1987) and Bhagwati (1988). For a theory of managed trade as the outcome of tacit cooperation among nations that set their tariffs and quotas as the outcome of a repeated game, see Bagwell and Staiger (1990).

Section 1 outlines the building blocks of the model, describing preferences, the short-run production, and the long-run decisions facing risk-neutral entrepreneurs determining the productive capacity of the economy. Section 2 investigates the equilibrium in the absence of FDI (possibly due to restrictions on capital mobility), where the global market is characterized by either a free-trade or a bargaining regime. Section 3 analyzes the implications of the introduction of FDI. This is done by studying the operation of a mixed regime, where countries may switch endogenously from free trade to managed trade. To gain insight regarding the role of FDI we contrast the equilibrium in the presence of capital controls prohibiting FDI with the one in the presence of unrestricted FDI. Section 4 closes with concluding remarks.

## 1. The Model

We consider a two-country, a two-period, and a two-classes-of-goods model.[4] In the first period entrepreneurs face the investment decisions, determining the productive capacity of the economy in the second period. We start in period one, with a given endowment of good Z, denoted by $\bar{Z}$. This good serves as both the consumption and the investment good in the first period. Following the capacity decisions of period one, entrepreneurs will use the services of labor in the second period towards the production of differentiated products, denoted by D and indexed by i. For exposition simplicity we focus on a framework where agents are risk neutral and the supply of labor is inelastic. This enables us to obtain a closed-form solution for the bargaining outcome, simplifying exposition. Section 4 deals with the implications of relaxing some of these assumptions. We start by presenting the key behavioral assumptions of the model, describing preferences, production, and the nature of the uncertainty. We

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4. We construct an intertemporal version of Dixit-Stiglitz (1977) monopolistically competitive framework of the type applied by Helpman-Krugman (1989) in the international context. A version of this model was used in Aizenman (1992a) to investigate the impact of exchange rate regimes on the behavior of domestic investment and foreign direct investment (FDI) in the presence of Phillips curve, and the correlation between exchange rate volatility and investment.

close the section by characterizing the consumers' demand, producers' pricing decisions, and the expected utility.

1.1 Preferences

The utility of the representative agent is given by

$$(1) \qquad U = Z_1 + \frac{D_2}{1+\rho}$$

where $Z_1$ is the consumption of the homogeneous good at period one, and the subjective rate of time preference is reflected by $\rho$. The utility derived from consuming d varieties of the differentiated products is given by $D_2$:

$$(2) \qquad D_2 = \left[ \sum_{i=1}^{d} (D_{2,i})^{\alpha} \right]^{1/\alpha}$$

for $0 < \alpha < 1$ ; and $\rho > 0$. The term $D_{2;i}$ is the consumption level of variety i in period two. Each consumer is risk neutral, and is assumed to supply inelastically $\bar{L}$ units of labor.[5] Agents in the foreign country have the same utility.

1.2 Production

The production of the differentiated product in plants located in the home and the foreign economy, respectively, is given by a Cobb-Douglas function:

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5. A specification of the utility that encompasses the possibility of risk aversion is $U = Z_1 + \frac{(D_2)^{\beta}}{1+\rho}$ for $\beta \leq 1$. The assumption of risk neutrality ($\beta = 1$) simplifies the presentation. Allowance for risk aversion will not change the key results of the model , but will add a new dimension in the comparison between the possible regimes (see Section 4 for further discussion of this point).

$$(3) \quad D^{s}_{2,i} = \frac{1}{a}(L)^{\gamma} \quad ; D^{s*}_{2,i} = \frac{1}{a^{*}}(L^{*})^{\gamma} \quad \text{for } 0 < \gamma < 1$$

Henceforth, foreign values are indexed by an asterisk.

1.3 Investment, Uncertainty and the Producer's Problem

The investment is location- and product-specific, allowing the production of the differentiated product i at the chosen location. An entrepreneur may invest in one of the two countries, at a cost of K. Alternatively, in the absence of restrictions on capital mobility, entrepreneurs may diversify their productive capacity by investing both at home and in the foreign country at a cost of $K(1+\eta)$, for $\eta \leq 1$. A diversified producer operates as a multinational firm, having the capacity to produce his variety in both countries. [6] Entrepreneurs are risk neutral, and there is free entry. The uncertainty pertains to the future productivity of labor. The joint distribution of the shocks is symmetric, and is known to all agents in period one. Investment is implemented at period one, prior to the resolution of the uncertainty regarding the productivity in period two. A strategy of diversifying the investment can be viewed as

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6. The value of $1 - \eta$ measures the returns to scale, associated with the presence of fixed costs that may be shared by both locations. It is noteworthy that entrepreneurs may also increase their production capacity by investing at home in two plants, at a capital cost of $K(1+\eta)$. In the absence of transportation costs, and in the absence of uncertainty, producers will be indifferent between choosing to produce in two plants operating at home, or one operating at home and one abroad. A small uncertainty (as well as small transportation costs) will suffice, however, to eliminate this indifference: producers who operate with two plants prefer to diversify internationally, benefiting from both the extra capacity and the spreading of country-specific shocks achieved via FDI.

"buying" the option of channeling production to the more productive location.[7] More formally, let us denote the real gross profits (revenue minus the wage bill) of a diversified and a specialized producer by $\pi^d$ and $\pi^{nd}$, respectively. A nondiversified equilibrium, where all producers specialize in one location, can be characterized by

$$(4a) \qquad E[\pi^{nd}] = K(1 + \rho_d)$$

$$(4b) \qquad E[\pi^d] < K(1 + \rho_d)(1 + \eta)$$

where E stands for the expectation operator, referring to the first-period expected level of second-period profits, and $\rho_d$ is the discount factor applied by investors. Equation (4a) is generated by the free entry, implying the break-even condition. Condition (4b) implies that the marginal producer does not have an incentive to diversify internationally. In the absence of restrictions on capital mobility, (4b) ensures the stability of the nondiversified equilibrium. Integrating the two conditions we infer that a nondiversified equilibrium is stable if

$$(5) \qquad \frac{E[\pi^d] - E[\pi^{nd}]}{E[\pi^{nd}]} < \eta .$$

Equation (5) indicates that the (percentage) gain from diversification falls short of the percentage increase of costs.

Applying the same logic, in the absence of restrictions on capital mobility, the diversified equilibrium is characterized by

$$(6a) \qquad E[\pi^d] = K(1 + \rho_d)(1 + \eta)$$

$$(6b) \qquad E[\pi^{nd}] < K(1 + \rho_d)$$

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7. Related models that focused on the entry-exit decisions facing entrepreneurs in the presence of volatile exchange rates are Dixit (1989) and Baldwin and Krugman (1989).

Or, that[8]

$$(7) \qquad \frac{E[\pi^d] - E[\pi^{nd}]}{E[\pi^{nd}]} > \eta \ .$$

We turn now to evaluate the interaction between managed trade and FDI. We begin by investigating the equilibrium in the absence of FDI (possibly due to restrictions on capital mobility), where the global market is characterized by either a free-trade or a bargaining regime.

1.4 Consumer's Demand

Consumption in the second period is characterized by the solution to

$$(8) \qquad \text{Max} \quad \left[\sum_{i=1}^{d} (D_{2,i})^{\alpha}\right]^{1/\alpha}$$

$$\text{s.t.} \quad \sum_{i=1}^{d} P_{2,i} D_{2,i} = IN_2$$

where $P_{2;i}$ , $IN_2$ are the second-period price of good i and the second-period income, respectively. The solution of the consumer's problem is:

$$(9) \qquad D_{2,i} = \left(\frac{\bar{P}_2}{P_{2,i}}\right)^{\sigma} \frac{IN_2}{\bar{P}_2},$$

for $\sigma = 1/(1-\alpha)$ and

$$(10) \qquad \bar{P}_2 = \left[\sum_{i=1}^{d} (P_{2,i})^{-\alpha\sigma}\right]^{-1/(\alpha\sigma)} .$$

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8. The intermediate case, where producers will be indifferent between the two investment strategies, will occur if all the inequalities in (5) and (6) are replaced with equalities.

The overall price index of differentiated products is $\bar{P}_2$. The consumer's utility function (1) is additive in the consumption of the homogeneous good in period one and the consumption of the differentiated products aggregate $D_2$. Applying (9) and (10) it follows that $D_2 = IN_2/\bar{P}_2$. This implies that, if we observe an internal equilibrium where goods are consumed in both periods, the real interest rate in terms of good Z must equal $1 + \rho$. At that interest rate, consumers are willing to postpone consumption to the second period, and the aggregate saving is determined by the investment. Henceforth we assume that the supply of the homogeneous good is large enough to induce an internal equilibrium, hence, $\rho_d = \rho$. [9]

1.5 Producer's Pricing

The producer of a differentiated product i has market power, facing a demand, the elasticity of which is $\sigma$ (see (9)). The condition for maximizing profits is that the value of the marginal product of labor (given by the product of the marginal revenue and the marginal product of labor) equals the wage. Applying (3) and (9) we can infer that the resultant supply of the differentiated product and the demand for labor (denoted by $D^s_{2;i}$ and $L^d_{2;i}$, respectively) are

$$(11) \qquad D^s_{2,i} = a^{-1/(1-\gamma)} \left(\frac{\alpha\gamma P_{2,i}}{W_2}\right)^{\gamma} \quad ; \quad L^d_{2,i} = \left(\frac{\alpha\gamma P_{2,i}}{a W_2}\right)^{1/(1-\gamma)}$$

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9. Note that the assumption of risk-neutrality implies that investment I in period one, generating real profits $\pi_2$ in the second period, will be undertaken if $E[\pi_2] - I(1 + \rho_d) \geq 0$. It can be shown that if the supply of Z is small enough, the Cobb-Douglas production function (defined by (3)) implies a corner solution where all Z is invested, and none is consumed in the first period. In such a case, the real interest rate is determined by the marginal productivity of capital. If the supply of Z is large enough to ensure positive consumption in period one, the real interest rate is determined by preferences (i.e., $\rho = \rho_d$). In such a case, the actual investment is determined by the demand for investment at that real interest rate.

where $\gamma' = \frac{\gamma}{1 - \gamma}$. The second period producer's real profits (denoted by $\pi_{2;i}$) are

$$(12) \qquad \pi_{2,i} = (1 - \alpha\gamma) \frac{P_{2,i}D_{2,i}}{\bar{P}_2} \quad .$$

The wage is determined as clearing the labor market. If there are m domestic producers, and if the aggregate supply of labor is denoted by $\bar{L}^S$, we obtain that

$$(11') \qquad D^s_{2,i} = \frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma} \quad .$$

1.6 Expected Utility

The two countries are symmetric ex-ante. Hence, we focuses on the symmetric equilibrium, where m producers operate in each country as nondiversified, and n operate as multinationals. The assumption of risk neutrality, and the fact that gross profits are a fraction $1 - \alpha\gamma$ of revenue imply that the expected utility from consumption is given by[10]

$$(13) \quad E[U] = \bar{Z} + \frac{\alpha\gamma}{1 - \alpha\gamma}[mK + .5nK(1 + \eta)].$$

Consequently, tracing the behavior of aggregate investment gives us information regarding the expected utility of consumption, or equivalently the expected net present value of real consumption.

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10. We obtain this result in several steps. First, we note that the first-period budget constraint is $Z_1 = \bar{Z} - mK - .5\,nK(1 + \eta)$, and that the break even condition is $(1 - \alpha\gamma)\,E\left[\frac{IN_2}{\bar{P}_2}\right] = mK + .5nK(1 + \eta)$. Equation (13) is inferred by applying the above equations to (1), using the result that $D_2 = IN_2/\bar{P}_2$, calculating the expected utility of consumption.

## 2 The Equilibrium in the Absence of Capital Mobility

We will study the equilibrium in several stages. First, we characterize the equilibrium with free trade in the absence of FDI. Next, we investigate the bargaining equilibrium in the absence of FDI, and determine the conditions under which we will observe a switch from free trade to a bargaining regime. This will provide us with the benchmark for the next section, where we will investigate the implications of removing the restrictions on FDI.

### 2.1 Free Trade

In the absence of capital mobility each country will produce m varieties. The equilibrium can be characterized by

$$\text{a.} \quad \frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma} = \left(\frac{\bar{P}_2}{P_{2,i}}\right)^{\sigma} \frac{IN_2 + IN_2^*}{\bar{P}_2} \quad , \quad i = 1,\ldots m$$

$$\frac{1}{a^*}\left(\frac{\bar{L}^s}{m}\right)^{\gamma} = \left(\frac{\bar{P}_2}{P_{2,j}}\right)^{\sigma} \frac{IN_2 + IN_2^*}{\bar{P}_2} \quad , \quad j = 1, \ldots, m.$$

(14) b. $$\bar{P}_2 = (m)^{-1/(\alpha\sigma)}\left[(P_{2;r})^{-\alpha\sigma} + (P_{2,r^*})^{-\alpha\sigma}\right]^{-1/(\alpha\sigma)}$$

c. $$IN_2 = m\, P_{2,r}\, \frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}; \qquad IN_2^* = m\, P_{2,r^*}\, \frac{1}{a^*}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}$$

d. $$E\left[(1 - \alpha\gamma)\frac{P_{2,i}}{\bar{P}_2}\frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}\right] = K(1 + \rho)$$

Condition (14a) is the goods-market equilibrium, equating the supply to the sum of the domestic and the foreign demand (as inferred from (9) and (11)). A similar condition applies for foreign varieties. Equation (14b) is the consumer CPI index, obtained from (10), where r and r* stand for a representative variety produced at home and abroad. The income equals the GNP, as given by (14c). Free entry implies that expected rents are zero, as is postulated by (14d). This is the condition determining the equilibrium number of producers. System (14) comprises six simultaneous equations that can be applied

to determine {m, IN, IN*, $P_I$ , $P_{I^*}$ and $\bar{P}$}.[11] Applying (14a) we infer that the terms of trade are given by

$$(15) \quad \frac{P_{r^*}}{P_r} = \left(\frac{a^*}{a}\right)^{1/\sigma} .$$

Further insight is gained by focusing on the simplest stochastic example: two states of nature, with a negative correlation between the domestic and foreign shocks[12]:

$$(16) \quad \left(\frac{1}{a}, \frac{1}{a^*}\right) = \begin{cases} (1+h,\ 1-h) \\ \text{or} \\ (1-h,\ 1+h) \end{cases} \text{, with equal probabilities } (1 > h > 0).$$

Solving system (14) for the above example we obtain that the number of varieties produced in each country is given by

$$(17) \quad m_{|FT,\,CC} = \left[\frac{.5(1 - \alpha\gamma)(\bar{L}^{s})^{\gamma}}{K(1+\rho)} H\right]^{\frac{\alpha}{\alpha(1+\gamma)-1}} \qquad \text{for } H = \left[(1+h)^{\alpha} + (1-h)^{\alpha}\right]^{1/\alpha}$$

where index FT,CC stands for a free-trade regime (FT), in the presence of capital controls (CC).
We will henceforth assume that the various heterogeneous goods are close substitutes, and that the labor share is large enough that $1/(1+\gamma) < \alpha$ . This assumption is needed in order to insure that a higher

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11. Note that condition (14a) provides 2m equations, characterizing the market equilibrium for the 2m varieties. The symmetry of the problem reduces (14a) into two equations, describing the equilibrium demand/supply condition for the representing domestic and foreign variety, r and r*.

12. The simplicity of the example enables us to focus on a closed-form solution, discarding the need to use approximations. Our results can be shown to apply to richer stochastic environments, with any number of states of nature, and can be readily extended to the case of a positive correlation.

capacity cost K will reduce the number of varieties offered.[13] Applying (14) we can infer the second-period utility of the representative consumer in the home and the foreign country:

$$
\begin{aligned}
D_2|_{FT,\,CC} &= \left(\frac{\bar{L}^s}{m}\right)^{\gamma} (m)^{1/\alpha}\, H \frac{(a^*)^{\alpha}}{(a)^{\alpha} + (a^*)^{\alpha}} \\
(18) \qquad & \\
D_2^*|_{FT,\,CC} &= \left(\frac{\bar{L}^s}{m}\right)^{\gamma} (m)^{1/\alpha}\, H \frac{(a)^{\alpha}}{(a)^{\alpha} + (a^*)^{\alpha}}
\end{aligned}
$$

where m is given by (17). Figure 2 summarizes the dependency of the expected utility on the volatility of shocks (measured by h). Curve FT,CC corresponds to a free trade regime in the absence of capital mobility. This curve is obtained by applying (17) to (13). From (17) it follows that a higher volatility will reduce welfare. This result relates the concavity of real profits with respect to productivity:[14] Volatility reduces expected profits, inducing a lower number of varieties and reducing the aggregate capital.[15]

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13. It can be shown that the elasticity of expected real profits with respect to the number of varieties is $[1 - \alpha(1+\gamma)]/\alpha$ . If the demand for the various varieties is relatively inelastic, more varieties will reduce the labor employed in the production of a representative variety, raising thereby profits. This will have the consequence that profits will go up with the number of varieties, and that a higher capacity cost will imply more producers. The assumption that varieties are close substitutes rules out this outcome, and plays a similar role to the Marshall-Lerner condition in trade theory.

14. Recall that our agents are risk neutral, implying that at given relative prices, income volatility does not affect the expected utility. The impact of volatility is dependent on the endogenous adjustment of prices induced by productivity shocks, and is determined by the substitutability among the various goods (i.e., by $\alpha$). As we approach perfect substitutability, the elasticity of curve FT,CC. approaches infinity.

15. Throughout the analysis we are assuming that producers find it optimally to operate only one plant. Formally, we require that $E\left[(1 - \alpha\gamma)\frac{P'_{2,i}}{\bar{P}_2} 2\, \frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}\right] < K(1+\rho)(1+\eta)$, where P' is the

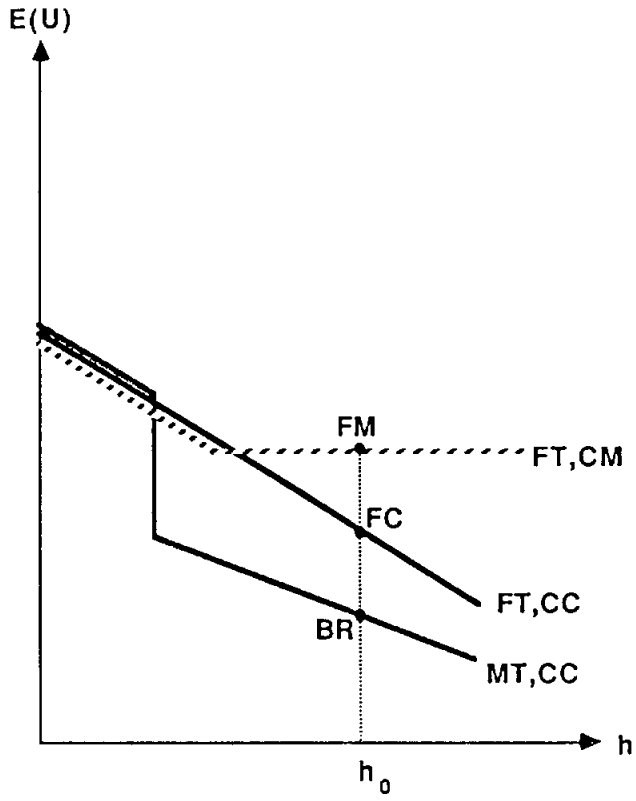


**Figure 2**

FT,CC - Free Trade, Capital Controls
MT,CC - Managed Trade, Capital Controls
FT,CM - Free Trade, Capital Mobility

2.2 Bargaining Equilibrium, No Capital Mobility:

We turn now to analyze the operation of a mixed regime, where countries may switch endogenously from free trade to managed trade. In such an environment the global market is characterized by either a free-trade or a bargaining regime. The bargaining outcome is derived by the Nash bargaining framework, where the *status quo*, disagreement point is the autarky.[16,17] Bargaining is costly, and we assume that the bargaining process will reduce the endowment of each country by a factor of b. The switching rule determining the prevailing equilibrium is that we will observe a bargaining outcome if for *either* party the bargaining utility exceeds the competitive free-trade utility, and if for *both* parties the bargaining outcome yields welfare that at least equals the autarky level. The

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price of a producer that operates two plants, and $\eta$ is the cost increase associated with the extra capacity. This price is determined by the condition that $2\frac{1}{a}\left(\frac{\bar{L}}{m}\right)^{\gamma} = \left(\frac{\bar{P}_2}{P'_{2,i}}\right)^{\sigma} \frac{IN_2 + IN^*_2}{\bar{P}_2}$. Applying these conditions and (14) we infer that the producer will operate only one plant if $2^{\alpha} - 1 < \eta$. Henceforth we assume that this condition applies.

16. See Nash (1950) and Roth (1979). The solution of this bargaining problem is obtained by the allocation that maximizes the products of the trade gains for each party (relative to the *status quo*, or the disagreement allocation). Although the cooperative Nash equilibrium concept applied here is a static one, the perfect equilibrium in the noncooperative alternating-offers game approaches the Nash bargaining solution when the interval between offers is short. If the time discount rates of the two parties differ, the perfect equilibrium approximates the asymmetric Nash bargaining equilibrium (see Binmore, Rubinstein and Wolinsky (1986)). Our key results continue to hold if we use the asymmetric bargaining Nash equilibrium concept.

17. The *status quo* allocation has been also referred to in the bargaining literature as the disagreement or the threat point. For a useful discussion regarding the role of autarky as the *status quo* in trade models, see Dixit (1987).

decision regarding the regime switch and the bargaining itself is carried out by a centralized decision maker (like the government). With the exception of these decisions, all the allocations are the outcome of competitive conduct of the private sector. Hence, in a bargaining regime, bargaining determines the international trade and the resources available to each country. The domestic allocation of these resources among the various activities is determined by the competition among domestic agents. A useful characteristic of the solution is that it is a Pareto-efficient allocation [see Roth (1979)]. This efficiency refers only to the temporal allocations: in both the competitive free-trade and Nash bargaining regimes, the welfare of one nation cannot be raised without reducing the welfare of the second nation with exogenously given stocks of capital and with the given regime.

The Appendix uses the Pareto efficiency feature of the global equilibrium to characterize the efficient allocations. It is shown that all the Pareto allocations are characterized by the share s of the global supply of goods consumed by the home economy. For a given share s, the second-period utility of the home and the foreign consumers is given by

$$(19) \quad D_2 = s(1-b)\left(\frac{\bar{L}s}{m}\right)^{\gamma}(m)^{1/\alpha}H \qquad \text{and}$$

$$(20) \quad D_2^* = (1-s)(1-b)\left(\frac{\bar{L}s}{m}\right)^{\gamma}(m)^{1/\alpha}H \ .$$

Applying the concept of Nash bargaining equilibrium we conclude that the equilibrium s is determined by finding the share that maximizes the Nash product:

$$(21) \quad \underset{s}{MAX} \ [D - D_{sq}][D^* - D^*_{sq}],$$

subject to

$$(21') \quad \{D > D_a \ \& \ D^* > D^*_a\} \text{ and } \{D > D_c \text{ or } D^* > D^*_c\}$$

where ( $D_{sq}$, $D^{*}_{sq}$ ) are the *status quo* (disagreement) points' utility, ( $D_{a}$, $D^{*}_{a}$ ) are the autarky utility, and ( $D_{c}$, $D^{*}_{c}$ ) are the free-trade equilibrium utility of the home and the foreign country, respectively. Equation (21) finds the bargaining solution subject to the bargaining inducements conditions specified in (21'): to induce bargaining the resultant allocation must improve the welfare of each country relative to autarky, and the bargaining outcome must make one country better off relative to the free-trade outcome. The rationale for this rule is that if one party can benefit from the switch to bargaining from a free-trade regime, it will be able to induce the switch by threatening to move to autarky. For this threat to be credible, it must be the case that the other party will be better off with bargaining relative to autarky. If the bargaining inducement condition (21') is satisfied, the parties will bargain. The outcome of this process is to deliver the bargaining share determined by the maximization of the Nash product. If (21') is not satisfied, the bargaining solution is not attainable, and we will observe the free-trade allocation.

The bargaining process itself is associated with a cost, modeled here as a proportional drop of the endowment of each party at a rate b. The *status quo* (disagreement) point is taken to be the autarky utility, adjusted for the drop in endowment induced by bargaining.[18] From (1') it follows that the *status quo* allocations are given by

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18. There is a certain arbitrariness in the assumptions regarding the bargaining cost. It is modeled here as a lump sum drop in endowment that occurs once the two parties enter into a bilateral bargaining. Hence, the *status quo* point itself is affected by the decision to enter the process, and equals a fraction 1-b of the autarky utility. Our analysis can be carried out applying an alternative specification, assuming that the bargaining cost affects only the post-bargaining endowment, without affecting the autarky *status quo* point. It can be verified that the same qualitative results are obtained in both specifications. An important question is the credibility of the autarky threat. A way to deal with this issue is to note that the perfect equilibrium in the noncooperative alternating-offers game approaches the Nash bargaining solution when the interval between offers is short (see Binmore, Rubinstein, and Wolinsky (1986)). Hence, the bargaining outcome may be viewed as being determined by such a

$$(22)\quad D_{sq} = (1 - b)\left(\frac{L}{m}\right)^{\gamma}(m)^{1/\alpha}\frac{1}{a}\ ;\ D^{*}_{sq} = (1 - b)\left(\frac{L^{*}}{m}\right)^{\gamma}(m)^{1/\alpha}\frac{1}{a^{*}}$$

Manipulating (4), (5), (7), and (8) we find that the bargaining share $s_b$ is determined by the solution to

$$(23)\quad \underset{s}{MAX}\ \ln\left[s\,H - \frac{1}{a}\right] + \ln\left[(1 - s)\,H - \frac{1}{a^{*}}\right]$$

subject to the requirement that

$$(24)\quad s(1 - b)\,H > \frac{1}{a} \quad \text{and} \quad (1 - s)(1 - b)\,H > \frac{1}{a^{*}}$$

and

$$s(1 - b) > \frac{(a^{*})^{\alpha}}{(a)^{\alpha} + (a^{*})^{\alpha}} \quad \text{or} \quad (1 - s)(1 - b) > \frac{(a)^{\alpha}}{(a)^{\alpha} + (a^{*})^{\alpha}}$$

The terms in (23) measure the percentage increase in the production (relative to the *status quo* point) of the home and foreign countries, respectively. From (23) it follows that if the bargaining inducements constraints (24) hold, the bargaining outcome is given by $s_b$:

$$(25)\quad s_b = .5\left[1 + \frac{1}{H}\left\{\frac{1}{a} - \frac{1}{a^{*}}\right\}\right].$$

Applying (24-25) it follows that as long as the substitutability between the differentiated products is limited (i.e., $\alpha < 1$) and the realized productivity differs across countries (i.e., $h > 0$), for bargaining costs small-enough the trade partners will observe a bargaining regime: one of the trade

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noncooperative process, where in the absence of agreement each party consumes the autarky GNP (net of the cost of bargaining).

partners will have the incentive to initiate bargaining. This threat to revert to autarky is credible enough to induce the second party to bargain.[19] We can review the two regimes with the help of the Edgeworth Box in Figure 3, summarizing the gains from trade between the two countries. The horizontal and the vertical dimensions indicate the supply of the representative domestic and foreign varieties, $\{\frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}, \frac{1}{a^*}\left(\frac{\bar{L}^s}{m}\right)^{\gamma}\}$, respectively. Points H and F are the origins from the point of view of the home and the foreign countries, respectively. A point K in the box represents the allocation where the home and the foreign country residents consume a basket of all varieties. The consumption levels of each domestic and foreign variety for domestic and foreign residents are given by $\{C_d, C_f\}$ and $\{\frac{1}{a}\left(\frac{\bar{L}^s}{m}\right)^{\gamma} - C_d, \frac{1}{a^*}\left(\frac{\bar{L}^s}{m}\right)^{\gamma} - C_f\}$, respectively. The autarky allocation is represented by AU, and the free trade equilibrium is associated with international trade along the ray FT, yielding an equilibrium at point CM. The domestic and the foreign indifference maps associated with autarky are given by $U_a$ and $U_{a^*}$, respectively, whereas the contract curve is given by the diagonal HF.

If bargaining is costless, the bargaining regime will be associated with a point along the dashed portion of the contract curve, where the Nash product is maximized. For example, if the bargaining outcome is at point B, bargaining will have the impact of transferring income from the foreign to the domestic country. The bargaining outcome will be induced by the home economy, whose threat to revert to autarky is credible. Costly bargaining has the effect of shrinking the box. From the point of view of the home economy, point F shifts to F', and the status quo point is represented by point AU'. The outcome of the shrinking global pie is that the bargaining outcome will shift towards point H, from B to a point like $B_h'$. From the point of view of the foreign economy, point H shifts to point H', and the bargaining outcome shifts from point B to $B_f'$. The bargaining regime will prevail if the bargaining

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19. Further insight is gained by applying a first order approximation of (24) around $\alpha = 1, b = 0, h = 0$ for $s = s_b$, obtaining that conditions (24) will hold if $b < (2^{1 - (1/\alpha)} - \alpha)h$ and $b < 1 - \frac{2(1+h)}{2h + 2^{1/\alpha}}$. Note that for $.5 < \alpha < 1$, $(2^{1 - (1/\alpha)} - \alpha) > 0$. Hence, for $h > 0$ and $.5 < \alpha < 1$ bargaining occurs for a small-enough values of b.

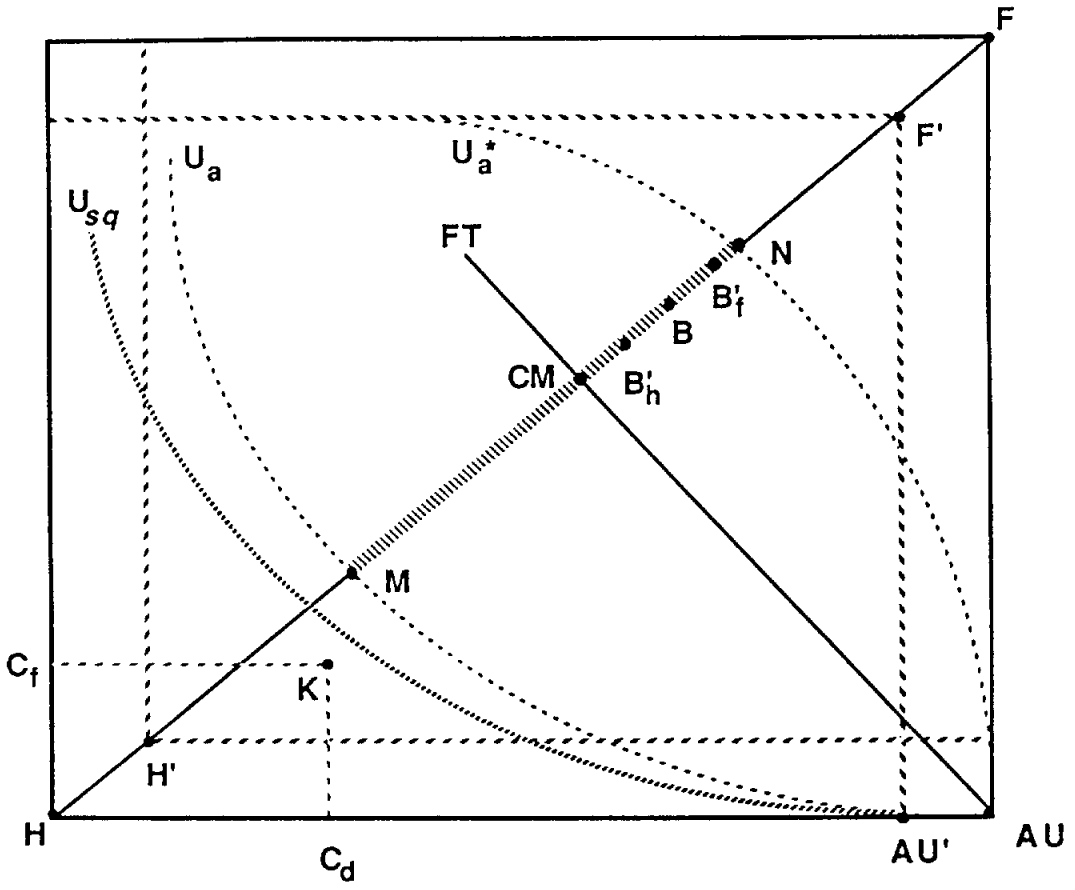


FIGURE - 3

COSTLY BARGAINING

inducements conditions hold. In terms of Figure 3, (21') will hold if point $B_f'$ is to the left of N, and $B_h'$ is to the right of CM.[20]

The scope for bargaining is determined by the magnitude of the gains from trade relative to the bargaining costs, and the degree to which the bargaining allocation differs from the competitive outcome. The gains from trade are related to the concavity of the indifference curve, and this curvature ultimately determines the size of the feasible bargaining range (as given by MN in the absence of costly bargaining). A key factor determining the curvature is the substitutability between domestic and foreign goods, as summarized by $\alpha$. With perfect substitutability, the indifference curves are straight lines, and hence MN shrinks to point CM. Lower substitutability increases the scope for gains from trade, enlarging MN. The impact of costly bargaining shrinks the global pie, reducing the gains from bargaining to the party that has the incentive to initiate it, and reducing the effectiveness of the autarky threat. If the shrinking effect is powerful enough relative to the gains from trade, it will eliminate the incentive to bargain.

We turn now to evaluate the ex-ante consequences of bargaining, assuming that the bargaining inducements conditions (24) are satisfied. In order to characterize the producers' behavior in the bargaining regime, we should specify the way that the bargaining outcome is implemented. We assume that the producers exchange their good for a foreign good according to the bargaining outcome. Hence, a representative domestic producer r, whose output is $D^{\delta}_{2,r}$, exchanges $(1 - s_b)D^{\delta}_{2,r}$ units of his product with $s_b D^{\delta}_{2,r^*}$ units of the foreign product. Hence, the real revenue of the domestic producer is given by

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20. If point $B_f'$ is to the right of N, the bargaining outcome is inferior to autarky for one of the countries (country F in Figure 3), implying that the bargaining regime is not incentive compatible. If $B_h'$ is to the right of CM, then the bargaining outcome is worse than the competitive outcome from the point of view of the country that has the incentive to bargain in the absence of bargaining costs (country H in Figure 3). Hence, the impact of costly bargaining is to eliminate the incentive to bargain.

$$(26) \qquad (1 - \alpha\gamma)\frac{s_b\{p_r D^s_{2,r} + p_{r^*} D^s_{2,r^*}\}}{\bar{P}_2}.$$

The free entry condition implies that in the equilibrium

$$(27) \qquad E\left[(1 - \alpha\gamma)\frac{s_b\{p_r D^s_{2,r} + p_{r^*} D^s_{2,r^*}\}}{\bar{P}_2}\right] = K(1 + \rho) \quad .$$

Applying (25) to (27) we infer that

$$(28) \qquad m|_{MT,\,CC} = (1 - b)m|_{FT,\,CC}$$

where $|_{MT,\,CC}$ denotes the managed trade (MT) regime, subject to capital controls. Recalling that the expected utility depends positively on the number of varieties, we infer that as long as bargaining is costly, it is associated with lower expected welfare relative to the case of the free-trade regime. Hence, in our model, bargaining is a costly rent-seeking activity. Ex-post, managed trade generates a costly redistribution of income across countries. Ex-ante, it reduces the expected welfare. In Figure 2, the effect of costly bargaining is to shift the expected welfare curve down at a rate of 1-b, from curve FT,CC to MT,CC.[21] This result suggests that there are potential gains associated with commitment mechanisms that will eliminate the ex-post incentive to bargain. We now evaluate the degree to which FDI in the presence of unrestricted mobility of capital will achieve this goal. Note that (28) implies that in the absence of bargaining costs the expected utility in the bargaining regime is the same as in the competitive free-trade regime. This result is model specific, and the concluding remarks discuss modifications that alter this outcome.

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21. Note that for small h relative to b bargaining will not occur. Hence, curve MT,CC coincides with FT,CC for $h \approx 0$.

3. Foreign Direct Investment and Managed Trade

Consider now the case where capital controls are absent, and producers may diversify internationally. If the benefits of diversification outweigh the costs, all producers will diversify. There will be n multinational producers, operating in both countries. The formal equilibrium conditions characterizing the diversified regimes are

$$\text{a.} \quad \left(\frac{1}{a} + \frac{1}{a^*}\right)\left(\frac{\bar{L}^s}{n}\right)^{\gamma} = \left(\frac{\bar{P}_2}{P_{2,i}}\right)^{\sigma} \frac{IN_2 + IN_2^*}{\bar{P}_2} \qquad , \quad i = 1,\ldots n$$

(29)

$$\text{b.} \quad \bar{P}_2 = (n)^{-1/(\alpha\sigma)} P_{2;r}$$

$$\text{c.} \quad IN_2 = n\, P_{2,r}\, \frac{1}{a}\left(\frac{\bar{L}^s}{n}\right)^{\gamma}; \qquad IN_2^* = n\, P_{2,r}\, \frac{1}{a^*}\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$$

$$\text{d.} \quad E\left[(1 - \alpha\gamma)\frac{P_{2,i}}{\bar{P}_2}\left(\frac{1}{a} + \frac{1}{a^*}\right)\left(\frac{\bar{L}^s}{n}\right)^{\gamma}\right] = K(1+\rho)(1+\eta)$$

$$\text{e.} \quad \frac{E[\pi^d] - E[\pi^{nd}]}{E[\pi^{nd}]} > \eta$$

where r stands for the representative variety. System (29 a-d) comprises five simultaneous equations that can be applied to determine {n, IN, IN*, $P_r$ and $\bar{P}$}. Multinational producers will produce in both countries; thus the supply of each good is the sum of the production in plants located in both countries (as indicated by (29a)). The CPI is modified in accordance with the presence of goods produced simultaneously in both countries. The zero expected rents condition (14d) recognizes that profits are due to production in both locations, and that the cost of capital goes up (at a rate of $\eta$) due to the needed investment in two plants. Equation (29d) is the stability condition: at the equilibrium, a marginal producer does not have the incentive to follow a nondiversified strategy. Solving the system for the special distribution given by (16) we infer that, with capital mobility, the number of producers operating in the diversified equilibrium is given by

$$(30) \qquad n|_{FT,\,CM} = \left[\frac{2(1-\alpha\gamma)(\bar{L}^s)^{\gamma}}{K(1+\rho)(1+\eta)}\right]^{\frac{\alpha}{\alpha(1+\gamma)-1}}$$

where CM stands for capital mobility. Applying (29) it follows that the condition for diversification is that

$$(31) \qquad \frac{2^{1+\frac{(1-\gamma)\alpha\sigma}{\sigma(1-\gamma)+\gamma}}}{(1+h)^{\frac{(1-\gamma)\alpha\sigma}{\sigma(1-\gamma)+\gamma}} + (1-h)^{\frac{(1-\gamma)\alpha\sigma}{\sigma(1-\gamma)+\gamma}}} > 1+\eta \ .$$

For a large enough volatility (as measured by h) all producers will diversify.[22] Comparison of (17) and (31) implies that if producers diversify internationally (i.e., if (31) is satisfied), then the aggregate investment with capital mobility exceeds the one with capital controls:

$$(32) \qquad K(1+\eta)n|_{FT,\,CM} > K\,2m|_{FT,\,CC} \ .$$

In Figure 2, the expected welfare in the presence of capital mobility is depicted by the dashed curve FT,CM. The diversification achieved with capital mobility implies that, in the presence of negatively correlated shocks, aggregate output of each variety and real profits are stabilized. As (31) and (32) reveal, for high enough volatility, curve FT,CM is above the other two curves. A smaller capacity cost of diversification (i.e., a smaller $\eta$) will shift curve FT,CM upward.

We turn now to evaluate the degree to which bargaining may occur with free capital mobility. Assuming that (31) holds, the representative multinational producing variety i will operate in both countries, producing $\frac{1}{a}\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$ and $\frac{1}{a^*}\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$ in the home and the foreign economy, respectively. Autarky will imply the equality of domestic output with the domestic consumption. Hence, the autarky utility level is

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22. Note that for h = 1 the LHS of (31) exceeds the RHS.

$$(33)\quad D_a = \left(\frac{\bar{L}^s}{n}\right)^{\gamma} (n)^{1/\alpha} \frac{1}{a} \; ; \; D_a^* = \left(\frac{\bar{L}^s}{n}\right)^{\gamma} (n)^{1/\alpha} \frac{1}{a^*} \quad .$$

The total pre-bargaining output of a given variety is $\frac{1}{a}\left(\frac{\bar{L}^s}{n}\right)^{\gamma} + \frac{1}{a^*}\left(\frac{\bar{L}^s}{n}\right)^{\gamma} = 2\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$. Similarly to our analysis in section 2.2, bargaining can be viewed as a process determining the division of the total output between the two counties, providing the home and the foreign countries with $s_b\,(1 - b)\,2\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$ and $(1 - s_b)(1 - b)\,2\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$, respectively.

If such a bargaining is implemented, it will yield a utility level of $D = s_b\,(1 - b)\,2\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$ and $D^* = (1 - s_b)(1 - b)\,2\left(\frac{\bar{L}^s}{n}\right)^{\gamma}$, respectively.

Inspection of the bargaining inducement constraints (21') reveals that they *fail* to hold. Hence, bargaining *will not* take place under these circumstances, because the threat to revert to autarky is not credible. There is no division of the global output that will make both countries better off relative to autarky. The rationale for this result is simple: with diversified production the gains from temporal trade disappear. In terms of Figure 3, with a diversified production, domestic and foreign goods are perfect substitutes. The indifference curve between domestic and foreign goods are straight $45^{o}$ lines, and hence the curve NM shrinks to point CM, eliminating the incentive to bargain. Hence, the threat to revert to autarky is not credible, due to the absence of gains from international trade.[23]

Applying (13), (28), and (32) we conclude that

$$(34)\quad \begin{array}{ll} \text{a.} & E[U]_{|FT,\,CM} \geq E[U]_{|FT,\,CC} \\ \text{b.} & E[U]_{|FT,\,CC} \geq E[U]_{|MT,\,CC} \end{array} .$$

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23. Note that an opportunistic regime may attempt to capture the profits of multinationals by imposing a tax on profits, nationalizing the industry. Such a tax loses its attractiveness if the production process used by the multinational is specific enough: the multinational can threaten to shift production entirely to the other country if such a tax is imposed ex-post. Our treatment assumed implicitly that due to the existence of this option (or due to other reasons) the host country abstains from nationalization.

Strict inequalities apply in (34a) if the volatility is significant enough (or if the cost of diversification is small enough), and in (34b) if bargaining is costly and the volatility is significant enough. In these circumstances, capital mobility has two distinct benefits: in addition to the standard benefits generated by higher aggregate investment, it eliminates the occurrence of costly bargaining. While (34b) applies even in the absence of capital mobility, the free-trade regime is not a time-consistent equilibrium, and frequently we will observe the inferior bargaining regime. In terms of Figure 3, if the volatility is $h_0$, in the absence of capital mobility we will observe the bargaining regime (being associated with expected welfare BR). With free mobility of capital, we will observe a free-trade, diversified equilibrium, and the expected welfare will be FM. While the ex-ante welfare with free trade, in the absence of capital mobility, is higher than the one associated with bargaining, (i.e., FC is above BR), the free-trade regime is not attainable ex-post in the absence of capital mobility. Hence, a beneficial effect of FDI is to enhance the credibility of the free-trade regime.

## 4. Concluding Remarks

This paper describes a model where FDI serves as a commitment device, the purpose of which is to solve the time inconsistency associated with commercial policy. Our model highlights the rent-seeking element of managed trade. It generated an outcome where, in the absence of transaction costs, the bargaining regime is associated with the same expected utility as the competitive free-trade regime. This result is model specific, the outcome of the various assumptions we use.[24] In more elaborate

24. In our model, output is independent of the regimes. Hence, the impact of bargaining is to change the division of a given pie. Therefore, in the absence of transaction costs, bargaining will not modify the expected utility. This result does not hold if agents are risk averse, or if the second-period consumption includes the homogenous good in addition to the differentiated products, or if international trade includes inputs. With risk aversion, bargaining will affect the expected utility because the volatility of income differs across free-trade and the bargaining regimes. Allowing for international trade in inputs, or the existence of the homogenous good in the second period implies that bargaining will affect the level of expected output. The diminishing marginal productivity of inputs implies that

models, even in the absence of transaction costs, bargaining will affect expected utility. The key result of our framework continues to hold in these models: the presence of FDI serves to diversify production internationally, with the byproduct of reducing the gains associated with nationalistic commercial policy. The welfare assessment of this result, however, will involve new channels. First, we will observe new benefits due to the ability of the multinational to shift production toward the more productive plants. Second, the various regimes are associated with different distributions of output and income across the various states of nature, and the welfare assessment of the various regimes should account for this effect.[25]

These arguments suggest that the expansion of FDI throughout the eighties may be viewed as a natural response to the growing concern regarding the emergence of managed trade. An important feature of FDI is that it benefits ex-ante both the host country and the multinationals. This may explain the relative tolerance toward FDI, and suggests that we should expect the continuation of the trend toward growing international diversification of production.

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bargaining impacts output, and it involves a division of a modified pie. Hence, unlike the case reviewed in the paper, the level of output and the expected utility differ across free-trade and bargaining regimes.

25. For further analysis of these channels in a different context see Aizenman (1992a, 1992b). The first paper deals with the welfare effects of the reallocation of production toward the cheaper plants achieved via FDI in a free trade regime. The second paper deals with an assessment of the international diversification of domestic shocks achieved in a free-trade versus a bargaining regime

## APPENDIX

The purpose of this appendix is to characterize the bargaining regime. Recalling that the bargaining outcome is Pareto efficient, we start by characterizing the allocation that maximizes the home country utility subject to a given utility level of the foreign country. Therefore, we maximize

$$\text{(A1)} \qquad \left[\sum_{i=1}^{d} (D_{2,i})^{\alpha}\right]^{1/\alpha}$$

subject to

$$\text{(A2)} \qquad \left[\sum_{j=1}^{d} \left(D^{*}_{2,j}\right)^{\alpha}\right]^{1/\alpha} = C_0$$

$$\text{(A3)} \qquad D_{2,i} + D^{*}_{2,i} = \frac{1-b}{a}(L_i)^{\gamma} \quad ; \sum_{i=1}^{m} L_i = \bar{L}^{s} \text{ for } 1 \le i \le m \qquad \text{and}$$

$$\text{(A4)} \qquad D_{2,j} + D^{*}_{2,j} = \frac{1-b}{a^{*}}\left(L^{*}_{j}\right)^{\gamma} \quad ; \sum_{j=1}^{m} L^{*}_{j} = \bar{L}^{s} \text{ for } 1 \le j \le m$$

where indexes i and j refer to home and foreign varieties, respectively. Equation (A3) corresponds to the supply constraints, where the sum of the consumption of the domestic varieties equals the supply, and the aggregate employment equals the supply of labor.[26] A similar condition applies for the foreign varieties, (A4). The formal solution to this problem is obtained by constructing the Lagrange function that corresponds to the five restrictions imposed by (A2-4), and maximizing the Lagrange function with respect to $D_{2,i}$ ; $D^{*}_{2,i}$ ; $D_{2,j}$ ; $D^{*}_{2,j}$ ; $L_i$, $L^{*}_{j}$, for $1 \le i, j \le m$. Collecting the various terms we obtain that in each country a fraction 1/m of its labor force is employed in the production of each variety, and that the ratios of the consumption of particulars varieties are equal across the two countries:

$$\text{(A5)} \qquad D_{2,j} / D^{*}_{2,j} = D_{2,i} / D^{*}_{2,i} \quad ; \text{ for } 1 \le i, j \le m \ .$$

The ratio in (A5) defines s/(1-s), where s is the consumption share of the home country. Applying (A5) to the budget constraints we infer, after tedious collection of terms, that:

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in a model where trade is confined to intermediate products, and trade dependency is endogenously determined.

26. We account here for the costs of bargaining as a drop in the productivity of labor.

$$(A6) \qquad s = 1 - \frac{C_0}{(1 - b)\, H\, m^{1/\alpha} \left(\frac{\bar{L}^s}{m}\right)^{\gamma}}.$$

Equation (A6) characterizes the share of global output consumed by the home economy for a given foreign country's utility $C_0$. By varying the utility level between 0 and $(1 - b)\, H\, m^{1/\alpha} \left(\frac{\bar{L}^s}{m}\right)^{\gamma}$ we change the share of global resources obtained by the home economy between 1 and 0, and trace the contract curve. Hence, Pareto allocations are associated with utility levels of $\{s(1 - b)\, H\, m^{1/\alpha} \left(\frac{\bar{L}^s}{m}\right)^{\gamma}; (1 - s)(1 - b)\, H\, m^{1/\alpha} \left(\frac{\bar{L}^s}{m}\right)^{\gamma}\}$ at the home and the foreign country, respectively. The bargaining process described in the paper determines the actual share.

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