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TIME INCONSISTENCY OF PROTECTIONIST PROGRAMS*

AARON TORNELL

INTRODUCTION

Protectionist trade policies have long been advocated as second best instruments to achieve certain national objectives in situations where there is a market imperfection. In essence, protection provides time and resources for firms to undertake cost-reducing investments. Recently there has been an emergence of new arguments to justify the implementation of “a national industrial policy” to encourage investment and to ensure the competitiveness of targeted industries. Also, at the theoretical level a new argument known as “strategic trade policy” has emerged. According to this argument, protectionism gives domestic firms strategic advantage against foreign firms to capture a greater share of export markets where rents are not competed away.¹

Actually, the performance of protectionist programs has been grim. Industries have not adapted, and protection has had to be renewed again and again. Arguments justifying protection have avoided this issue by implicitly assuming that authorities can credibly precommit to eliminate protection. This is a very strong assumption. In fact, government actions are not exogenous, but they are rather the result of an optimization process, or they are best responses to political pressures, as stressed in the public choice literature.² Therefore, if authorities capitulate to protectionist pressures in the present, they are unlikely to resist them in the future, in the event that the targeted firm would not have adapted.

The inability of authorities to precommit to the unconditional elimination of protection generates a trade-off for the firm. If, during the program, the firm does not invest sufficiently in cost

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1. This argument was originally developed by Spencer and Brander [1983]. For a survey of the recent developments, see Helpman and Krugman [1989].

2. According to this literature, protection reflects not national welfare maximization, but rather pressure by special interest groups. This has been formalized by Bhagwati and Srinivasan [1980], Brock and Magee [1980], Findlay and Wellisz [1982], Krueger [1974], and Rodrik [1986]. For recent surveys see Bhagwati [1988], Baldwin [1985], and Hillman [1989].

reductions, then it gains a renewal of future protection, and it saves the opportunity cost of capital. It loses, however, the benefits derived from cost reductions. If, at the margin, the gains are greater than the losses, then the firm will inevitably choose not to invest sufficiently. In this case, a protectionist program that was intended to be temporary becomes "time inconsistent." This happens because the original plan of eliminating protection will no longer be optimal when the future actually arrives; i.e., authorities will have to renew protection.

If an argument is to provide a valid justification for protection, it must prove that the protectionist program is time consistent. Some proponents of activist industrial policies, recognizing this, have suggested that protectionist programs should not only give breathing time and rents, but should instead consist of subsidies that are granted only if the firm made cost-reducing investments, i.e., "investment-contingent subsidies."³

In this paper we analyze whether the introduction of an investment-contingent subsidy renders a protectionist program time consistent or not. Obviously, if authorities could credibly precommit just to grant investment-contingent subsidies in the future, and no other type of subsidies, then these subsidies would bring about time consistency because the above-mentioned trade-off would disappear: although a reduction in current investment induces a renewal of protection, such protection will only be obtained by investing in the future. Since this deviation just implies a delay of investment, as well as a delay in obtaining the additional investment-contingent subsidy, it follows that the firm will not find it profitable to reduce investment.

Note, however, that a protectionist program cannot just promise to grant investment-contingent subsidies in the future because it takes time for investment to reduce costs and because firms in "need" of protection are not able to obtain resources from the capital market. The program must also consider that, in case of failure, there would be a need for a "bailout" in order to allow the firm to operate in the short term. This bailout must consist of a general and front-end-load subsidy, which would be granted before

3. For example, according to Zysman and Tyson [1983]: "Sector-specific programs that provide specific gains to firms in the name of facilitating adjustment should be linked to obligations to spend those funds on adjustment activities . . . Policies must be made conditional upon certain well-defined business responses, such as explicit tax breaks for reinvestment in research and development in a specific sector."

investment takes place; i.e., the bailout could not be an investment-contingent subsidy.

Given the possibility that firms have of inducing future bailouts, it follows that the introduction of investment-contingent subsidies does not necessarily eliminate time inconsistency. This happens because the renewal of protection will not be investment-contingent as considered above. Therefore, the trade-off mentioned at the beginning reappears: if the firm reduces investment, it gains the rents generated by the renewal of protection, and it saves the opportunity cost of capital. However, it loses due to higher future costs, and also it loses part of the investment-contingent subsidy.

In this paper we show that a protectionist program in which the investment-contingent subsidy is designed, assuming away the possibility of future bailouts, will fail to induce the firm to invest sufficiently in cost reductions. Thus, protection will have to be renewed.

Staiger and Tabellini [1987] and Matsuyama [1990] also analyze time inconsistency problems. Staiger and Tabellini show that when protectionist policies are time inconsistent it might be optimal for authorities to choose tariffs over production subsidies, which would otherwise be the optimal policy. Matsuyama addresses the issue of whether or not there exists a sequence of credible government threats to liberalize in the future, which can support the pair {protect, invest} as a subgame-perfect equilibrium. His result is similar to ours; although a policy supporting {protect, invest} exists and can be subgame perfect, time inconsistency results because such a policy fails to be "renegotiation-proof."

In Section II we present the model. In Section III we analyze equilibrium in the case where authorities can precommit not to renew protection in the future. In Section IV we drop this assumption and prove the time inconsistency result. Finally, in Section V we present the conclusions.

II. THE MODEL

In this paper we do not model the political process that leads to protection. Instead, we concentrate on a particular firm and assume that, due to some political pressures, authorities have to induce, at all times, a certain level of employment in the firm: "the negotiated employment level" (\bar{N}). Once \bar{N} has been set, authori-

ties must implement a protectionist program that will induce a level of employment that is never lower than \bar{N} .⁴

Before introducing the model, we shall note that the notion of a negotiated employment level encompasses a variety of cases commonly discussed.

1. The case of injured or infant industries that need time and resources to make cost-reducing investments that will allow them, in the future, to “compete more effectively” in the world market.⁵ Targeting a higher \bar{N} is equivalent to demanding higher competitiveness, which in turn is equivalent to having a higher marginal product of labor.

2. The case of “strategic trade and industrial policy,” according to which, protection enables firms to capture a larger share of the world market in rent-earning industries. The desired share can be interpreted as \bar{N} .

3. The case of “sunset” industries in which protection is intended to allow the targeted industry to contract more gradually and thereby, to reduce the costs related to the reallocation of the specific resources it employs. In this case, \bar{N} represents displaced labor effectively reemployed in other sectors. Protection is intended to allow workers to be retrained, i.e., to induce investment in human capital.

Next, we introduce the model. To focus on the essentials, we consider only two periods and a profit-maximizing firm that is a domestic monopolist, but faces a perfectly competitive international market.

At the beginning of time t_0 the political process occurs, and \bar{N} is set for the targeted firm. Once this has occurred, the government implements a protectionist program that is supposed to end at time t_1 . The program consists of two parts: (i) an investment-contingent subsidy granted during t_0 ; and (ii) an announcement that protection will elapse in t_1 . Given this announcement, the firm chooses

4. Considering employment as the outcome of the political process is more appropriate than considering protection as the outcome. By doing so, authorities' long-run objectives play a role, because there is the possibility that protection will be eliminated if the firm adapts, even if the political process that led to protection does not change. Also, the negotiated employment level is in line with Baldwin's [1985, p. 31] view that: “The pattern of interindustry protection is influenced not only by differences among industries in their ability to succeed in the political marketplace but in their ability to compete in economic markets since the latter factor affects the perceived need for protection.”

5. This argument must rely on the existence of externalities or on a capital market imperfection that does not allow firms to finance their projects.

the level of cost-reducing investment and receives the investment-contingent subsidy according to this investment level. If the firm invested sufficiently at time t_0 , then the increase in the marginal product of labor will be such that, during t_1 , it will employ \bar{N} without protection. In this case, the protectionist program will be successful, and protection will not have to be renewed.

Now, we shall describe the technology: the firm produces a homogeneous good transforming labor and capital using a neoclassical production function. We assume that investment increases the capital stock with a one-period lag and that there are no installment costs of capital. Thus, all investment will be bunched at time t_0 . In addition, we assume that there is no depreciation; the initial capital stock is zero; and domestic demand is not binding. Under these assumptions we can express the firm's profits as⁶

$$(1) \quad \Pi = [\phi - r]K + r\{p[1 + \mu]F(N, K) - \omega N\},$$

During the first period the firm chooses its investment level (K); it incurs an opportunity cost of rK ; and it receives a subsidy of ϕK (the investment-contingent subsidy). During the second period, taking as given the capital stock and the domestic price ($p[1 + \mu]$), the firm chooses its employment level (N) in order to maximize short-run profits. The term μpF represents the gains from a renewal of protection, which will be analyzed in the next section. Note that we did not include in (1) a term corresponding to the first-period employment or to μ_0 . This is because from a t_0 perspective, μ_0 is just a bailout that is not contingent on investment. Therefore, the choice of K is independent of μ_0 .

III. PRECOMMITMENT REGIME

In this section we shall assume that authorities can precommit not to change their stated policy regarding μ once the future arrives. In terms of our model this is equivalent to a world where firms cannot induce bailouts. Thus, at time t_0 , taking as given the announced policies (i.e., ϕ and μ), the firm chooses K in order to maximize (1) subject to the condition that at time t_1 it will choose employment so as to equalize the marginal product of labor to the

6. The production function has the standard properties: $F_n > 0$, $F_k > 0$, $F_{nn} < 0$, $F_{kk} < 0$, $F_{nk} > 0$, and $F_{nn}F_{kk} - F_{kn}F_{nk} > 0$.

real wage. That is,

$$(2) \quad \frac{\partial \Pi^p}{\partial N} = rp[1 + \mu]F_n(\tilde{N}, \tilde{K}) - w = 0.$$

The firm will set its investment level so as to equalize, in the margin, the cost of investing with the value of future benefits:

$$(3) \quad \frac{\partial \Pi^p}{\partial K} = [\phi - r] + rp[1 + \mu]F_k(\tilde{N}, \tilde{K}) = 0.$$

The superscript p stands for precommitment.

Under the standard assumptions made in footnote 6, these equations implicitly define a unique optimal pair (\tilde{N}, \tilde{K}) , which is chosen by the firm for a given set of policies $\{\phi, \mu\}$.

Authorities have available an infinite number of combinations $\{\phi, \mu\}$ that induce \bar{N} . We shall assume that it is the authorities' objective that, at the end of the protectionist program, the firm should be able to meet international competition without further government intervention. Thus, authorities announce at time t_0 that μ will be set equal to zero.⁷

In order for the firm to have a level of employment equal to \bar{N} during t_1 , in the absence of protection, authorities must induce the firm to invest at time t_0 an amount (\bar{K}) such that the marginal product of labor would be equal to the real wage when $\mu = 0$. It follows from (2) that \bar{K} is implicitly defined by

$$(4) \quad F_n(\bar{N}, \bar{K}) = w/p.$$

In order to model the fact that the firm has low competitiveness, we assume that in the absence of intervention (if $\phi = 0$), the investment level chosen by the firm at time t_0 would be such that, at time t_1 , the optimal employment level (\tilde{N}) would be lower than the negotiated employment level (\bar{N}) if μ is zero. Thus, we make the following assumption:

$$(5) \quad pF_k(\bar{N}, \bar{K}) < 1.$$

Since authorities can precommit to set μ equal to zero, it

7. If we had modeled explicitly the process that led to protection, then the choice of a pair $\{\phi, \mu\}$ would depend on the authorities' loss function. Note, however, that the time inconsistency result stated in Proposition 1 is robust to the choice of the pair $\{\phi, \mu\}$. If at time t_0 authorities chose $\mu \geq 0$, only \bar{K} in (4) and the renewal-of-protection function (7) would have to be rescaled.

follows that the investment-contingent subsidy should be equal to the difference between the cost of capital and the benefits derived from future lower costs. It follows from the first-order condition (3) that

$$(6) \quad \phi^{mtm} = r[1 - pF_k(\bar{N}, \bar{K})].$$

Under assumption (5) this subsidy is positive. Following Corden [1974], we shall label it the "made-to-measure" subsidy. According to this principle, "The tariff structure would be tailored so that no industry or product is protected more than is 'necessary' " [p. 220].

It is clear from the model that, if the firm cannot induce a bailout and thus believes the announcement that protection will be eliminated at time t_1 regardless of its employment level, then an investment-contingent subsidy at a rate of ϕ^{mtm} will induce the firm to invest \bar{K} at time t_0 and employ \bar{N} at time t_1 .

IV. NONPRECOMMITMENT REGIME

In this section we drop the assumption that authorities can precommit to eliminate protection in the future (i.e., set $\mu = 0$ at time t_1), or equivalently, that firms cannot induce bailouts. This gives rise to a "renewal-of-protection" function that allows the firm to determine, by choosing K at time t_0 , the degree of protection it will get at time t_1 . This renewal of protection is not investment-contingent, but it is a bailout.

The renewal-of-protection function arises from the asymmetric bargaining power of both parties at time t_1 . Authorities are weak because they have to induce a level of employment not lower than \bar{N} . In contrast, the firm is strong because at time t_1 , the capital stock is fixed since investment increases the capital stock with a one-period lag. Thus, the firm can credibly threaten to employ less than \bar{N} if it does not receive protection.

The argument is as follows: at time t_1 the firm will optimally choose employment to equalize the marginal product of labor to the real wage. If μ was set equal to zero, it follows from (4) that the firm would employ \bar{N} at time t_1 only if it invested at time t_0 an amount equal to \bar{K} . If the firm chooses at time t_0 an investment level lower than \bar{K} , then the marginal product of labor at time t_1 will be reduced. Thus, at this latter date when the program was

originally scheduled to come to an end, authorities will have to impose an import tariff in order to raise the domestic price and induce \bar{N} .

This implies that at time t_0 , when choosing its investment level, the firm behaves as a Stackelberg leader facing the following renewal-of-protection function:

$$(7) \quad \mu(K) = \begin{cases} \frac{w}{pF_n(\bar{N}, K)} - 1 & \text{for } K < \bar{K} \\ 0 & \text{for } K \geq \bar{K}. \end{cases}$$

For $K < \bar{K}$, it follows from (4) and the fact that $F_n(\bar{N}, \bar{K}) < F(\bar{N}, K)$ that the above expression is positive. Also, since F_{nk} is positive, the function defined in (7) is decreasing with investment, meaning that less investment ultimately results in more protection. That is,

$$(8) \quad \mu'(K) = \begin{cases} -\frac{wF_{nk}(\bar{N}, K)}{p[F_n(\bar{N}, K)]^2} < 0 & \text{if } K \leq \bar{K} \\ 0 & \text{if } K > \bar{K}. \end{cases}$$

A. Time Inconsistency of Made-to-Measure Protectionist Programs

The existence of a renewal-of-protection function introduces a trade-off for the firm. On the one hand, by lowering its investment at time t_0 , the firm gains because it induces a higher protection rate at time t_1 . On the other hand, it loses due to a lower labor productivity. It also loses part of the investment-contingent subsidy. Next, we shall show that if protection is made-to-measure, then the gains from having protection renewed are greater than the losses. Therefore, the firm will set its investment at a level lower than \bar{K} , making the protectionist program time inconsistent.

To see why this is true, note that from the standpoint of the firm, investment is more expensive under the nonprecommitment regime. This is because under the nonprecommitment regime an increase in investment reduces future protection, while under the precommitment regime it does not. In different terms, under the nonprecommitment regime the cost of investment is r , while under the nonprecommitment regime it is $r - rp\mu'F$, which is higher than r since μ' is negative. The term $-rp\mu'F$ is the value of protection forgone by investing an additional unit of capital.

Consider a firm that made its decision under the precommitment regime and set its investment level equal to \bar{K} . Now, suppose that suddenly the firm finds itself in the nonprecommitment regime. Will it reduce its investment?

The gains of reducing investment from an initial position \bar{K} are

- i. an increase in the domestic price faced during t_1 :

$$\{-rp\mu' \cdot F(\bar{N}, \bar{K})\}dK;$$

- ii. a reduction in costs:

$$\left\{ r + rw \cdot \frac{dN}{dK} \right\} \cdot dK.$$

The losses are

- iii. a reduction in the investment-contingent subsidy received at time t_0 :

$$\phi dK;$$

- iv. a reduction in the rents received at time t_1 due to lower production:

$$rp[1 + \mu(K)]dF.$$

Given that, initially, $K = \bar{K}$, the gains in (ii) equal the losses in (iii) and (iv). To see why (ii), (iii), and (iv) cancel out, substitute $\mu(\bar{K}) = 0$ and $dF = F_n dN + F_k dK$, and subtract (iii) and (iv) from (ii) to get

$$r[w - pF_n(\bar{N}, \bar{K})]dN + [-\phi + r - rpF_k(\bar{N}, \bar{K})]dK.$$

Note that from the definition of \bar{K} (equation (4)), it follows that the first term in brackets is equal to zero. From the definition of the made-to-measure “ ϕ ” (equation (6)), it follows that the second term in brackets is equal to zero. Therefore, starting from \bar{K} , the renewal-of-protection effect will dominate, and the firm will optimally choose a lower level of investment. The net gain from reducing investment is $-rp\mu' \cdot F(\bar{N}, \bar{K})$. We can summarize this result as

PROPOSITION 1. Protectionist programs based on the made-to-measure principle are time inconsistent. The firm will find it optimal to have an investment lower than the one envisioned by the program in order to induce a higher protection rate in the future.

This is graphically shown in Figure I. The dotted curve with a maximum at \bar{K} , represents the profit function under the precommitment regime. The profit function corresponding to the nonprecommitment regime is identical to the former one for $K \geq \bar{K}$ because $\mu(K \geq \bar{K}) = 0$. However, it has a negative left-hand derivative at $K = \bar{K}$. Thus, it reaches a maximum to the left of \bar{K} . Its left-hand

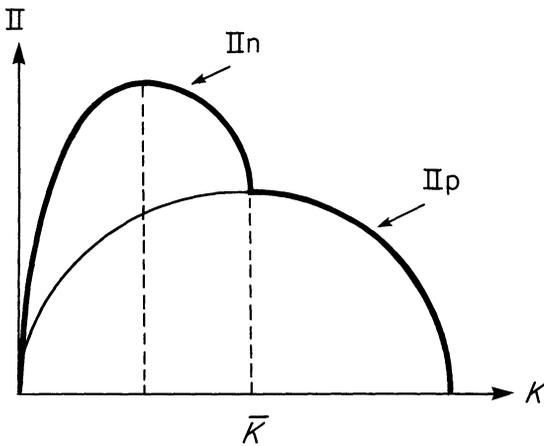


FIGURE I

derivative is equal to⁸

$$\frac{\partial \Pi^{np}(\bar{N}, \bar{K})}{\partial K} = rp\mu'(\bar{K}) \cdot F(\bar{N}, \bar{K}).$$

Note that this is equal to the net gains from reducing investment considered above.

An issue on the agenda for future research is whether or not the time inconsistency, considered in this paper, can be eliminated with oversubsidization of investment above the made-to-measure level. The two-period model we have analyzed is not appropriate to address this issue. It implicitly assumes that authorities can precommit not to grant investment-contingent subsidies in the future.⁹ We need to recognize, however, that if it is optimal to grant a high investment-contingent subsidy in the present, it will also be optimal to oversubsidize in the future. To model this correctly, the

8. The concavity of Π^p does not imply the concavity of Π^{np} . However, the concavity of Π^{np} is not necessary for the validity of Proposition I, it is sufficient that the slope of Π^{np} at K is negative. Note that $\Pi_{kk}^{np} = \mu F_{kk} + 2\mu' F_k + \mu'' F$. Since the first two terms are negative, a sufficient condition for Π_{kk}^{np} to be negative is that $\mu'' < 0$, which is equivalent to $F_{nkk} \cdot [F_n]^{-2} > 2F_{nk}$.

9. Since, in the model considered, the investment-contingent subsidy at time t_1 is zero by assumption, the time inconsistency can be eliminated by offering an investment-contingent subsidy higher than the made-to-measure one, by an amount only greater than the value of a bailout. If the firm invested less than \bar{K} , it would lose an investment-contingent subsidy, which is higher than the value of the bailout it would receive.

horizon would have to be lengthened. With a longer horizon a "high" investment-contingent subsidy need not induce the firm to invest \bar{K} if authorities cannot precommit to set a sufficiently low subsidy in the future. This is because the lost oversubsidization can be recouped by investing at any time in the future.

V. CONCLUSIONS

When authorities cannot precommit to eliminate protection, the targeted firm has the ability to induce a renewal of protection by not investing sufficiently in cost reductions. The firm will choose to do so and render the program time inconsistent, if the rents it would obtain from a renewal of protection are greater than the profits it would get by competing in the world market.

The introduction of investment-contingent subsidies does not necessarily eliminate time inconsistency because in case a renewal of protection would be necessary, this should consist not only of such subsidies, but also of a bailout, which would have to be granted before investment took place. Its purpose would be to allow the firm to operate in the short term.

If, as is customary, the investment-contingent subsidy is designed assuming away the possibility of future bailouts, the firm will find it profitable not to invest sufficiently and induce a renewal of protection.

This paper does not imply that all protectionist programs are ineffective, nor does it contradict successful protectionist experiences such as that of the Japanese. If the oversubsidization rate is sufficiently high, the program will be time consistent from the outset. Japan, on the other hand, has solved the problem by promising subsidized loans or government procurement contracts only to those firms within the targeted industries, that will lower costs and develop new products, thus encouraging vigorous competition among domestic firms [Carliner, 1986]. It should be noted that Japan has also experienced troubles with protectionism in the aluminum, chemical, and steel industries. In order to allow them to contract more gradually, a "Temporary Law to Stabilize Industries in Recession" was enacted in 1978. However, given subsidies and allowed to form cartels, declining firms were none too anxious to reduce their capacities, and when this law expired in 1983, it was necessary to renew it for another five years under a new name: the Law to Promote Industrial Structure" [Yamamura, 1986].

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