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Endogenous learning and trade policy

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Abstract

If governments announce 'transitory' protection for inefficient sectors, learning may slow down as firms correctly realize that the only way to insure protection for their sector is to remain inefficient. In contrast with the learning-by-doing justifications for protection, our model suggests that protection deteriorates rather than enhances learning.

Keywords: Trade policy; Time inconsistency; Learning

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Growth theory has recently witnessed an important debate on the merits of an active trade policy whereby domestic production should be protected so that it can develop a dynamic comparative advantage. Work by Krugman (1987), Lucas (1989, 1993) and Young (1991, 1993) has argued that in the presence of learning-by-doing, trade protection can have a long-lasting positive effect on productivity and welfare. While all authors are cautious when drawing implications for policy, it is clear that their work, at least under some conditions, justifies an active trade policy in which domestic sectors should be stimulated by government protection. In contrast, the work of Romer (1990), Rebelo (1992) and Rivera Batiz and Romer (1991) has emphasized that scale economies, and therefore open trade, will have beneficial effects on growth performance.

Obviously, one essential assumption that underlies the learning-by-doing literature is that technological progress is exogenous. Grossman and Helpman in their comprehensive work on the interaction between R&D and trade have dealt with this issue (see Grossman and Helpman, 1991). Their results, which rely on the effects of trade on factor prices and the profitability of R&D, are, however, ambiguous, trade only in some cases having a positive effect on growth performance.

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In this paper we also contest the notion of an exogenous learning process, but rather than emphasizing the effects of trade on factor prices and the incentives for R&D, we model learning as an investment decision that may be affected by government policies. In short, we want to study how government policies (and, in particular, trade protection) may affect the incentive to engage in cost reductions. Tornell (1991) has raised the important point that in the presence of (time-inconsistent) trade protection the incentives to improve technology may be weakened rather than strengthened because firms anticipate a reduction in protection if they become fully competitive. Unfortunately, this argument appears to have had little impact on trade policy evaluations.[1] This is surprising considering the extensive evidence in the literature regarding the failure of 'import-substitution' trade policies and the experience of many 'infant industries' that never grow up. Thus, the purpose of this paper is to present a simplified exposition of Tornell's point of how trade policies may lead, in the long run, to inefficiencies rather than to improvements in productivity. In other words, we want to provide a simple model in which government policies, rather than accelerating the learning-by-doing process, will slow it down. The intuition is simple enough: if government policies support inefficient firms, and the threat of future reductions in those levels of protection are time inconsistent and therefore not credible, firms will have a lower incentive to improve their efficiency because doing so could imply a reduction in the level of protection they enjoy.

Because our exposition aims at providing a simple model of learning, we assume a partial equilibrium framework in which a firm faces a demand function $p(q)$ with constant elasticity ϵ. Firms maximize

$$\pi_0 = \int_0^\infty \{qp(q) - \alpha q - F - \phi(i)\}\, e^{-\rho t}\, dt\,, \tag{1}$$

where q is the quantity sold, F is a fixed cost paid every period and α is the marginal cost of production.[2] $\phi(i)$ is a cost of adjustment for the investment rate i. Investment helps to reduce the fixed cost F, thus

$$\dot{F} = -i\,. \tag{2}$$

Additionally, we have the restriction that $F \geq 0$. The firm starts with $F(0) = F_0$. The first-order conditions for this problem are

$$p + qp'(q) - \alpha = 0\,, \tag{3}$$

$$-\phi'(i) - \lambda = 0\,, \tag{4}$$

$$-1 + \mu = -\dot{\lambda} + \rho\lambda\,, \tag{5}$$

$$\mu \geq 0 \quad \text{and} \quad = 0\,, \quad \text{if } F > 0\,, \tag{6}$$

[1] Rodrik (1994), for example, does not mention Tornell's results in his recent review of trade policy. The point has also been made in Matsuyama (1990) and Staiger and Tabellini (1987). For an opposite view, see Head (1990).

[2] For notational simplicity we omit the functional dependency on time for q, p, F and i.

and finally the transversality condition:

$$\lim_{t\to\infty} \lambda i\, e^{-\rho t} = 0\,, \tag{7}$$

where λ is the Lagrange multiplier for (2) and μ is the multiplier for the constraint that F has to be non-negative. Eq. (3) gives the usual profit maximization condition: $p(1+1/\epsilon)=\alpha$, which pins down a unique and constant output–price pair. Eqs. (4) and (5) can easily be reduced to a dynamic system in (i, λ) of the form:

$$\begin{aligned} \dot{F} &= -\phi^{-1}(-\lambda)\,, \\ \dot{\lambda} &= \rho\lambda + 1 - \mu\,. \end{aligned} \tag{8}$$

This phase diagram is depicted in Fig. 1. The economy evolves along a saddle path until $F=0$, where it jumps to a steady state in which $(F, \lambda) = (0, 0)$. As long as production is profitable, firms will tend to learn and thus reduce their fixed costs. Owing to the presence of adjustment costs to investment, they will do so slowly; however, learning possibilities are fully exploited in the long run *when no government intervention is present*.

Now consider a subsidy policy that provides a cash transfer to the firm. It could be argued that this cash subsidy might provide an incentive for the firm to engage in production and that once it has achieved sufficient efficiency the subsidy could be discontinued without any future hindrance on production. However, this transfer scheme is time inconsistent because if firms decided not to reduce costs, that is, not to become efficient, the government would face the same incentive to provide the subsidies as it does today. This is Tornell's point and it can easily be captured in our framework by adding a stable efficiency-dependent subsidy of the form $g(F)$ with $g'>0$ and $g''<0$. This specification has two properties. First, that firms perceive it as a permanent and stable subsidy function. Second, that the level of subsidies depends on how inefficient firms are. The first property is justified on the argument that the

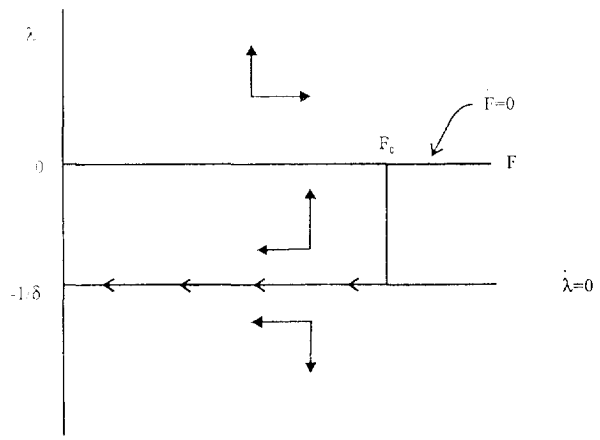

Fig. 1.

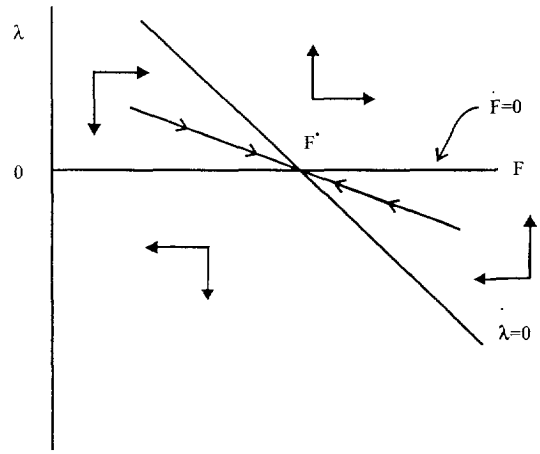

Fig. 2.

policy is time inconsistent, and, therefore, that any threats of temporary policies are not credible.[3] The second property follows from the ample empirical evidence that trade protection is devised to help weak firms, not those that already have a comparative advantage. This coincides with the general pattern of protection in many developing countries, which tries to protect the (relatively inefficient) industrial sector at the expense of agricultural producers. Additionally, it could be argued, that sectors that are less productive will have a larger (relative) productivity in the lobbying sector and will thus obtain on average bigger protection. With this modification, the dynamic system becomes

$$\dot{F} = -\phi^{-1}(-\lambda)\,,$$

$$\dot{\lambda} = \rho\lambda + 1 - g'(F) - \mu\,,$$

which is depicted in Fig. 2. As can be seen in the graph, the firm converges to a positive level of fixed cost F^* and thus tends to settle in a situation with a residual amount of inefficiency. This inefficiency persists because the firm balances the benefits of reducing costs with the loss from a reduction in government protection.

Thus, in a setup such as that described, trade policy, rather than enhancing increased productivity (as suggested in the learning-by-doing literature) achieves exactly the opposite result: it induces a persistence in economic inefficiency. The applied trade literature is full of episodes describing infant industries that never grow up (see Michaely et al., 1991; Edwards 1993; and Tornell 1991). To incorporate the effects of this time-inconsistency problem into general equilibrium growth models should be an important item in the future agenda on how to assess the effects of trade policies.

[3] We do not model here this time-inconsistency problem. This is done in Tornell (1991).

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