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Shock Versus Gradualism in Models of Rational Expectations: The Case of Trade Liberalization

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Abstract

This paper provides a new argument for "shock" versus "gradualism" in the implementation of trade policies. In the simple context of a small open economy with rational expectations, we consider the comparative welfare effects of eliminating an import tariff either immediately as an unanticipated shock, or gradually over a preannounced length of time. The gradualist policy introduces a distortion in consumption-accumulation decisions and generates welfare costs. And if the gradual change is extended over "too long" a period, these costs may exceed the long-run benefits of liberalization.

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SUMMARY

This paper presents another argument in favor of "shock" versus "gradualism" when implementing trade liberalization policies. In a small open economy in which agents have rational expectations, all policies are credible, and all gains from trade are production gains (an assumption made for simplicity), we show that gradually removing a tariff is in itself distortionary. A temporary, nonzero rate of change in the policy variable—the falling tariff rate—introduces an intertemporal relative price distortion between consumption and asset accumulation for the duration of the policy.

An unanticipated, immediate removal of the tariff is always superior to a gradual removal. If the shock approach of reform is precluded, a gradualist program must be evaluated by comparing the usual permanent gains from free trade with the transitory welfare losses generated from the intertemporal distortion. For certain parameters, if the duration of liberalization is extended over too long a time period, gradualist policies may be worse from a welfare standpoint than not removing the tariff at all.

An immediate implication is that a third policy option—removing the tariff at once at a future date, without a previous announcement—may be better than gradually removing the tariff starting at the present date. Such a policy delays the benefits of the intratemporal production gains but avoids the intertemporal distortion of a gradualist policy. In some cases the gains from avoiding these costs dominate the costs of delay.

I. Introduction

The twin assumptions of rational expectations (perfect foresight in deterministic models) and individual agents who implement optimal programs over time have generated a revision of many fundamental propositions in macroeconomics generally, and in the balance of payments literature in particular. One branch of this literature deals with the timing of policy changes and with the effect of those changes when they are expected to be transitory or to take place in the future.[2] The purpose of this paper is to address within this framework the question of "shock" versus "gradualism" in the implementation of policies—a question that has been raised mostly for stabilization and trade liberalization programs.

In general, the argument for gradualism hinges on the presence of adjustment costs;[3] the argument for shock is based on the idea that if a change is worth implementing, the sooner the better. In this paper we develop a different argument favoring shock rather than gradualism, based on the welfare losses incurred during the transitional finite period of gradual change. The argument goes as follows. A tariff or a tax introduces permanent, intratemporal distortions, and a reform, introduced gradually or as a shock, eliminates these distortions. A gradual reform creates transitory, intertemporal distortions.[4] On this account, then, not only is a shock superior to gradualism, but in some cases intratemporal gains from a gradual reform are more than offset by the intertemporal losses from gradualism. Notice that this argument is very different than the trivial one: "if a change is worth implementing, the sooner the better." Indeed, we show that sooner is not always better— in some cases if the reform cannot be implemented within a certain length of time, then the longer is the transition period, the better.

Although the argument is general and applicable to the timing of any reform, we perform the analysis in the context of a small open economy considering the reduction of a tariff. At any initial time, $t = 0$, at which the policy change is evaluated, we assume that the economy is at the long-run steady state corresponding to the initial level of the tariff and to the expectation that this level will remain in force forever. We characterize a shock policy as one that immediately (at $t = 0$) reduces the tariff to its lower desired level, and a gradualist

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[2]See, for example, Auernheimer (1987) and the bibliographical references to Calvo's work. Although our question is different, two seminal papers by Calvo (1987, 1988) are in the same spirit of the analysis that follows.

[3]More specifically, adjustment costs involving an externality. See Mussa (1982).

[4]We thank an anonymous referee for suggesting this characterization.

policy as one that, starting at $t = 0$, reduces the level of the tariff smoothly over a transition period τ, so that the long-run desired level is reached at some well-defined point $t = \tau > 0$.[5]

The next section presents a standard model of a small open economy. Section III discusses the results of a shock and a gradual trade liberalization in the simplest possible context— one in which the level of the tariff has no effect on production, so that there are no intratemporal gains from removing it, and only the "pure" intertemporal losses of gradualism are present. This case is presented only in order to isolate the pure welfare losses of gradualism and focus on the nature of the intertemporal distortion. Section IV then analyzes the more realistic and interesting case in which, due to effects on production, the tariff has created an intratemporal distortion, so that its removal generates welfare gains. These gains are then compared to the intertemporal welfare losses incurred because of gradualism.

In both sections III and IV we assume particular parameter values and structure of the behavioral equations, presenting the results of some simulations. Section V summarizes the results. Throughout the paper we assume that policy changes are credible, that is, the public does not expect any departure from the announced paths of the policy variables. We do so not because of a lack of awareness of the importance of the credibility question, but simply because we are addressing a different problem.

II. The Simple Model

We use a simple model similar to that of Calvo (1987), and one that is a particular case of the model discussed in Auernheimer (1987). Consider a small open economy producing fixed flows[6] of three perishable commodities: a nontradeable (home) good, x_1, and two tradeable commodities, x_2 and x_3, with a world relative price normalized at unity. Individual residents, who are all identical, hold foreign securities denominated in terms of baskets of x_2 and x_3, which earn a real rate of interest, r, in the world market. These securities are assumed to be "call bonds" with zero maturity, so there are no capital gains and losses due to unexpected changes in the interest rate. Although we assume that the level of these bonds is positive, individuals could hold net debt.

We define p as the relative price of either of the two traded commodities in terms of the domestic good, x_1, and assume that individuals consume only x_1 and x_2, which we

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[5]In a two-period model in which they analyze the question of the sequencing of trade and capital markets liberalization, Edwards and van Wijnbergen (1986) characterize gradualism as a two-stage process, with an intermediate and final tariff level. In their analysis gradualism turns out to be the best policy because the distortion that it imposes compensates for a preexisting distortion assumed to exist in capital markets.

[6]The assumption of a fixed level of x_2 and x_3 is later relaxed.

characterize as the importable good.[7] Then, the typical individual's budget constraint, expressed in terms of the domestic good, x_1, is:

(1) $x_1 + upx_2 + px_3 + par = p(\mathrm{d}a/\mathrm{d}t) + c_1 + upc_2 - pT,$

where a is the stock of foreign securities, c_1 and c_2 are the flows of consumption of the domestic and the imported good, u is 1 + a proportional tax on imports, and T is the flow of per-head government transfers (expressed in terms of the imported good). Notice that according to equation 1, all production of commodity x_3 is exported.

Individuals have perfect foresight, and their utility is given by the function $U(c_1, c_2)$, which is strictly concave, with $U_1, U_2 > 0$, $U_{11}, U_{22} < 0$ and $U_{12} > 0$. Individuals live forever, and at every instant $t = 0$ each individual maximizes:

(2) $\int_0^\infty U(c_1, c_2)\, e^{-\delta t}\, \mathrm{d}t,$

where δ is the constant rate of time preference. Maximization of equation 2 subject to equation 1 yields the Euler equations:

(3) $(\mathrm{d}U_1/\mathrm{d}t)(1/U_1) + (\mathrm{d}p/\mathrm{d}t)(1/p) = \delta - r$

(4) $U_2/U_1 = up.$

By differentiating equation 4 and performing a simple substitution, we get:

(5) $(\mathrm{d}U_2/\mathrm{d}t)(1/U_2) = \hat{u} + \delta - r$

where $\hat{u} = (\mathrm{d}u/\mathrm{d}t)(1/u)$.

In the aggregate the market clearing condition for the domestic good requires that $c_1 = x_1$ at all times, so that consumption of the domestic good is constant. After some transformations equation 5 can be expressed as:

$$\mathrm{d}c_2/\mathrm{d}t = (U_2/U_{22})\,(\delta + \hat{u} - r).$$

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[7]As we will see later, essentially the same results are obtained without a nontraded commodity. We include it because its introduction does not complicate the analysis and sets the stage for an eventual discussion of the behavior of the "real exchange rate" (the price of traded goods in terms of nontraded goods).

Notice that in this expression a falling tariff, $\hat{u} < 0$, affects consumers in the same manner as a temporary rise in the real interest rate—which, as will become apparent later, has the effect of increasing asset accumulation.

For analytic simplicity we assume, as in other works,[8] that the world interest rate, r, is equal to the domestic rate of time preference, δ. Then, the above expression becomes:

(6) $dc_2/dt = (U_2/U_{22})\hat{u}$.

Assume that the government returns the proceeds from the import tax in the form of a transfer, T, in a manner unrelated to the payment of the tax. Then $T = (u - 1)(c_2 - x_2)$, and the aggregate constraint, equation 1 becomes:

$$da/dt = (x_2 + x_3) + ar - c_2,$$

which is the balance of payments identity. Since the world relative price of the two traded commodities is normalized at unity, we can write $x_2 + x_3 = s$ for convenience, so that the global constraint is:

(7) $da/dt = s + ar - c_2$.

Notice some features of the simple construction. First, equations 6 and 7 define a system in the two endogenous variables a and c_2. Equation 4 determines the domestic price of imports in terms of the domestic good, p, given the level of c_2 at each point in time, the fixed and equal levels of production and consumption of the home good (x_1 and c_1), and the tariff rate. Second, for a given constant tariff, and hence for $\hat{u} = 0$, consumption of the imported commodity is constant. In the absence of any expected future change, the only constant level of c_2 that satisfies the transversality condition $da/dt \to 0$ as $t \to \infty$ is the level $c_2 = s + ar$, at which $da/dt = 0$. Under these conditions the long-run steady state is given by the stock of foreign assets, determined by past history, and by the fixed production level of traded goods, s, and is therefore *independent of the level of the tariff.* The level of the tariff has no effect on production because production levels are fixed by assumption. It has no effect on consumption because although it makes consumption more expensive than asset accumulation, it does so uniformly over time.[9] As far as the relative price of the imported versus the domestic commodity, in the aggregate the level of the relative price p, adjusts to generate the same result as in a one-commodity world. But when $\hat{u}$ has different proportional rates of change, the cost of consuming today versus consuming in the future permanently rises

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[8]See, for example, Calvo (1987, 1988) and Obstfeld (1986).

[9]This is, of course, the same case as a tax on consumption in the one-sector growth model. The tax has no effect when its expected path is constant, but it does have an effect when the path is expected to change.

(if $\hat{u} > 0$) or falls (if $\hat{u} < 0$), and therefore the level of consumption of the imported good continuously rises or falls. Obviously, then, the only permanent policy compatible with a stationary steady state is one with a constant u, that is, with a constant import tax rate and $\hat{u} = 0$.

III. THE PURE COSTS OF GRADUALISM

A fixed level of production of both traded commodities implies, of course, that a tariff has no production effects (and, in our case, no consumption effects, since only one of the two traded goods is consumed). We use this unrealistic assumption here to isolate the "pure" costs of a gradualist policy. In the next section we relax it.

A. The Basic Analysis

Consider an initial long-run equilibrium with a stock of foreign assets, $a(0) > 0$, given by past history, and a positive tariff $u = u_0 > 1$. The initial, constant levels of consumption of the domestic and the imported goods are $c_1 = x_1$ and $c_2 = s + ra(0)$, respectively.

A shock change toward free trade (that is, toward $u = 1$) is characterized as an unexpected, permanent, once-and-for-all change in the tariff. Since we assume that the change is expected to be permanent, it will not alter equations 6 and 7 —the term $\hat{u}$ being zero before and after the change.

We characterize a gradual change toward free trade, implemented at some initial time $t = 0$, as a continuous fall of u toward its new level $u_1 = 1$ at a constant rate $\hat{u} < 0$ during a predetermined time τ. Given the initial and final levels of u ($u_0 > 1$ and $u_1 = 1$) and the length of the transition period, τ, u's constant rate of change is given by:

(8) $\hat{u} = -\ln(u_0)/\tau.$

During the transition period, then, $\hat{u} < 0$, and, according to equation 6, the level of consumption of the traded commodity will be rising. The solution to the paths of consumption of the traded commodity and the level of foreign assets is given by equations 6, 7 and 8, together with the following conditions. Since at $t = \tau$ there is no discrete change in u, consumption of the traded good does not change at that time, that is,

(9) $c_2(\tau^-) = c_2(\tau^+),$

where the superscripts $^-$ and $^+$ denote values just before and just after the corresponding date. Also,

(9') $a(0^-) = a(0^+) = a(0)$

(9'') $a(\tau^-) = a(\tau^+) = a(\tau).$

These conditions allow us to solve for the unique initial value of consumption of the traded good, $c_2(0^+)$, which in turn determines $c_2(\tau^-) = c_2(\tau^+) = s + a(\tau)r$.

Figure 1 represents the typical path of adjustment for such a gradual change, the straight line satisfying, $c_2 = s + ar$ and the arrows representing the laws of motion of c_2 and a. Starting from an initial equilibrium at point A, the implementation of the gradual fall in u immediately generates a fall in the level of consumption of the traded good from A to a point such as B. During the transition period $0 < t < \tau$, consumption of the traded good and the level of foreign assets follow the path indicated by the arc BC. At time $t = \tau$ (point C) consumption of the traded good reaches its new constant level compatible with a constant stock of foreign securities, and the new long-run steady state is achieved.

The proof that the consumption path of the traded good during the gradual implementation is not socially optimal is immediately clear: a social planner maximizing aggregate welfare would choose a constant consumption path for any given inherited stock of foreign assets. The distortion arises because during the transition period the "wrong" signal is sent to the market, indicating that accumulation is more efficient than it really is. A negative $\hat{u}$ during the transition has the same effect, in terms of its signal and the private incentives to agents, as a temporary rise in the interest rate. There is then a substitution away from consumption of the imported commodity, resulting in an inefficient aggregate accumulation of foreign securities.

B. Insights from Utility Analysis

We assume a particular utility index of the form:

$$(10) \quad U(c_1, c_2) = [(c_1^{\alpha} c_2^{\beta})^{(1-\gamma)}]/(1-\gamma) \qquad \alpha, \beta, \gamma > 0.$$

This form allows for a simple analytical solution and for an exact measurement of the present value of utility—and therefore a straightforward welfare ranking. By assuming particular values of the parameters, equation 10 enables us to run simulations that give an intuitive grasp of the nature and magnitude of the results. If, for instance, $\gamma = 0$, then equation 10 is of the Cobb-Douglas form, and the intertemporal marginal rate of substitution is:

$$\eta = -1/[1-\beta(1-\gamma)] < 0,$$

which is $\eta = -1/\gamma$ for the case of $\alpha = \beta = 1$, which has been used in other works.

Under the assumption of equation 10,

$$U_2/U_{22} = -c_2/[1-\beta(1-\gamma)]$$

and equation 6 becomes:

(6') $(dc_2/dt)/(1/c_2) = \eta \hat{u}$.

Equation 6' shows that consumption of the traded good rises at a constant rate, and, therefore, its path during the interim period between $t = 0$ and $t = \tau$ is given by:

(11) $c_2(t) = c_2(0^+) \exp(ht)$

where $h = (\hat{u}\eta) > 0$ for the case under analysis, with $\hat{u} < 0$.

The path of the stock of foreign securities for $0 < t < \tau$ is then:

(12) $da/dt = s + ar - c_2(0^+) \exp(ht)$,

which has the solution

(13) $a(t) = (-s/r) - [c_2(0^+) \exp(ht)/(h-r)] + \{a(0)+[c_2(0^+)/(h-r)]+[s/r)]\} \exp(rt)$,

where, as before, $c_2(0^+)$ is the level of consumption immediately after the implementation of the program, as well as the initial consumption of the imported commodity. Equation 13 determines the stock of foreign assets at the conclusion of the transition period, $a(\tau)$. At $t = \tau$ the new long-run equilibrium is attained, at which point the stock of foreign assets must satisfy:

(14) $a(\tau) = [c_2(\tau) - s]/r$,

where

$$c_2(\tau) = c_2(0^+) \exp(h\tau).$$

Before proceeding, notice that the term $h\tau = -\hat{u}\eta\tau = -\ln(u_o)\eta = z > 0$ is constant, independent of the length of the transition period, and dependent only on the intertemporal elasticity of substitution and the long-run change in the tariff level. Then, $c_2(\tau) = c_2(0^+) \exp(z)$, so that $c_2(0^+)$ and $c_2(\tau)$ will be related in a manner independent of τ.

The term $z = - \hat{u}\eta\tau$ has a straightforward economic interpretation. The adverse intertemporal effects of a gradualist policy depend on the magnitude of the rate of change of the tariff ($\hat{u}$); the duration of the transition period (τ), and the intertemporal elasticity of substitution (η), that is, the magnitude of consumers' response to the distortion. The term z summarizes these three elements.

Using equations 13 and 14 we can calculate the level of consumption of the imported good immediately after the implementation of the policy, $c_2(0^+)$, as

(15) $c_2(0^+) = \{-\exp(r\tau)[s+a(0)r][h-r]\}/\{r[\exp(r\tau)h-\exp(h\tau)]\}$.

C. Welfare Effects

We now use these results to derive propositions concerning the level of welfare. Normalizing the constant level of production and consumption of the domestic good at unity, $x_1 = c_1 = 1$ and equation 10 becomes:

(10') $U(1, c_2) = [(c_2^{\beta})^{(1-\gamma)}]/[1-\gamma]$.

The present value of utility at time $t = 0$ is:

$$V(0) = \int_0^{\tau} \{[c_2(0^+)\exp(ht)]^{[\beta(1-\gamma)]}/(1-\gamma)\}\exp(-\delta t)\, dt +$$

$$+ \int_{\tau}^{\infty} \{[c_2(0^+)\exp(z)]^{[\beta(1-\gamma)]}/(1-\gamma)\} \exp(-\delta t)\, dt.$$

The first part of the preceding expression is the present value of the utility during the transition period, and the second part is the present value of the utility in the long-run steady state, that is, for $t > \tau$.

After a few calculations, we obtain

(16) $V(0^+) = [c_2(0^+)^{\mu}/(1-\gamma)(h\mu-\delta)]\ \{[\exp(z\mu-\delta\tau)\beta h(1-\gamma)/\delta] - 1\}$

where $\mu = \beta(1-\gamma)$.

The welfare effects of trade liberalization can then be obtained from equations 15 and 16, which give the impact of τ on the initial value of consumption of the traded good immediately after $t = 0$, and the dependence of welfare on $c_2(0^+)$. Such simple expressions can be derived because the whole path of adjustment is uniquely summarized by $c_2(0^+)$.

Further examination of equations 15 and 16 and a few computations show that

$$\lim_{\tau \to 0} c_2(0^+) = c_2(0^-) \exp(-z)$$

$$\lim_{\tau \to 0} c_2(\tau) = \lim_{\tau \to \infty} c_2(0^+) = c_2(0^-)$$

$$\lim_{\tau \to \infty} c_2(\tau) = c_2(0^-) \exp(z)$$

$$(17) \quad \lim_{\tau \to 0} V(0) = \lim_{\tau \to \infty} V(0) = V(0^-),$$

where $c_2(0^-)$ and $V(0^-)$ are the pre-existing level of consumption and present value of utility at $t < 0$. What these expressions indicate is intuitively clear. There are two possible maximum welfare points of equal value: one for $\tau = 0$, that is, for a shock change, and one that is approached as $\tau \to \infty$, that is, for a gradual change with a transition period so long that, in the limit, $\hat{u} = 0$. Of course, an infinitely long transition period means, in this case, no change at all. In the case under analysis, in which the preexisting tariff did not disturb the first best, these maximum values are, of course, equal to the pre-existing level of discounted utility, $V(0^-)$. Thus when there are no intratemporal gains from liberalization, the optimum policy (one that does not worsen the initial position) is either a shock tariff reduction or no change at all. Any gradual reduction of the tariff (for $0 < \tau < \infty$) brings about a welfare loss, and there is at least one τ for which V(0) is a minimum, that is losses are a maximum.

Figure 2 shows these results for simulations performed assigning specific values to the parameters. The values selected are $\beta = 1$, $\gamma = 0.7$, $u(0) = 2$ (that is, an initial tariff of 100 percent, not uncommon in some developing countries), a real world interest rate $r = \delta = 0.05$, a zero initial endowment of foreign assets, $a(0) = 0$, and a fixed level of production of traded commodities $x_2 + x_3 = s = 1$.

Figure 2 shows the dependence of the present value of aggregate utility (welfare) at $t = 0$ on the length of the transition periods, τ. For $\tau = 0$ the initial level of welfare is preserved, and the function converges back to the same value as $\tau \to \infty$. The (unique) minimum occurs at around $\tau = 28$, which characterizes the worst possible case.

IV. Costs of Gradualism Versus Gains from Liberalization

We now consider the more realistic case in which the level of the policy variable is changed to a "better" value (in our case, $u = 1$), generating intratemporal gains. Thus a shock reform, for which there are no intertemporal losses, results in an unequivocal improvement. The net outcome of a gradual reform will then depend on whether the intratemporal gains from a lower tariff are offset by the intertemporal losses of a transitory $\hat{u} < 0$.

A. Reformulating the Model

Suppose that the domestic good is produced with a specific factor (perhaps, labor totally specialized in the production of nontradable services), so that its production is kept constant as before. Assume that production of the two traded goods (x_2, the imported good, and x_3, the exported good) is governed by a smooth, conventional transformation curve with an elasticity of substitution larger than zero.[10] Then, the imposition (or increase) of a tariff on imports of x_2 lowers the value of x_2 and x_3, evaluated at world prices, that is, there is a fall of s.[11] The level of s, then, is a function:

(18) $s = s(u), \qquad s'(\cdot) < 0$ for $u > 1$.

In this case a shock liberalization, that is, a sudden fall of u from $u > 1$ to $u = 1$, results in a once-and-for-all increase in s and, for an unchanged initial level of foreign assets, a, in a once-and-for-all increase in the level of consumption of the imported commodity, c_2. At an unchanged level of c_1, this is a clear welfare improvement.

A gradual fall of the tariff, on the other hand, is characterized by a gradual increase in s. The equations governing the path of adjustment toward equilibrium (that is, the counterpart to equations 6 and 12) are:

(19) $dc_2/dt = (U_2/U_{22})\hat{u}$

(20) $da/dt = s[u(t)] + ar - c_2$.

Using equation 8, the path of u is given by

$$u(t) = u_0 \exp(\hat{u}t).$$

The representation of equations 19 and 20 in a phase diagram is not as immediate as the representation of the previous case in equations 6 and 7. But it is easy to show that in general the final levels of s and a, and hence the final level of c_2, will be higher than in the case of no gains from free trade. The welfare analysis is a bit more involved, and the net result of weighing the pure losses from gradualism and the pure gains from free trade may be negative or positive. This result turns out to depend crucially on the length of the transition period τ.

There are two limiting cases. If $\tau = 0$ (shock implementation), there are no intertemporal losses from gradualism, and the result is the pure intratemporal gain from free trade. As $\tau \to \infty$, then $\hat{u} \to 0$, and the change in welfare approaches zero because the reform never takes place. Since the function ultimately relating the present value of utility at time $t = 0$ to the length of the transition period is continuous, it then follows that there will be at least one τ for which the change in welfare is zero. This is an important policy implication. It means that even in the presence of gains from free trade, if liberalization can be implemented only

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[10]The case of fixed production of x_2 and x_3 considered in the last section can then be thought of as the limiting case of a transformation curve with a zero elasticity of substitution.

[11]This is, of course, the classical "production loss" generated by a tariff.

gradually, then for at least some lengths of the transitional period liberalization may be worse than retaining the tariff.

B. Adding a Utility Index

As in the previous section, we can gain additional insight by using the utility index—equation 10. In addition, we need to examine the behavior of s over time. Call $(\partial s/\partial u)/(u/s) = \epsilon$ the elasticity of production of the bundle of traded goods $(x_2 + x_3)$ valued at the unitary international price with respect to u. Then, from equation 18, $(ds/dt)(1/s) = \epsilon\hat{u}$, where $\epsilon < 0$.

In order to facilitate the solution of the system, we assume that ϵ is constant. Thus for given initial and final levels of u, during the transition period the term s will be changing at the constant rate $m = \epsilon\hat{u} > 0$, so that its path is:

(21) $s(t) = s_0 \exp(mt)$.

Using equation 8, we see that $m\tau = -\epsilon\ln(u_0) = v > 0$ is constant.

Under these assumptions equation 20 becomes:

(20') $da/dt = s_0 \exp(mt) - c_2(0^+) \exp(ht) + ar,$

which has the solution:

(22) $a(t) = [s_0 \exp(mt)/(m-r)] - [c_2(0^+) \exp(ht)/(h-r)] +$ (22)

$$+ \ \{a(0)+[c_2(0^+)/(h-r)]-[s_0/(h-r)]\} \exp(rt).$$

Following the same procedure as in the last section, the solution for the initial level of consumption of the imported good, $c_2(0^+)$, becomes

(23) $c_2(0^+) = [s_0 \, (A/B)] - [a(0) \exp(r\tau)/B]$

where

$$A = [1/(m-r)][\exp(r\tau)-\exp(m\tau)] - [\exp(m\tau)/r],$$

$$B = [1/(h-r)][\exp(r\tau)-\exp(h\tau)] - [\exp(h\tau)/r].$$

The present value of utility at time $t = 0$ is, for a given $c_2(0^+)$, the same as that when there are no gains from trade. This is so, of course, because during the period of gradual change c_2 grows at a rate h that is independent of the behavior of s. The effects of trade liberalization on welfare can now be obtained from equations 16 and 23.

C. Sorting Out the Welfare Changes

We can draw several conclusions. First, as in the previous case, a shock change results in a higher level of c_2 and in a higher level of welfare than any gradual change. Second, depending on the values of the parameters, the magnitude of the change in u, and the response of production to the falling level of u, there may be gradual implementations that are worse than no implementation at all. In other words, the intratemporal gains from reducing the tariff may be outweighed by the intertemporal losses due to inefficient asset accumulation during the transition.

A third and important conclusion can be derived by asking about a third possible implementation, namely, a shock treatment to be implemented at a later date $t = \tau$ (a delayed shock). This is an important question to ask for at least two reasons. First, the policymaker may not be able to implement an immediate shock policy at $t = 0$, but may be able to choose between a gradual policy (starting at $t = 0$ and ending at $t = \tau$) or a shock policy taking place at the later date $t = \tau$.[12] Second, the answer to the question helps to distinguish the argument of this paper from the argument sometimes made in favor of shock rather than gradualism, that "if the policy is welfare enhancing, the sooner it is implemented the better." In fact, in many cases it would be beneficial to delay any action until $t = \tau > 0$ and at $t = \tau$ implement an unexpected shock, rather than implement a gradual change at $t = 0$, that will be concluded at $t = \tau$.

The present value of utility at $t = 0$, for a shock change implemented at some later time $t = \tau > 0$ is given by a very simple expression. Since $s(\tau) = s_0 \exp(v)$ is independent of τ, and since the shock policy will not change asset accumulation, so that $a(\tau) = a(0)$, the level of consumption of the traded commodity will be constant from $t = 0$ to $t = \tau$, at the pre-existing level $c_2(0\text{-})$, and constant from $t = \tau$ onward, at the new level $c_2(\tau) = s(\tau) + a(\tau)\, r$. The present value of utility at $t = 0$ will then be:

$$(24) \quad W(0)=\{1/\delta(1-\gamma)\}\{[a(0)r+s_0]^{\mu}+\exp(-\delta\tau)\{[a(0)r+s_0 \exp(v)]^{\mu}-[a(0)r+s_0]^{\mu}\}\}.$$

Comparing equations 16 and 24 shows that both expressions yield the same welfare result for $\tau = 0$ and that, for $0 < \tau < \infty$, W(0) may yield a higher value than V(0).

Figure 3 shows the results of a simulation using the same parameter values as in the previous section, but assuming a 5 percent increase in the level of production of the bundle of traded goods. The graph shows the preexisting level of welfare and welfare evaluated at $t = 0$

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[12]Of course, this implies that if the policymaker adopts the second possibility (a shock policy taking place at a later date t=τ), he could implement such policy as a surprise. As we mentioned in the introduction, in this paper we are abstracting from credibility and time inconsistency problems.

for both a gradual change starting at $t = 0$ and lasting until $t = \tau$, and a delayed shock policy taking place at $t = \tau$.

The simulation illustrates a case for which (i) a gradual policy may be worse than no change at all (in this case for $\tau > 15$); (ii) a delayed shock policy implemented at a later date (for $0 < \tau < \infty$) always dominates a gradual policy lasting from $t = 0$ to $t = \tau$; and (iii) as in the case with no gains from trade, there is a length of a gradualist policy ($\tau = 38$) that maximizes the welfare loss. These results depend, of course, on the value of several of the parameters, which in turn determine the magnitude of the intratemporal gains from the fall in the level of the tariff (the response of production) and the intertemporal losses from gradualism (the rate of intertemporal substitution in consumption). The lower is the former and the higher is the latter, the stronger is the case against gradualism.

V. Concluding Remarks

We have shown, in the particular context of trade liberalization, that a policy change that would in principle be neutral or beneficial when implemented at once, introduces a temporary intertemporal distortion when implemented gradually over time. We have also shown instances in which such a distortion due to gradualism may outweigh the permanent gains generated by trade liberalization.

The basic economic reason behind these results could be summarized in terms of the differential effects of the level of a policy variable, which determines intratemporal gains or losses, and its rate of change over time, which generates intertemporal distortions. In our analysis a lower level of the tariff is associated with either no change in or a higher level of welfare; a rate of change different than zero modifies the marginal conditions for the optimality of consumption versus asset accumulation. A gradualist program aimed at ultimately reducing the level of the tariff brings about a temporary rate of change of the tariff different than zero, and therefore signals economic agents a rate of return on asset accumulation different than the true market rate. In other words, while slowly removing a distortion from the socially optimal production conditions (which respond to the level of the tariff), such a program will for some time introduce a distortion in the socially optimal conditions for asset accumulation (which respond to the rate of change of the tariff). The simple observation that a change in the level of a variable, if implemented slowly, can be accomplished only by a nonnegative rate of change of the variable, suggests that the point analyzed in this paper has general applicability.

We should also add that our argument in favor of shock policies is presented simply as another argument that should be considered in the designing and timing of policies. Whether one or another mode of implementation should be chosen, of course, depends on other possible arguments, such as adjustment costs or political economy arguments, already discussed in the literature.

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Figure 1. Paths of Consumption and Assets Following a Gradualist Policy: The Case of the "Pure Costs of Gradualism"

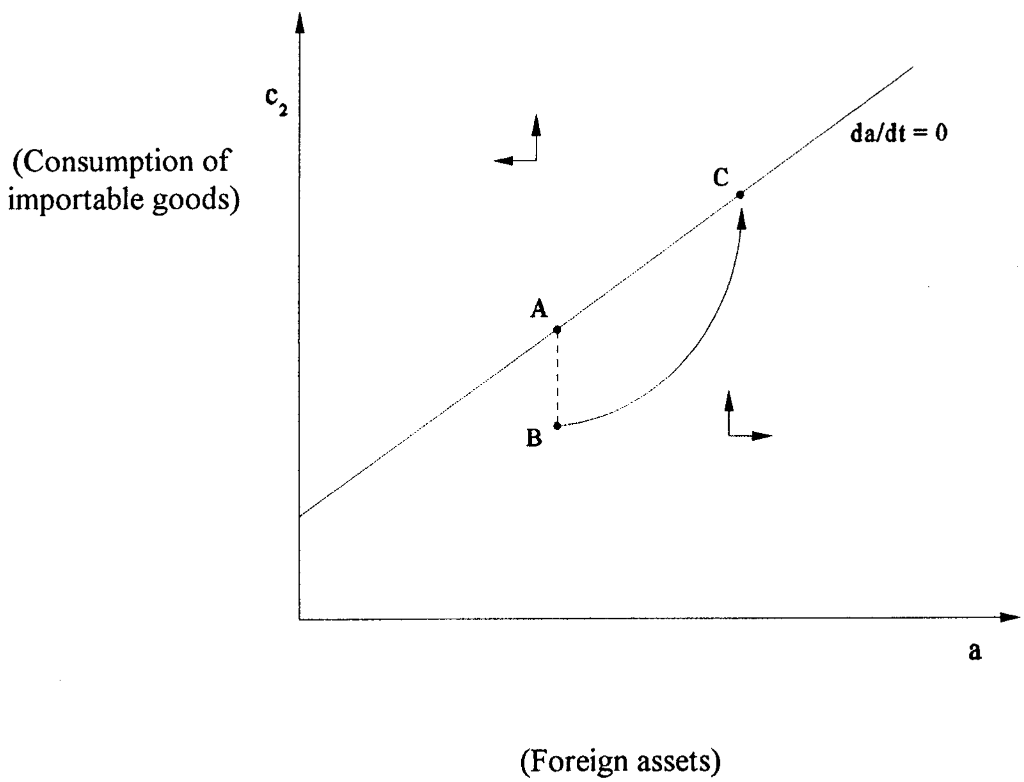

FIGURE 2. WELFARE LEVELS FOR THE CASE OF NO PRODUCTION RESPONSE: The "Pure Costs of Gradualism"

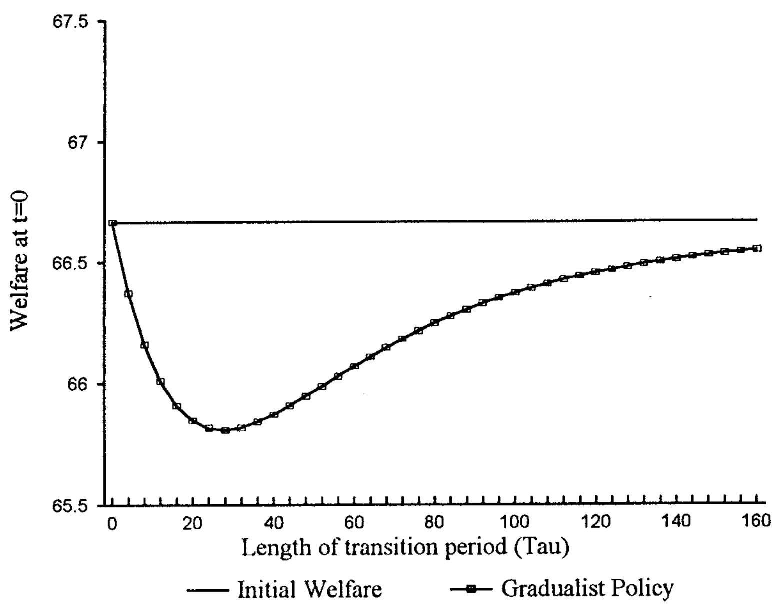

FIGURE 3. WELFARE LEVELS WITH PRODUCTION RESPONSE: Gradualism and Delayed Shock