RATIONAL DELAYS IN TARIFF REDUCTION PROGRAMMES: INSIGHTS FOR TRADE POLICY FROM CORE ECONOMIC MODELS

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Abstract

This paper is an attempt to shed light on a tricky issue in trade policy: whether pre-announced reductions in trade barriers should ever be suspended or reversed. The model invokes the micro-economic assumptions of imperfect competition and product differentiation with differential investment responses aligned to the tariff-reduction scenarios of delay and ongoing reduction.

The criterion equation shows whether any induced investment benefit does or does not compensate for the alternative-policy loss of welfare arising from delaying the benefits to consumers from the earlier reduction in tariffs under the reduction strategy. We also show the degree of investment-induced cost reduction that is required to justify delaying the program of tariff reduction. The model provides the framework for these issues to be tackled and for trial or actual numbers to offer quantitative answers.

Subject to a sufficient investment-induced cost reduction, the case remains open for delays in pre-announced tariff reduction programs to be policy optimal. Moreover, this case does not depend on adjustment delays and burdens. In many ways we have developed a more strictly economic, rather than political or reactions-based, set of circumstances that may justify the delay.

The message here is not that delays in tariff reduction programs are, in general, justified. It is that a set of questions can be developed that open up this possibility. The questions are specific and demanding. Unless the welfare gains from cost reductions induced by the business investment are sufficient, and unless the business investment would not have arisen without the incentive effects of the tariff delay, the case is not made out.

Key Words

Tariff reductions, delays, imperfect competition theory, induced investment responses, cost reductions.

JEL Codes

F12, F14.

I. The Setting and the Issues.

Modern economies frequently reduce formal trade barriers (tariffs and other import barriers especially). They also face domestic political pressures to limit, slow, halt or even reversethese reductions. Two decisions of the Australian (Howard) Government in the later

1990s[1] to "freeze" tariffs that would otherwise have been reduced has prompted derisory calls that the measures were "unjustified", "irrational" and inconsistent with economic theory. We show here that these decisions to freeze rather than reduce tariffs may indeed be economically "rational", yet this result is derived using very conventional economic tools. We use a core pricing model from industrial economics to address these issues.

Two striking features of trends in world trade policy since about 1990 have been:

1. significant, often spectacular, reductions in announced and actual nominal tariff rates; and
2. delays and reversals in the actual tariff reductions and often the replacement of import-duty protection by other protective measures.

The first trend seems fully in accordance with economist textbook demonstrations that freer trade enhances national and world welfare. The tariff reductions arose from unilateral actions, multi-lateral agreements, such as China's requirements to attain membership of the World Trade Organization (WTO), and the succession of bilateral free-trade agreements (FTAs) between pairs of countries and trading blocs. The most spectacular recent example of significant reduction in tariff rates must be China's near-removal of very high nominal tariffs. In 1996, import duties applied to foreign motor vehicles entering China were 80% and 100%, depending on engine capacity; they apply more recently at 12 to 15%. Australia's car import duty rates were reduced from 57.5% in the late 1980s to 10% at present.

The second trend appears as a politically-driven contradiction of the first trend that can have no apparent foundation or support from economic analysis. A clear example of delay in the

[1] Both were in fact announced in 1997, concerning (a) motor vehicles and (b) textiles, clothing and footwear industries.

pre-announced program of tariff reductions occurred in the early life of the Howard Government in Australia: substantial delays in tariff reductions were applied to textile, clothing and footwear tariff reductions and to those applying to motor vehicles, in 1997. Much earlier the Whitlam Government's 25% across-the-board tariff reductions in July 1973 had been followed by exchange rate, tariff and quota responses within two years that effectively reversed the tariff reductions. Some detailed documentation of the replacement of tariff by other protective measures in many countries is provided in Boyce et al., 1980.

Standard economic analysis does not accommodate either: (a) time delays, or any specific chronology, or (b) adjustment burdens imposed on specific sectors, regions, business firms or individuals. Accordingly, any significant emphasis upon those negatively affected by tariff-reduction programs and policy responses designed to address their plight can easily be branded 'purely political' responses that delay reaping the consumer benefits of lower tariffs. Press reports from journalists and some economists following the Howard delay decisions in 1997 said exactly this. Somewhat grudgingly, it was said that such delays might be the only political course to attain the goals of eventual free trade. We can call this the 'adjustment burdens and adjustment costs' political justification for delays in tariff reduction programs. In a broad sense it is also an economic argument, if one accepts that the political alternative is a return to the starting point before tariff reductions, as in the Whitlam example cited above.

Some attempts have been made by economists to incorporate this adjustment burden argument into formal economic models. In many ways, economists are here responding to a huge challenge laid down by the prominent Canadian economist, Harry G. Johnson, whose writings and seminars dominated international economics in the 1960s and the early 1970s. Johnson claimed frequently that while politicians accepted the case for delaying tariff reductions, such

policy responses were not derivable as policy-optimal from any formal economic models. This challenge was issued by Johnson at international conferences, such as the Monash International Trade Conference organized in 1969 by Ian MacDougall and Richard Snape, and at the Cambridge World Development and Trade conference, organized by Paul Streeten, in 1972. Johnson's challenge does not seem to have appeared so bluntly anywhere in print.

One approach is to ascribe time paths to potential economic activity that has three relevant scenarios:

(a) a control state where tariffs are left unchanged. Overall economic activity (say, real GDP), product prices and measure of welfare stay constant or grow at some pre-determined growth rate;

(b) a radical one-off elimination of tariffs, with significant short-term adjustment costs and delays as immobile and specialized resources are retrenched from import-competing sectors and take time to move to, or be retrained for production in, the efficient/export-competing sectors, if ever. Real national production reaches greater heights, eventually, than under the control scenario, the difference being the long-term gains from trade, which incorporates the main message from standard (static) economic analysis of tariffs in a more realistic dynamic setting; and

(c) a staged or sequenced set of partial tariff reductions that takes longer to attain the static gains from trade; however, this strategy cushions the adjustments costs and makes it more 'politically' acceptable.

Some examples of these time-path approaches include Wonnacott and Hill, 1988, and a mathematical 'snake function' devised by the writer. An important ingredient of any time-

based approach to policy analysis is to incorporate present values by applying discount rates to time-specific economic variables. This procedure has the immediate consequence of favouring strategies that delay the bad news (adjustment costs) even though part of the good news (gains from trade) is also delayed. It also demonstrates how impatient policy propensities (high discount rates) will justify delayed rather than full-throttle tariff reductions. In formal terms, the delays are economically optimal, at least from the standpoint of individual nations. There are important pointers here for negotiators of free-trade agreements and also for the role and relevance of formal economic analysis.

There is another aspect of tariff reduction sequences that offers a completely different potential economic justification for delaying tariff reduction. It is not based on political responses or adjustment delays, or even significantly on present-value considerations. It arises from a close treatment of business investment responses to the alternative tariff-reduction scenarios. Once again it is not easy or not possible to incorporate such aspects into standard trade and tariff theory. It is important to understand why this is the case.

Classical tariff theory supposes implicitly that the capital stock is fixed and given in what is ostensibly a stationary-state economic model driven by comparative static policy experiments. There is by definition zero business investment activity, other than capital stock replacement and maintenance. Consistently, there is no incentive for the perfectly-competitive firms to embrace profit-seeking extraneous activities as free entry competes away any potential advantage they might seek. A broader world of multi-national firms operating in oligopoly markets with product differentiation and entry barriers offers richer opportunities. In this setting, there is potential for cost-reducing aggressive business investment and technology strategies to be adopted under the ‘delay’ scenarios to a fuller degree that under the full-

throttle scenario. This is exactly what firms like General Motors argued to support the delays in tariff reduction in Australia in 1997. An important further consequence of the business setting we envisage is that costs and prices of (imperfectly-) competing products can be different, both from each other and over time. This feature is not consistent with standard tariff theories that invoke the 'law of one price' for all relevant products in every relevant market. It has been established long ago (Isard, 1977) that the "law of one price" hardly ever applied and should be categorically rejected. In strongly language, supported by his analysis, Isard claims "students have been seduced by visions of an imaginary world .. with homogeneous (products). In reality the law of one price is flagrantly and systematically violated by empirical data." (Isard, 1977, p. 942).

Economists and other observers are wise to be circumspect about the arguments advanced by protected interests for delaying tariff reductions. This is why a return to modelling this entire process seems highly desirable. The two main questions that economists should ask are: (1) would the cited business investment have happened anyway under the more radical reduction scenario? and (2) would the cited business investment detract from other/better uses of the same funds in other parts of the economy? In the Australian case, clear answers were given to the Australian Government by companies like General Motors: (1) the business investment would not otherwise have happened, an assertion supported by confidential board minuets and research papers; and (2) if the investment had not gone ahead in Australia, it would not have released funds for any other investment in Australia. This second observation reflects one of many significant consequences firm incorporating the activities of multi-national firms into the analysis. Even accepting both these representations, economists have further questions: (3) how extensive and sustained are the cost reductions flowing from the business investment that would not otherwise have occurred; and (4) are the welfare benefits to consumers arising from

the cost reductions associated with the induced investment sufficient of offset the detriment to consumers flowing from the delays in the tariff-reduction program?

The answer is that there are some demanding tests to be passed before this investment-based argument turns out to be welfare increasing. In summary, they are positive answers to all four test questions posed in this paragraph, and significant quantitative cost reductions associated with the delay-induced investment. That said, if the tests are passed, we have established a new argument for potentially optimal delays in tariff reduction programs that has nothing directly to do with adjustment delays and burdens.

II. The General Linear Imperfect Competition Model.

We use for the price and quantity responses in the import-competing sector a general linear imperfect-competition model (GLIC) similar to that commonly applied in many conventional microeconomic expositions.[2] The demand and cost functions embodied in this model would seem almost to be the default position in most industrial economics applications in all advanced treatments like Martin, 2001. They also carry the advantages of moving beyond the perfect competition framework which cannot accommodate the investment responses we are highlighting and also to include product differentiation which is found to be the predominant product form in modern trade and trade policy in practice. The model also accommodates the now-prevalent finding that domestic and foreign prices of products in (imperfect) competition with each other are neither identical nor move (proportionately) together over time. (Isard, 1977, and Coutts and Norman, 2007.) We are in company with a large number of theoretical

[2] Some other applications of this general model include the Nordhaus-Loury model of research outlay decisions as expounded in Martin, 2002, at Ch 13, or in Shy, 2000, at Chapter 9.

and empirical studies[3] based on this product-differentiation, imperfect-competition framework that has still made very little headway in undergraduate textbooks.

In the model a linear inverse demand function position-connected to a rival imported product is combined with constant unit costs and profit maximisation business goals to generate unique price-quantity choices. There are some important properties of the model which we used in deriving our results. They are stated here and proved in the appendix.

BASIC FORMAL PROPERTIES OF THE GLIC MODEL

A: Equilibrium Properties - demand and cost functions given:

A.1: Price is always midway between the choke-off price at which demand disappears and the level of unit costs. Given the demand intercept and costs, price never depends on the slope of the demand function, though output selected by the firms does.

A.2: Profits are always double consumer surplus, so net social welfare, the sum of these two components is always 1.5 times profits.

A.3: The demand function is always elastic for feasible conditions.

B: Responses to cost reductions – demand functions given:

B.1: Price always falls by one-half of the unit cost reduction.

B.2: The percentage price change is less than one-half of the percentage cost change.

B.3: Production volume always increases.

B.4: Profits always rise with a cost reduction, the percentage gain in the unit profit margin being identical to the percentage gain in production volume.

C: Responses to demand reductions – cost functions given:

C.1: Price falls by one half of the reduction in the choke-off price, which is implied by A.1 above.

C.2: Production volume falls according to the (unchanged) slope of the demand function.

C.3: Profits and thus consumers' surplus (because of A.2 above) always fall, meaning that social welfare is reduced, despite the price reduction.

[3] Such as Armington, 1969a,b, Aw, 1991, Barker, 1977, Brander & Spencer, 1984, Brenton, 1989, Cheng, 1988, Christodoulakis & Weale, 1992, Devarajan & Rodrik, 1993, Dixit & Stiglitz, 1977, Flam & Helpman, 1987, Greenaway, 1988, Harris, 1984, Helpman & Krugman, 1985 & 1989, Krugman, 1979, 1982, 1990a and 1990b, Lancaster, 1980, Lyons, 1981, Melvin & Markusen, 1981, Negishi, 1961, N. Norman, 1996, V. Norman 1989, Pettengill, 1979, Robinson, 1971, Staelin, 1976, Suzuki, 1991 and Venables, 1982.

The standard "classical" trade and tariff models begin and end all trade and trade-policy experiments with the same state of competition. Pure or perfect competition prevails at all relevant times, which by definition is unaffected by all the policy actions embraced. So X is a homogeneous product, identical in substance and perception by buyers or all its sources, whether from home or foreign suppliers. Accordingly, the dominating models of tariff analysis – the Marshallian, the general equilibrium and effective protection approaches – are incapable of giving any answer other than 'no effect of freer trade on the state of competition in the home economy'. When one considers the reality of industry sectors such as Australia's oligopolistic car industry where imports have risen from a controlled 20% in the middle 1980s to around 70% these days, it is difficult to argue that on any conception of competition, the competitiveness of that industry has not increased in company with, and because of, trade liberalization.

Nor can the radically non-classical post Keynesian mark-up pricing model (as in Norman, 1996) shed much light on competition aspects as it presupposes the mark-up percent to either marginal costs or price to be invariant, so the Lerner Index of Monopoly Power (LIMP) never changes. This is a surprisingly similar characteristic shared by totally different economic models. The GLIC model, however, shows in general that reducing tariffs applied to horizontally-competitive imported products ("product tariffs") does in general increase competitiveness, by reducing the LIMP. Correspondingly, reducing tariffs on imported inputs raises LIMP, reducing market competitiveness, thus acting like a subsidy to recipient firms.

III. A Model for Investigating Differential Investment Responses to dynamically-different trade policy sequences.

There are three relevant avenues of final expenditure within the home country: (i) outlays on the protected manufactured products, designated X; (ii) outlays on rival (product-differentiated) foreign-produced goods, denoted Y; and (iii) outlays on other products, called Z. The tariffs applied to Y are either reduced in accordance with a pre-announced timetable, or are frozen for a time and then reduced later. We call these policy alternatives the 'reduction' and 'freeze' (or 'delay') scenarios.

The essential difference between these two scenarios is that we allow the level of production costs (and product prices in X) to become lower under the delay scenario, through the cost-reducing effects of the induced business investment. That carries consumer benefits associated with higher tariffs than would otherwise be the case. Anyone drilled in conventional tariff analysis would find this difficult to accept, but it has already been established (by Helpman and Krugman, 1985) and is consistent with recent econometric work directly investigating price responses by import-competing firms in the case of cost ands global pricing influences. (See Martin, 1997, and Coutts & Norman, 2007.) The criterion equation developed is whether this induced investment benefit does or does not compensate for the alternative-policy loss of welfare arising from delaying the benefits to consumers form the earlier reduction in tariffs under the reduction strategy. This criterion can be transformed to ask a more direct question: What degree of investment-induced cost reduction is required to justify delaying the program of tariff reduction? The model provides the framework for these questions to be answered and for trial or actual numbers to be inserted to gauge quantitative answers.

We first develop the chronological back-drop to the policy exercises, explain how the model is adapted to suit a three-sector model of the economy and then to run the policy experiments.

1. The Temporal Setting: The freeze period is N years (say, five) such that economic actions and consequences before and after this period are unaffected by the decision to either (a) "freeze" or (b) "further reduce" tariffs, which are the two policy options considered. Pre-freeze values are simply reference points.

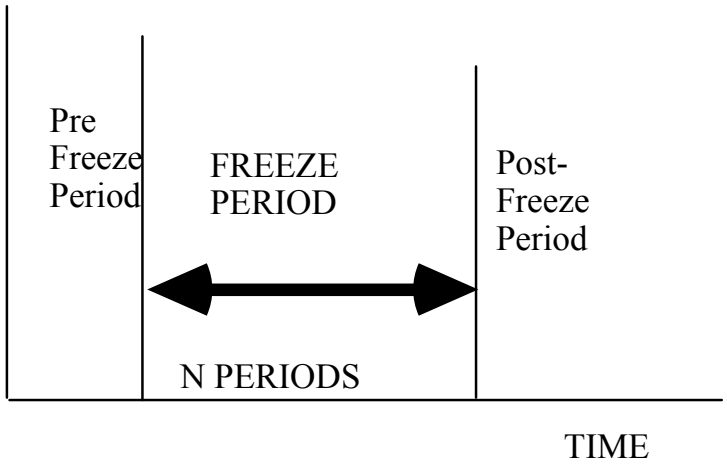


Diagram 1

2. **The Product Structure:** Domestic consumers choose between X-goods subject to the tariff reduction (or freeze), Y-goods (imperfectly) substitutable with X-goods and to which the only tariffs are applied, and Z-goods unaffected directly by protection.

3. Production Conditions: Unit costs in activity X are invariant with respect to output but would be reduced in the "freeze" period by investment that depends on profit expectations formed before the freeze period. In sector Z either investment is not contemplated or it does not exhibit cost-reducing consequences.

4. Policy Options: We are concerned mainly with the "freeze" period, considering both producer and consumer welfare derived all relevant activities, directly or indirectly. There are but two policy choices:

(I) **freeze** tariffs affecting the protected product, X, for N years; or (II) proceed with the previously agreed commitment or expectation for tariff **reduction**[4].

IV. Economic Consequences of Cost Reductions arising from the Freeze.

In the set-up, we have a linear (inverse) demand function for X-goods and constant unit costs, **C**, which will fall to the lower rate, $\mathbf{C_f}$, if the freeze is adopted, provoking the cost-reducing investment. This factor trends to increase consumers' surplus, but the story is not complete yet. The set-up is shown in diagram 2 below.

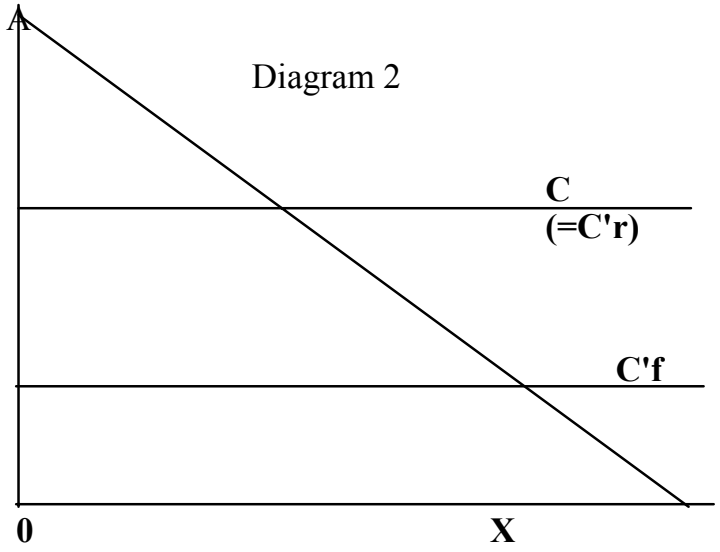


Diagram 2

[4] Unprimed variables relate to pre-freeze conditions when both the policy and investment decisions are taken. All variables with primes relate to periods in the (prospective) freeze, so that any variable V' can be written as V' = V(1+v). Suffices (f,r) denote the freeze and reduction options, respectively, Y, Z denote quantities of the three products; P = prices of X-goods to home consumers; J = prices of imported goods, Y; W is net social welfare, the sum of profits (Π) and consumer surplus (CS).

Profit-maximising firms always price at the mid-point between unit costs (C) and the choke-off price (A)(the inverse demand function intercept value), (property A.1) which is a very convenient result. So the pre-freeze price is P in diagram 3.

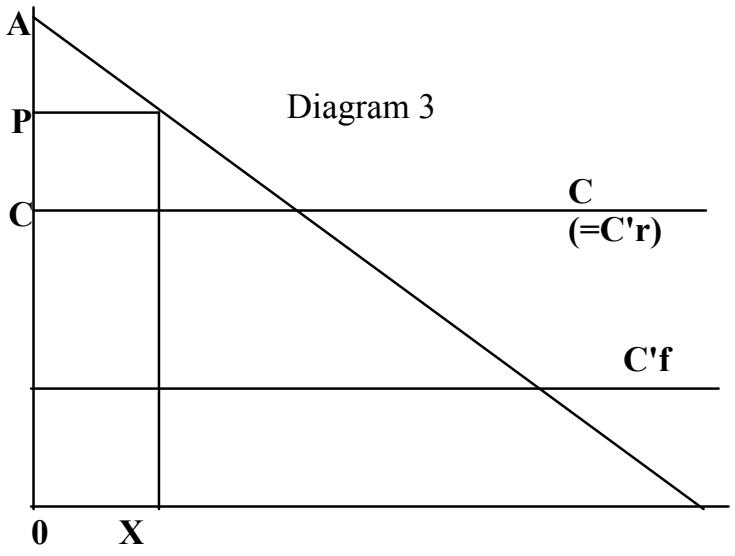
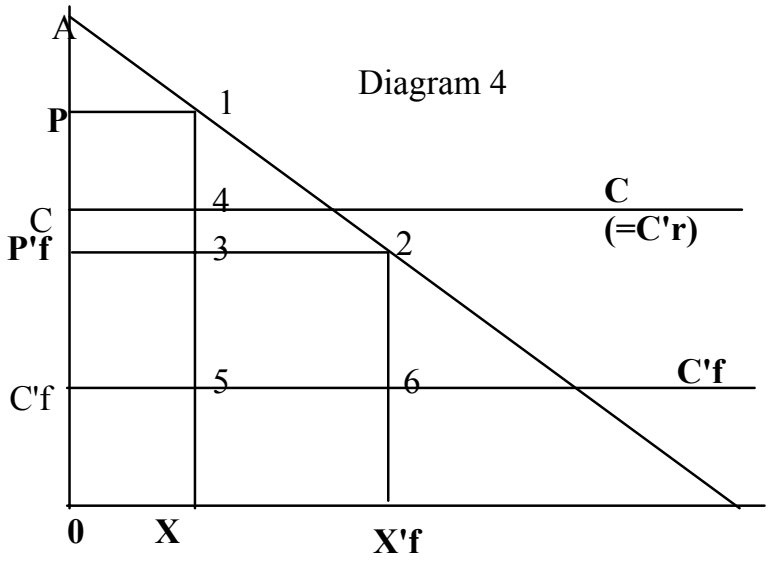


Diagram 3

In the freeze period the tariff (on imports, of Y) do not change, nor do other demand conditions of X or Y (or Z), so the demand function for X remains unchanged. Profit-maximising prices fall to **P'f**, which is exactly half the cost reduction (property B.1) Compared with the pre-freeze period there is a clear gain in net social welfare, measured as consumers' surplus plus profits: in diagram 4 CS rises from **P A 1** to **P'f A 2**, while profits rise from **C P 1 4** to **C'f P'f 2 6** .(Thus properties B.1 to B.4)



Now imagine a similarly-constructed diagram for product Y, the imperfect foreign-produced substitute. Because the price of the locally-produced rival, X, has fallen, the demand function for substitute Y moves inward, reducing consumer surplus derived from this product, offsetting some of the gains arising through product X. (See the properties C. above)

The appendix sets out expressions for the sources of gain that in this section derive entirely from decision to **interrupt** the tariff reductions. It is evident, however, that the extent of cost reductions following causally from the investment which the freeze has occasioned is the central determinant of these welfare gains. If the investment or the cost reductions do not flow from the freeze, then the social benefits are not produced.

V. Economic Consequences of the Alternative Tariff Reduction Policy Option.

Our policy options are diametrically opposed. If the tariff reductions were to proceed through the period during which we have assumed them above to be frozen (for N years), then the cost-reducing benefits of the investment will be lost. If the freeze option is selected, then the import-price reducing benefits of the tariff reductions will be lost. The policy question is

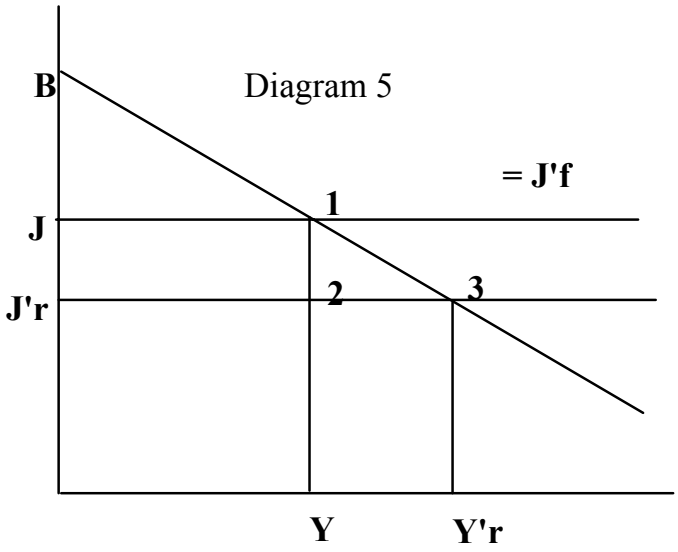
whether the welfare benefits arising from the investment-inspired cost reductions are larger than those arising from the tariff reductions.

In principle the answer could go either way. The approach here is designed to show the factors that will determine which of the rival policy options is superior.

In the tariff reduction approach we commence with the imported product, Y. The applicable tariff standing at T% (ad valorem) is reduced by "t" per cent. For example, if T were 20% reduced by 25% of this rate to 15%, then T is 0.2 and t is (-)0.25. The price of Y in the home country (J) will fall by up to 4.2% in these circumstances. A reduction of 4.2% is the only result standard trade theory offers, though in more general (imperfect competition) conditions a less degree of price fall would be expected[5].

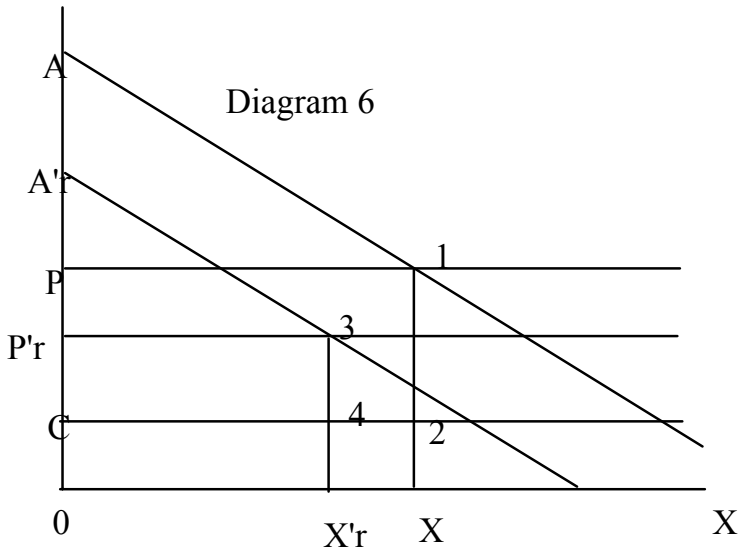
The price reduction generates some gain in consumers' surplus, but this is blunted by the loss of tariff revenue (J 1 2 J'r in diagram 5) so that the gain is restricted to the triangle 1 2 3.

[5]Cf. Norman, 1975.



The story unfolds further as we transmit this price reduction to product X, where consumers and producers both lose from the inward movement of the demand function through the substitution effect, despite the fact that the price of this product falls. This somewhat surprising result derives from the GLIC property that producer and consumer welfare rise and fall together in relation to products such as X. (property A.2)

Diagram 6 illustrates for the locally-produced product X the reductions in price and both components of welfare. Profits fall from C P 1 2 to C P'r 3 4 and CS from P A 1 to P'r A' 3, remaining in proportion to each other, as ever. Both sides of the rectangle from which CS is computed have fallen, the base because demand volume is reduced (property C.2), and the height because price falls less than the demand function intercept (choke-off price)(property C.3)



VI. Some Comments on the Model and possible Extensions of the Analysis

The GLIC format is a powerful device that incorporates imperfect competition in a classical framework. But are there some missing bits?

(a) Resource transfers: no additional resources are called for in the reduction option; however, we need to add some social value for resources released to sector Z. In the freeze option, some additional resources may be called into X, despite the investment there.

(b) Balance of payments adjustment: import volumes and values are reduced in the freeze option; import volumes are increased in the reduction option. Some price-softening currency upvaluation might then accompany the freeze, and some price-raising currency movement might accompany the tariff reductions, if the exchange markets are to clear.

(c) Cost of Investment: Investment in the Freeze option is not costless, Periodic costs, C. might incorporate them on a current cost basis.

(d) Product/quality improvement: we have supposed product specifications to be given. if the freeze promoted investment in improved products this would advance the case for the freeze. There is scope to amend the model to incorporate quality change (as studied in Aw & Roberts, 1986, Das & Donnenfield, 1987 and Hocking, 1980.)

(e) Flow-on effects form the freeze: if there are other protected sectors with little or no cost-reducing investment options seek the tariff freeze as a reciprocal political bargain, any benefits from the freeze will be eroded. The imperative is a demonstration that cost-reducing social benefits are demonstrated.

(f) Post-freeze protection. If the welfare benefits of the freeze are greater than those arising from the tariff reductions, then the benefit is gained in each of the N periods of the freeze. Why, then, should N be advanced at long as possible? Why not postpone the tariff reductions as long as possible. Herein lies a strange irony: usually it is said that the conventional economic arguments favour freer trade and the only "justification" for protectionist-like responses is political. We have turned this on its head: **if the economics supports a tariff freeze then only political economy arguments (like free trade commitments) give reasons for resuming the tariff reductions.**

The general conclusion is that, subject to a sufficient induced cost-reduction, the case remains open for delays in pre-announced tariff reduction programs to be policy optimal. Moreover, this case does not depend on adjustment delays and burdens, which is the supporting base for previous demonstrations that tariff delays may be policy optimal. In many ways we have

developed a more strictly economic, rather than political or reactions-based, set of circumstances that may justify the delay.

The message here is not that delays in tariff reduction programs are justified. It is that a set of questions can be developed that open up this possibility. The questions are specific and demanding. Unless the welfare gains from cost reductions induced by the business investment are sufficient, and unless the business investment would not have arisen without the incentive effects of the tariff delay, the case in not made out.

A pertinent point is that the way in which classical tariff theory is set up, these questions cannot even be asked, let alone be answered.

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APPENDIX

1. FORMAL PROPERTIES OF THE GENERAL LINEAR IMPERFECT COMPETITION MODEL

The "workhorse" model of modern industrial economics has representative firms facing linear, downward-sloping (inverse) demand functions and constant marginal costs defined on period rates of output, X. We can write these functions as:

(1) **AR** (average revenue) = **A – (S/2)X**, whence:
(2) **TR** (total revenue) = **AX – (S/2)X^2**, and
(3) **MR** (marginal revenue) = **A – SX**, and
(4) **MC** (marginal cost) = **C**.

The parameters A (the choke-off price), S (the slope of MC) and C (the initial, constant marginal cost) are all given until varied or endogenised in this set-up. We need (A,S) positive, X non-negative and (A>C). Furthermore, the business goal is one of simple profit maximization, until this is also varied, as it can be (unlike perfect competition models where no variation in the maximand is permissible).

Basic Propositions A: with given demand and cost functions

A.1: Profit maximisation implies MR=MC, or (3)=(4), which means A-SX=C or
(5) **X* = (A-C)/S**, using * to denote optimal values. Note that the second-order condition for a maximization is immediately satisfied with (-S)<0 (the output derivative of MC). To ensure this optimal rate of output applies to them, firms charge the corresponding optimal price (P*) derived by substituting X* into the demand function (1), whence we get
(6) **P* = (A+C)/2,** which is **property A.1**.

Notice four important properties of this optimal price solution specific to GLIC:
(i) A.1 implies (A-P*) = (P*-C), the optimal price-midpoint theorem: P* always bisects the interval (A-C);
(ii) P* requires ONLY knowledge of A and C: the slope coefficient of the demand function is irrelevant to the price solution and price effects under all uses of the model;
(iii) the ordinary price elasticity of demand (oped), or (e), is simply

(7) **e= -[(A+C)/(A-C)]**[6]**,** so once more the slope/position of the demand curve is not needed for analysis: just knowing A and C suffices, as it does to determine P*; and

(iv) writing the price-cost margin, M as (P*-C) [=A-P*], the Lerner index of monopoly power (LIMP)[7] is simply expressed as

(8) **LIMP = (P*-C)/P* = [(A-C)/(A+C)]** which is always **-1/(7) = -1/e**.

Notice that, as C approaches given A, LIMP falls as oped (e) rises in absolute magnitude: the familiar textbook observation about such elasticities with linear demand curves. The market power of the subject firms is measured to decrease; a cost reduction (say, through a technological advance or currency appreciation or tariff reduction affecting imported inputs) reduces demand elasticity and raises market power. In the extreme with C=0 as in some hi-technology areas these days, the measures of LIMP are unity (absolute market power) and e is (-)1. It is important to apprehend the technical properties of GLIC before seeking to apply it.

A.2: **Profits in activity X** are

(9) **(Profits) = (P-C) X, (=MX),**

while consumers' surplus is given easily in this model as

(10) **CS = (A-P) X/2**, **(=MX/2).**

Notice especially from the definition of M and the mid-point price property of GLIC, that CS is immediately and always in GLIC one half the value of profits: (9) = 2.(10).

Social welfare is commonly specified as the net return to consumers and producers, or just the aggregation of profits and consumer surplus, or from each X firm just the sum: (9) +(10), which is always 1.5 times profits. The corollary is simple: as profits, CS and welfare always remain in these proportions to each other, the percentage change in any one of them suffices for all.

A.3: at the optimal selection (P,X), **the ordinary demand elasticity** is given as:

(11) **e= ∂X/∂P.P/X =(-) [(A+C)/(A-C)],** as derived above. Notice that e is always "elastic" (<-1) whenever production is ever feasible (A>C).

Propositions B: Cost Reductions from C to C' [= (1-c)C].

[6] From (1) the direct demand curve is X={2(A-P)}/S, so dX/dP = -(2/S) and e = (dX/dP).(P/X) = -P(A-P), or using property A.1 for profit-maximising P*, e= [(A+C)/(A-C)] as stated.

[7] C.f. Martin (2002), p.119.

B.1: Using A.1, for any exogenous cost change, [c=(dC)/C], price is revised to
(12) P' = [{A + (1-c)C}]/2 = P-[cC/2], so price falls exactly by one-half of the cost reduction (cC).

B.2 Using B.1, (12), the percentage price reduction, in sales of product X, which we write as p, is
(13) p = [cC/2]/[(A+C) = (cC)/(A+C)
which is less than c. As C cannot exceed A, the maximal value for C/(A+C) is one half.

B.3: Selected production volume rises to
(14) X' = (A-C')/S = X+cC/S >X.
Using B.3 and A.1, the percentage gain in X, denoted x, is
(15) x= cC/(A-C).

B.4 As X has increased, profits will increase if unit profits (U) also rise. The necessary condition for this to occur is that costs decrease by more than prices decrease. This condition is always met as the cost decrease (cC) is double the price decrease (cC/2), using B.1 (12). Unit profits therefore rise by one-half of the cost reduction. The percentage rise in unit profits, u, is
(16) u = cC/(A-C), which is identical with the percentage gain in output established in B.3 above. Profits themselves, a component of welfare, rise proportionately by 2cC/(A-C), which is the same percentage gain experienced in both consumers' surplus and social welfare, consistent with A.2.

Propositions C: Demand Reduction, with Given Costs.

C.1: Given the GLIC midpoint theorem in A.1 above, the reduction in the choke-off price (inverse demand intercept) must be accompanied by a reduction to the extent of exactly one-half of this change in price. The intercept is reduced by aA and the price by (aA)/2.

C.2: Differentiating the solution value for production, $\partial[(A-C)/S]/\partial A = 1/S$, a positive relation, so when A falls, so does X, according to the inverse of the slope of the marginal revenue function(S).

C.3: Remembering that profits and consumers' surplus rise and fall together, as established in A.1 above, we can slow that both profits and consumer surplus fall with an inward (parallel) demand shift, despite the price fall which would normally benefit consumers. The height and width of the rectangle from which CS is derived each fall: the height because price falls less than the choke-off value, proved at C.1 above; the width, because volume is also reduced, as demonstrated in C.2. CS therefore necessarily falls, despite the price reduction.

C.4: If the nature of the demand function in X is to reflect substitution effects from a radiating position (choke-off price) at A, then price effects are confined to cost effects, given the optimal price equation (6)(property A.1).

2. AN APPLICATION OF THE GLIC MODEL TO CONSIDER THE EFFECT OF TRADE POLICY LIBERALIZATION ON MEASURES OF MARKET COMPETITION

Defining
(17) L=LIMP (Lerner's index of Market Power) = (P-C)/P = M/P, using (iv) in A.1 above, and using single primes for policy adjustments to "product" tariffs and double primes for policy adjustments to "input" tariffs, we have the following results:

(a) Marshallian tariff model: M = 0 at all times, whence M=M', so L=L'
(b) General equilibrium tariff model: as for the Marshallian model.
(c) effective rate model: M=M'=M"
(d) mark-up pricing Post Keynesian tariff model, M=kP (k>1 and constant at all times), so L=kP/P = k, whence L=L'=L"

The surprising result is that in these very different models, both Classical and Post Keynesian, there is no capacity whatever for measure of market power, L, to be affected in any way by trade policy changes affecting either product or input tariffs.

In the GLIC model we can identify some competitive impact consistent with intuition. For GLIC specifically we can write the Lerner index as:
(18) L = [(A-C)/(A+C)], which is (8) above as derived there.

The reduction of product tariffs is akin to the imposition of a tax on recipient firms, reducing their market power. In the general case, the substitution effect of a competitor price being reduced lowers the choke-off price A, in the percentage a, so
(19) L' = [{A(1-a)-C}/{A(1-a)+C)}], which given A always >C for viable production, means that L'<L: the measure of market power is reduced. This result according with intuition is not available form any of the standard theories of protection described above.

The reduction in input tariffs is akin to the introduction of a subsidy to recipient firms, raising their market power. The impact on L is as follows:

(20) L" = [{A-C(1-c)}/{A+C(1-c)}] >L.

So we have the relativity:

(21) L'>L>L" under the GLIC model.

3. AN APPLICATION OF GLIC TO CONSIDER POLICY OPTIONS TO FREEZE OR CONTINUE PRE-ANNOUNCED REDUCTIONS IN TARIFF RATES.

The groundwork has been laid to complete our task. The set-up conditions before either the freeze or tariff reductions are given in propositions A.

Under the freeze scenario, costs in X fall, invoking proposition B. But the price cut in X leads to an inward movement in the Y-product demand function, involving propositions C.

In the tariff reduction strategy, the price of Y falls, causing an inward shift of the X-product demand function, again invoking propositions C. It follows that our experiment requires only downward shifts in demand and cost functions to be studied.

The model can be further integrated by defining a substitution parameter, σ, which is the percentage reduction in the demand function intercept arising from a given percentage reduction in the price of the rival product. As a plausible symmetry assumption, we suppose that if

$p = j = 1\%$, then the cross-effects $a = b = \sigma$.

The price effects on product X can first be studied. From B.1 we have a price reduction arising from the freeze of c[C/2]. With a tariff reduction of t per cent, the price of Y falls by j percent, shifting the X-product demand function down by $\sigma\alpha t$ (per cent), where α is the ratio j/t. The price of X falls by one-half of the intercept shift, by the midpoint theorem, whence the price cut is $t(\sigma\alpha A/2)$. As A always exceeds C, write $A = k.C$ ($k>1$). Comparing these results, it follows that the price reduction in X is greater under the cost-reduction strategy than the tariff reduction if $c > t(\sigma\alpha k)$. A numerical illustration might assist. With $T = 0.2$, α has an upper bound of [T/(1+T)] or 0.167; assign it the value 0.12, so the 25% cut in tariffs reduces Y-product prices by 3%, and X-product prices by 3% also. If $k = 1.5$, the cost reduction compared with pre-freeze conditions needs to be more than 4.5% to produce lower X-prices under the freeze by more than they are reduced under the tariff reductions.

Now we examine the welfare effects. Ignoring cross-product terms, the cost reduction increase welfare through boosting the profits in X by cCX, and thus welfare overall by (3/2)[cCX]; it diminishes CS in product Y by cσCBY/(A+C), so the overall welfare effect is given as:
cC[(3X/2) - σBY/(A+C)].

Inspecting [...], generally B/(A+C) will be less than unity, [..} is positive and welfare is increased, again sensitively depending on the cost-reduction parameter, c.

The tariff reduction alternative boosts consumer surplus in Y by $\sigma^2t^2J^2/G$, and reduces welfare through product X where it cuts profits and CS by t[3XσαA/S]. The total welfare effect of the reduction strategy is thus:

$t[(t/G)\ \sigma^2J^2$ - 3XσαA/S]

These criterion equations can be inspected to determine the preferred strategy. For sufficient cost reduction, c, subject to other parameters, the freeze will conceivably be optimal. If so, the freeze itself should on economic grounds be indefinite. If politicians in these circumstances continue the march to freer trade (by terminating the freeze) then IN THESE CIRCUMSTANCES it is freer trade rather than continued protection which is economically irrational.