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A NOTE ON THE EFFECTIVE RATES OF PROTECTION AND THE PERIOD OF PRODUCTION

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Introduction

In recent years the extensions of the theory of effective protection have focussed on several critical issues, such as the general equilibrium foundation for the theory [ ], the possibility of substitution between inputs [ ], and the appropriate treatment of nontraded goods [,]; but, as yet, no one has addressed the question of time in the production process. The effective rate models to date have all assumed instantaneous production from primary and intermediate factors; any costs incurred by producers because of non-zero periods of production, such as expenditures on maintenance of inventories of raw materials and goods in process have been ignored. The purpose of this note is to repair this deficiency by developing a formula for the effective rate of protection that explicitly incorporates the cost of working capital. In the last section of this note, the revised formula is applied to data for 30 Pakistani industries, whose effective rates have already been calculated in a previous study [ ] and the two sets of effective rates are compared in order to determine the seriousness of the current omission of the costs associated within the estimates of effective protective rates.

Working Capital in the Theory of Effective Protection

If production were instantaneous and inputs were instantaneously available at all times with certainty there would be no need for inventories. Such not being the case, inventories of raw materials and goods in process become necessary and the corresponding cost of working capital is an integral part of the cost of production. Naturally, the period of production is not constant for all production processes nor is the variability in the supply of inputs and in the demand for outputs constant across products. Thus, ~~These~~ differences among industries in the importance of working capital costs will arise. It must be recognized, however, that not all of the observed levels of inventories can be associated with the time lags involved in the production or sales process alone. In economies where foreign exchange is chronically scarce -- Pakistan for example -- the uncertainty in the supply of imported inputs created by the periodic foreign exchange crises causes producers to overstock inventories by comparison to producers in industrial countries. If the economy suffers from inflation as well, inventory accumulation is a convenient and profitable way to hold liquid assets. In developing a new estimating formula for the effective rate, it is important to distinguish between these different reasons for inventory holdings; however, in the empirical calculation of effective rates it will be extremely difficult to distinguish among these various uses.

(1)

Working capital enters into the calculation of effective rates because the value of inventories, like the value of purchased inputs, is affected by the tariff system and the different values of inventories under different tariff regimes will in turn affect the levels of pre-tariff

and post-tariff values added on which rates of effective protection are based. The annual cost of inventory holdings can be treated as any other input cost in the calculation of effective rates. The one notable difference between these two kinds of input costs is that the annual cost of inventories will rise either because the value of the stock of inventories increases or because the rate of interest which must be applied to inventory holdings increase or possibly because of both types of increases.

Few studies of effective protection have been able to observe the values of inputs and outputs at both their domestic and world prices; instead the domestic values of inputs and outputs are deflated by a factor which reflects the markup of the domestic price over the cif price in order to infer what the values would be if there were no tariffs. The estimation of the world value of inventories by this process encounters a number of difficulties, some common to all goods and others pertaining only to goods held as inventories.

The first difficulty is that in many countries the difference between the domestic price and the world or cif price is not accurately measured by the tariff rate. Restrictive quotas will sometimes drive the domestic price far above its tariff-indicated level; in other cases competition will have driven the domestic price below the tariff-indicated level, rendering the tariff redundant. In economies where quotas are used, there are really two prices for every imported good: the cif plus tariff price which the license holder pays and the scarcity price, usually above the cif plus tariff price, which the non-license holder is forced to pay. The difficulty in deflating the recorded values of domestic inventories is that one is unsure of which price to use since there is no way, ex-post, to determine which price the manufacturer was obliged to pay (and reported to the statistical office).

A second problem relating to the valuation of working capital involves the treatment of goods in process. Since there are no cif prices for unfinished goods, their world prices have to be inferred from the world prices of their inputs. The major categories of direct costs embodied in goods in process are wages and intermediate inputs. The world value of the embodied intermediate inputs can be derived by the procedure described above but the deflation of wages required a slightly different approach. Since labor is not traded internationally, it has no cif price. Nevertheless, a "world price" of labor can be calculated if it is assumed that the labor supply curve is infinitely elastic in the relevant range at the going real wage. On this assumption the money wage manufacturers would have to pay in a tariff protected equilibrium is increased compared to the no-tariff equilibrium is by a factor proportional to the increase in the cost of living. In turn, by deflating each expenditure item in the budget of an industrial worker by its cif/domestic price ratio, a new, world price consumer budget can be determined . The percentage difference between these two budgets will be a good measure of the percentage difference between the domestic and world price money wages, provided price substitution in consumption can be ignored.

can be calculated by determining what money wage manufacturers would have to pay in a no-tariff equilibrium in order to maintain a constant real wage compared to the tariff protected equilibrium. By deflating each expenditure item in the budget of an industrial worker by its cif/domestic price ratio, a new, world price consumer budget can be determined. The percentage difference between these two budgets will be a good measure of the percentage difference between the domestic and world price money wages, provided price substitution in consumption can be ignored.

The Modified Effective Rate Formula

Since our purpose is to modify the standard effective rate formula, we can begin by adjusting the basic components of it for the costs of working capital. If U is the effective rate of protection[1], then:

1. The industry subscript is dropped for ease of exposition. Also, the U form of effective protection is employed rather than the Z form, which computes the subsidy given to industry as a percentage of value added at world prices. The U form computes the subsidy as a percentage of domestic value added. The U form is prefarable in the following derivations because of its ease in dealing with negative value added industries, although it does not satisfactorily rank industries with negative value added at world prices. see Guisinger [ ]

$$U = \frac{W - V}{W}$$

where: W is the industry's value added measured in domestic prices
V is the industry's value added at world prices

In equation 1, working capital costs are not treated as an intermediate input and therefore show up in both W and V as part of value added. In order to derive the modified

one need only subtract the costs of inventories from W and V, the costs being measured at their domestic and world values respectively.

$$2.\quad U^o = \frac{1}{W-(K_m+K_s)\cdot r}\Big[(W-(K_m+K_s)r) - \Big(V - r'(K_m+sK_s)\frac{1}{1+t_m} - r'(1-s)K_s\frac{1}{1+t_w}\Big)\Big]$$

where: K_m is the domestic value of the average level of raw material stocks held during the year.
K_s is the domestic value of the average level of semi-finished and finished goods held as inventories during the year.
s is the share of raw material costs in total direct costs (equal to raw material costs plus wage costs)
t_m is a weighted average tariff on raw materials, the weights being the shares of each input item in the total domestic value of raw material inputs
t_w is the weighted average tariff on items consumed by industrial workers with weights chosen according to each item's importance in the total consumption budget. is able to
r is the interest rate at which the firm/borrow. funds. The prime indicates the interest rate which would prevail at world prices.

Setting r = r' and combining:

$$3.\quad U^o = \frac{1}{W-(K_m+K_s)r}\Big[W-V-\Big(r\cdot K_m\frac{t_m}{1+t_m} + K_s\cdot r\Big(\frac{t_w}{1+t_w} + s\Big(\frac{1}{1+t_w}-\frac{1}{1+t_m}\Big)\Big)\Big)\Big]$$

$$4.\quad U^o = \frac{1}{1-(K_m+K_s)\,r/W}\Big[U - \Big(r\cdot K_m\frac{t_m}{1+t_m} + K_s\cdot r\frac{t_w}{1+t_w} + s\Big(\frac{1}{1+t_w}-\frac{1}{1+t_m}\Big)\Big)\frac{1}{W}\Big]$$

Estimates of U^o

All the variables on the right hand side of equation 4 can be taken from or derived from Census of Manufacturing

Industries' data for Pakistan and from the previously cited study of effective rates by Lewis and Guisinger. These data are of varying quality and the estimates of U^0 should only be taken as orders of magnitude. Nevertheless, we believe that the data are adequate to determine just how sensitive the traditional formula for effective protection is to our proposed modification.

The Data (shown in Appendix):

U: the standard effective rates of protection, taken from Lewis and Guisinger, [ ], were calculated from data for the period 1963/64.

W, K_m, K_s: These data are drawn from the 1959/60 Census of Manufacturing Industries, which contains the most recent and most detailed record of inventories in manufacturing firms in Pakistan. An implied assumption in using these 1959/60 data with the effective rates for 1963/64 is that the ratios of working capital to value added in equation 4 are the same in both years. A second assumption is that these inventory data, which are end of year totals reflect the average value of stocks held during the year.

t_m: the average tariff on intermediates was taken from an earlier version of the Lewis and Guisinger study. The weights used in calculating the averages are the value shares of inputs in the total value of intermediate inputs, both values at world prices.

t_w: t_w was calculated in much the same way as t_m. The budget of a typical industrial worker was broken down by the percentages spent on individual products or product groups, as shown in Appendix ____. The tariff applying to each product group was then used to deflate each share to its world value. The sum of these shares represents in effect a wage index at world prices with 100 equaling the index at domestic prices. Because no item in the workers' budgets was subsidized by the tariff system, his "world valued" wage index is less than 100 and the ratio of 100 to this world value index is equal to $1+t_w$.

r: r is the rate of interest which has arbitrarily been set equal to 10% and 20% for the two sets of estimates shown in Table . We assumed that the rate of interest on working capital would not change substantially between the no-tariff and post-tariff situations.

The Results

Inspection of the rates of protection in Table reveals that the adjustment for working capital does make a difference in the absolute level of effective protection. When an interest rate of .10 is uded, the adjustment for working capital raises the average level of effective protection from 95 to 109 percent. With a rate of interest equal to .10 the average rate rises to 123 percent. In both sets of rates using the modified formula, there are a greater number of firms with negative value added--10 firms when r = .10 and 12 when r = .20. When inventories are treated as a material cost instead of as a part of value added, negative value added takes on a slightly different meaning. In the traditional approach, a negative value added signifies an industry in which the foreign exchange earnings on the inputs, if sold on the world market, exceeds the foreign exhhange earnings for savings in the case of import substitutes) of the output. In the modified approach, the foreign exchange valuation of imports includes, as well, the interest which could be earned on the stock of tradeable items held as inventories.[3]

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3. One may question whether goods in process, included in this study as part of working capital, is really a tradeable item on which interest could be earned if sold abroad. One answer could be that the value should apply only to the raw materials embodied. If this were true, then our estimates, which include the embodied wages, will bias world price value added in the downwards direction.

were these inventories sold abroad and the proceeds from the sale ~~xxxxx~~ invested.

Although the absolute level of rates is altered significantly, the addition of working capital costs makes little difference in the rank ordering of effective rates. Columns 2,4 and 6 show the rank order of effective rates under the traditional formula, the modified formula with r = .10 and the modified formula with r = .20, respectively, Spearman's rank order correlation for columns 2 and 4 is .99 and ~~xxx~~ for columns 2 [illegible] .98, neither of which suggests any significant [illegible] as a result of the inclusion of working capital.

In one sense, the robustness of the traditional measure of effective protection is not surprising since previous studies have shown that other critical adjustments--e.g. for currency overvaluation and for the differing treatments of non-traded goods--make little difference in the rank-ordering of industries by their effective rate. In Pakistan, this stability is caused primarily by the wide range of effective rates in the industrial sector--from -10 to 430--and by the spacing of industries within the range. were the rates of protection more ~~xxxxxx~~ closely bunched together, changes in the rank order would be much more significant.

Things to do:

1. Compute averages by major sector--consumption, investment and intermediate to see differential effects

2. Compute weighted average to see if that number differs much from unweighted.

3. Take partial derivative of equation [illegible] to [illegible] general property of interest rate adjustment. I can show that dU/dr is greater than zero if and only if U is [illegible] than tm/1+tm when K_s equals zero. But not the [illegible] general formula

4. Write conclusion

5. Try other inventory data. ?? from GFP study ?? what will we learn.

6. Show that Uniform nominal tariffs will not give Uniform BAP because of worldwide CAPITAL

	U	~~Rank~~	Rank	U^o	Rank	U^o	Rank
Consumption goods:							
1. Sugar	235	30	28	276	28	334	29
2. Edible oils	489	32	30	563	30	664	30
3. Tea	-10	2	1	-11	1	-12	1
4. Cotton textiles	88	21	20	94	19	101	19
5. Silk and art silk textiles	119	27	26	127	25	137	25
6. Footwear	46	6	5	48	5	51	5
7. Wearing apparel	127	29	27	138	26	151	26
8. Printing and publishing	18	4	3	18	3	19	3
9. Soaps	64	11	10	68	9	73	9
10. Matches	10	3	2	10	2	10	2
11. Plastic goods	87	20	19	92	17	97	19
12. Sports goods	48	8	7	50	6	52	6
13. Pens + pencils	71	12	11	75	11	80	11
14. Electrical appliances	1033	23	22	115	23	129	23
15. Motor vehicles	251	31	29	281	29	319	28
Intermediate goods:							
16. Jute textiles	105	24	23	110	22	116	20
17. Thread + thread ball	62	10	9	69	10	77	10
18. Saw milling	92	22	21	93	18	94	16
19. Tanning	85	19	18	100	21	121	22
~~20. Rubber products~~	~~122~~	~~28~~					

	U	Rank	Rank	U°	Rank	U°	Rank
20 ~~21~~. Fertilizer	117	26	25	151	27	215	27
21 ~~22~~. Paints + varnishes	72	13	12	79	12	87	13
22 ~~23~~. Chemicals	75	14	13	81	13	87	13
~~24. Petroleum products~~	~~7~~	~~2~~					
23 ~~25~~. Paper products	79	17	16	85	15	92	15
Investment + related goods:							
24 ~~26~~. Non-metallic mineral products	77	15	14	82	14	87	13
25 ~~27~~. Cement	39	5	4	42	4	44	4
26 ~~28~~. Basic metals	84	18	17	98	20	119	21
27 ~~29~~. Metal products	113	25	24	122	24	133	2
28 ~~30~~. Non-elec. mach.	78	16	15	86	16	95	17
29 ~~31~~. Sewing machinery	58	9	8	60	8	61	7
30 ~~32~~. Elec. mach. + equipment	47	7	6	55	7	65	8
Average	95	75		109		123	
Median	78	50					

Rank order correlation: .94 between 2 and 4 note only Jute and Tanning jump around.

$\frac{552}{30(899)}$ $\frac{552}{2697\ 0}$

U = 9 NVA industrie

U°(.10) = 10

U°(.20) = 12 NVA industrie

Rank order correlation
col. 2 and 6 = .98
col. 2 and 4 = .99

Appendix. A

	% t_j	U	Rank	Raw material	Semi-finished & finished goods	Value Sp.	Value Added	3
Consumption goods:								
1. Sugar	31	235	30	16.	63.8	148.6	46.8	10
2. Edible oils	62	489	32	24.	14.7	210.8	26.3	1
3. Tea	37	-10	1	7.8	4.9	103.0	13.0	7.
4. Cotton textiles	18	88	21	206.6	106.1	1,007.5	424.9	2
5. Silk + art silk textiles	58	119	27	19.7	10.[illegible]	78.3	40.6	2
6. Footwear	64	46	6	7.8	9.[illegible]	[illegible]	[illegible].9	11
7. Wearing apparel	146	127	29	.8	.9	[illegible]	1.9	1.
8. Printing + publishing	69	18	4	5.2	5.3	54.1	36.5	[illegible]
9. Soaps	57	64	11	16.0	4.3	[illegible]	31.7	[illegible]
10. Matches	47	10	3	3.7	4.5	39.4	28.3	[illegible]
11. Plastic goods	40	87	20	1.4	.9	7.8	3.8	1
12. Sports goods	35	48	8	.5	.2	3.5	1.6	1.
13. Pens + pencils	50	71	12	2.1	1.2	8.2	4.9	2
14. Electrical appliances	34	103	23	.6	.2	1.10	.7	5
15. Motor vehicles	52	251	31	15.0	4.5	62.7	17.4	[illegible]
Intermediate goods:								
16. Jute textiles	11	105	24	43.5	41.8	301.6	141.4	[illegible]
17. Thread + thread ball	132	62	10	2.1	1.2	12.7	3.1	[illegible]
18. Saw milling	32	92	22	.08	.02	2.2	1.1	[illegible]
19. Tanning	33	85	19	8.6	11.3	63.4	12.3	[illegible]
~~20. Rubber products~~	~~35~~	~~122~~	~~28~~	~~.9~~	~~.4~~			

20 2/1. Fertilizer	47	117	26	11.5	.8	18.3	5.2	67
21 2/2. Paints + varnishes	33	72	13	6.4	1.7	20.6	8.7	31
22 2/3. Chemicals	49	75	14	10.4	6.7	44.0	22.0	23.
2/4. Petroleum-products	32	7	2	—	—	—	—	
23 2/5. Paper products	50	79	17	22.9	3.0	82.8	34.0	27
Investment + related goods								
24 2/6. Non-metallic mineral products	42	77	15	3.2	3.9	20.2	9.8	15
25 2/7. Cement	58	39	5	31.3	13.3	130.7	67.0	23
26 2/8. Basic metals	21	84	18	34.0	32.8	97.0	39.0	3
27 2/9. Metal products	22	113	25	38.7	12.5	1[illegible].1	60.1	2
28 3/0. Non-elec. mach.	19	78	16	20.8	7.6	54.4	28.0	3
29 3/1. Sewing machinery	20	58	9	1.0	.2	10.1	4.5	1
30 3/2. Elec. mach. + equipment	31	47	7	30.6	14.7	64.7	28.6	
Average		95	79					
Median		78	50					

Rank order correlation: .94 between 2 and 4 note only Jute and Tanning jump around.

Note: Col. 6 From Lewis, S.R. Jr and Stephen Guisinger "Measuring Protection in a Developing Country: The Case of Pakistan" ~~Table 2~~ p.20 Economic Development Report #20, Harvard University, Sept 1967, mimeo p.20

Col. 1 ~~From~~ From Lewis, S.R. Jr. and Stephen Guisinger "Measuring Protection in a Developing Country: The Case of Pakistan", The Journal of Political Economy Nov./Dec 1968 Table 3 col. 2, p.1184

Col. 2, 3

Census of Manufacturing Industries 1959,
pp. 106-113

Col. 4, 5, 8, 9 ibid. pp. 32-35

Data used to calculate wage deflator:
consumer budget from.
Consumer Price Index Numbers For
Industrial Workers 1961=100
Central Statistical Office
Economic Affairs Division
Government of Pakistan, Karachi, 1964
p 18
Tariffs were taken from Lewis and Guisinger
and other sources.

	U	Rank	8 Wages	9 Cost of materials and fuels		
Consumption goods:						
1. Sugar	235	30	14.6	101.9		
2. Edible oils	489	32	6.7	183.0		
3. Tea	-10	1	3.6	89.7		
4. Cotton textiles	88	21	170.0	582.1		
5. Silk + art silk textiles	119	27	12.9	39.0		
6. Footwear	46	6	10.9	40.1		
7. Wearing apparel	127	29	1.0	4.9		
8. Printing + publishing	18	4	18.7	26.3		
9. Soaps	64	11	5.7	39.9		
10. Matches	10	3	7.7	11.1		
11. Plastic goods	87	20	1.4	4.0		
12. Sports goods	48	8	.7	1.9		
13. Pens + pencils	71	12	1.59	3.28		
14. Electrical appliances	103	23	.23	.46		
15. Motor vehicles	251	31	5.55	49.1		
Intermediate goods:						
16. Jute textiles	105	24	59.8	160.2		
17. Thread + thread ball	62	10	1.27	9.36		
18. Saw milling	92	22	.51	1.17		
19. Tanning	85	19	4.9	51.59		
20. Rubber products	122	26	—	—		

20 21. Fertilizer	117	26	2.5	13.1			
21 22. Paints + varnishes	72	13	2.2	11.9			
22 23. Chemicals	75	14	5.68	21.98			
~~24. Petroleum products~~	~~7~~	~~2~~					
23 25. Paper products	79	17	9.73	49.0			
Investment + related goods:							
24 26. Non-metallic mineral products	77	15	5.72	10.87			
25 27. Cement	39	5	12.11	63.77			
26 28. Basic metals	81	18	14.52	61.50			
27 29. Metal products	113	25	26.13	90.80			
28 30. Non-elec. mach.	78	16	11.1	32.3			
29 31. Sewing machinery	58	9	.6	5.6			
30 32. Elec. mach. + equipment	47	7	11.2	39.0			
Average	95	75					
Median	78	50					

Rank order correlation: .94 Between 2 and 4 note only Jute and Tanning jump around.