Effective Rates of Protection When Domestic and Foreign Goods are Imperfect Substitutes: The Case of Thailand

DRAFT

EFFECTIVE RATES OF PROTECTION WHEN DOMESTIC AND FOREIGN GOODS ARE IMPERFECT SUBSTITUTES : THE CASE OF THAILAND

By

Shantayanan Devarajan
Harvard University

and

Chalongphob Sussangkarn
Thailand Development Research Institute

October 1987

I. Introduction

Tariffs on imported goods protect domestic industries because the higher price on the import bids up the price of the domestic, import-competing good. However, it has long been recognized that tariffs also raise the cost of intermediate inputs, which may have adverse effects on value added. Consequently, the concept of "effective protection" has emerged, which captures the effect of the tariff structure on value added in every industry. In general, effective protection measures the difference in value added in each sector of the economy with and without a given pattern of tariffs.[1]

When stated this way, it is plain that effective protection requires a *general equilibrium model* for its conputation. This is because it is necessary to ask the counterfactual question, "what will be the distribution of values added by sector in the absence of the current tariff structure?" Traditionally, such a general equilibrium model has been hard to come by, particularly at the level of aggregation required for effective protection studies.

Fortunately, an alternative exists. Under certain conditions (explained below), it is possible to determine

[1] See eg. Balassa (1965).

the pattern of effective protection without solving a general equilibrium model explicitly. The conditions are those of the non-substitution theorem combined with those of a small, open economy. In a small open economy the domestic price of a traded good is its world price, P*, multiplied by (1+t) where t is the import tariff (or export subsidy) rate. If production is governed by constant returns to scale, there are no joint products and there is only one non-produced factor, then the non-substitution theorem tells us that the mix of production -- and therefore of value added -- is determined by prices alone (independenly of demand). Hence it is possible to compute the "effective rate of protection" (ERP) by calculating just the price of value added by sector in the presence and absence of tariffs. In symbols, if we assume intermediate inputs are used in fixed coefficients a_{ij}, the effective a rate of protection of sector j, ERP_j, is

$$ERP_j = \frac{P_j^*(1+t_j) - \sum_i P_i^*(1+t_i)a_{ij}}{P_j^* - \sum_i P_i^* a_{ij}} - 1$$

Thus, ERP's can be calculated simply with knowledge of world prices, tariff rates and the input-out put structure.

Not surprisingly, ERP's have been calculated in several countries for innumerable industries. Moreover, they have been used to guide policy. Sectors found to have ERP's much higher than what was intended would have tariffs on their competing imports reduced, and conversely. Given the importance of ERP's, it is reasonable to ask how robust they are as rules-of-thumb for predicting the impact of tariffs on value added. In particular, how sensitive are ERP's to the (rather strong) assumptions of the underlying general equilibrium model?[2]

In this paper, we attempt to answer part this question by focussing on a specific assumption of the model, one which is often left unstated: the assumption that imported and domestic goods in the same sector are perfect substitutes. Without this assumption, the equality between the domestic and world prices of traded goods will not obtain. Yet, even at a faily disaggregated level, imported and domestic goods are not the same. Thailand, for example, imports and produces canned food. The domestically produced items are canned fruits and vegetables, whereas imports include caviar and suchlike. It is hard to imagine that a 10 percent tariff on caviar imports will lead to a 10 percent increase in the domestic price of canned lychees. Nevertheless, this is the assumption that is made in calculating the ERP of the canned food industry.

---

[2] See Ethier (1977) and Balassa (1982) for discussions of the underlying general equilibrium model for the ERP concept, and point to some of the diffculties when there is substitution in production (between value added and intermediate inputs, say)

Unrealistic as it may be, the assumption of perfect substitutability is necessary if we wish to measure effective protection without solving a full-blown general equilibrium model. Furthermore, until recently, it was not possible to solve models whose level of disaggregation was as large as that required by ERP studies. Today, however, this constraint has been removed to a large degree. In this paper, we compute ERP's in Thailand and compare them with results from a 54-sector, computable general equilibrium (CGE) model of Thailand. In the CGE model, we relax the assumption of perfect substitutability between imports and domestic goods by assuming that Thai consumers have a CES utility function over the two types of goods (in each sector). We calculate effective protection in Thailand for reasonable estimates of these elasticities of substitution. We show how, as these elasticities get larger, the pattern of effective protection approaches that obtained by the traditional approach. For sensible levels of the elasticities, however, the structure of effective protection diverges quite sharply from the standard ERP calculation. Not only is the ranking of industries different, but the level and spread of effective protection rates obtained from the CGE model are significantly less. In short, the assumption of perfect substitutability between imports and domestic goods gives rise to ERP's that are too high and too widespread compared to the actual mix in the economy.

The choice of Thailand as the country of application is by no means accidental. During the years of import-substitution-led industrialization, Thailand erected sizeable tariff barriers to protect domestic industries. Now that the country has embarked more towards an export-led growth strategy, the structure of protection is subject to dismantling. How this is done will depend, inter alia, on the pattern of effective protection in the economy. There have been many studies of effective rates of protection in Thailand using traditional methods.[3] Most of these studies have shown that ERP's in Thailand can be quite high and varied. By showing that finite substitution elasticities lead to ERP's that are lower and more concentrated, we hope to shed light on these estimates as well as inform the current policy debate in Thailand.

The plan of the paper is as follows. In section II, we present some simple, two sector general equilibrium models that capture the essential features of the larger (54-sector) model. By solving these small models analytically, we are able to anticipate some of the results of the CGE model. Section III presents our empirical results. We compare nominal and effective rates of protection computed by traditional methods with the percentage change in value added from solving the CGE model with and without tariffs.

---

[3] As examples, see Table 19 in Tambunlertchai (1987).

This percentage change in value added, in turn, is calculated for various assumptions about the elasticity of substitution between foreign and domestic goods. Section IV contains our concluding remarks.

II. General Equilibrium Models and Effective Protection

In this section, we present a family of general equilibrium models that portray the relationship between foreign-domestic goods substitutability and effective protection. We examine the parameters on which this relationship depends. In this way, the results of the larger, 54-sector model in section III may be interpreted in terms of the structure of the economy.

A. Protection

The role of imperfect substitutability between imports and domestic goods in determining the degree of protection can be captured by the following simple model:

Let there be two sectors in the economy, an exportable (all of whose output, E, is exported), and an import-competing good, whose output, D, is an imperfect substitute for imports, M. The latter is captured by the equation

$$\frac{D}{M} = k \left(\frac{P^*(1+t)}{P}\right)^{\sigma} \qquad (1)$$

where P^* is the world price of the import, t the tariff rate, P the price of the domestic good and σ the elasticity of substitution. Note that as σ approaches infinity, the domestic sector becomes a perfect substitute for the import.

Log-differentiating (1) and assuming world prices do not change, we obtain

$$\hat{D} - \hat{M} = \sigma(\hat{\tau} - \hat{P}) \qquad (1)$$

where a "^" denotes percentage change $(\hat{X} = \frac{dX}{X})$, and $\hat{\tau} = \frac{\hat{t}}{1+t}$.

To close the model, we must specify the supply side and budget constraints. Assume E is sold abroad at a parametrically given world price (i.e., it is pure traded good). With one mobile factor which is fully employed, and perfect competition, the supply of E and D can be expressed by

$$\hat{E} = - \O\hat{P} \qquad (2)$$

$$\hat{D} = \Omega\hat{P} \qquad (3)$$

where $\O$ and Ω are the (general equilibrium) supply elasticities of E and D respectively. Finally, we assume all income is spent on D and M (tariff revenues are rebated to consumers in a lump-sum fashion), so that there is trade balance.

Recalling that world prices are fixed, this is expressed as:

$$\hat{M} = \hat{E} \qquad (4)$$

Solving (1)-(4) for $\hat{P}$ in terms of $\hat{\tau}$, we obtain:

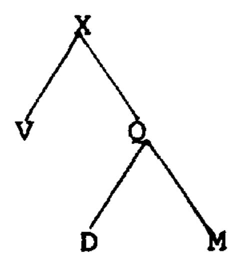
$$\hat{P} = \frac{1}{1 + \frac{\Omega + \emptyset}{\sigma}} \hat{\tau} \qquad (5)$$

As σ -- ∞, the coefficient governing the relatonship between $\hat{P}$ and $\hat{\tau}$ approaches 1. That is, a 10 percent tariff rate will lead to a 10 percent increase in the domestic price of the import-competing good. For finite values of J, however, this coefficient is less than one. A 10 percent tariff will lead to a less-than-10 percent increase in the domestic price. In this way, the degree of protection given to the domestic industry is damped.

Just because imperfect substitutability weakens the link between domestic and cum-tariff world prices, it does not follow that effective protection is unambiguously reduced. Effective protection depends on output and input prices. While the assumption of perfect substitutability overstates the output price, it also overstates the input price. The net effect depends on the mix between the two, as well as on the share of imports in each sector. To see this, we turn to a slightly more elaborate model.

B. Effective Protection

To capture the role of imperfect substitutability on effective protection, we assume that good 1, the exportable, is not produced by value added alone, but by a fixed coefficients combination of value added and material inputs. The latter, in turn, is satisfied by a mix of domestically-produced and imported inputs, which are taken to be imperfect substitutes. The production function can be described by the following tree:



The technology at the first level is fixed coefficients (between V and Q, but at the second level (between D and M it is CES. We assume that the domestically produced material input, D, is provided by the second sector, all of whose output is sold to the exportable sector. Hence if a is the material input coefficient,

$$V = (1-a)X \qquad (6)$$

$$\pi X = PD + P^*(1+t)M + P_v V \qquad (7)$$

where π is the parametrically given world price of the exportable and P_v and V are the price and quantity of value added in that sector. Units in section II. A, we assume some of this sector's output is consumed:

$$X = C + E \qquad (8)$$

We assume further that the import-competing good, D, is produced by value added alone. With the same factor assumptions as before, value added in each sector will depend on the relative price between the two:

$$V = (P_v/P)^{\theta} \qquad (9)$$

$$D = (P/P_v)^{\Omega} \qquad (10)$$

Given our assumption of imperfect substitutability, cost-minimizing by the exportable sector leads to:

$$D/M = k \; \frac{P^*(1+t)}{P}^{\sigma} \qquad (11)$$

Finally, the production technology gives rise to the following relationship among prices:

$$\pi = aP_Q + (1-a)P_v \qquad (12)$$

where P_Q is the price of the "composite good" which is a CES combination of M and D. The relevant fact about P_Q is that its log-differential, $\hat{P}_Q$ is

$$\hat{P}_Q = \theta\hat{\tau} + (1-\theta)\hat{P}$$

$$\text{where} \qquad \theta = \frac{P^*(1+t)M}{P^*(1+t)M + P.D}$$

That is θ is the share of imports in the total "supply" of material inputs.

We can log-differentiate the system of equations (6)-(12) and solve for $\hat{P}_v$ in terms of $\hat{\tau}$. This would measure the change in effective protection to the exportable as a result of a tariff on one of its *intermediate* inputs. The resulting equation is:

$$P_v = \frac{-[\beta_2(1-\beta_3)(\Omega+\emptyset)+\beta_2^2\sigma+\beta_2\beta_1\sigma]\hat{\tau}}{\beta_1(\Omega+\emptyset)-(1-\beta_3)[(\beta_1+\beta_2)(\Omega+\emptyset)+\beta_1+\beta_2\sigma]}$$

where $\beta_1 = a(1-\theta)$

$\beta_2 = a\theta$

and $\beta_3 = 1-a$

Several lessons can be learned from this analytical solution. First, effective protection is negative for this good, since the tariff raises the price of its intermediate inputs, while its output price is fixed by world prices.

Second, the degree of effective protection depends not just on the elasticity of substitution, σ, but also on the share of imports in total supply, reflected in β_2. Indeed, wherever it appears in the above expression, σ is multiplied by β_2. Hence, even if the import and domestic goods are close substitutes (σ is high), if the share of imports is low, the impact of tariffs on effective protection is weakened. Third, as σ appraoches infinity, the formula above becomes

$$\begin{aligned} \hat{P}_v &= -(\beta_1+\beta_2)\hat{\tau} \\ &= -a\hat{\tau} \end{aligned}$$

That is, the effect of a 10 percent tariff is to lower the price of value added by ten percent of the input-output coefficient. This is the justification for the standard ERP formula. Hence in this simple model, the standard ERP calculation would apply if and only if the imported and domestic good were perfect substitutes.

III. Results

Having identified the critical parameters that determine effective protection in a general equilibrium model, we examine results from the CGE model of Thailand to see how they diverge from standard ERP calculations in practice. The model is essentially a 54-sector version of that in section II.B, with a few crucial differences. There is no "pure" traded good. All sectors are imperfect substitutes with imports, although the degree of substitutability varies (see Table 1). Unlike the model in II.B., trade is not in balance in the CGE model. Rather, we fix the real level of investment and government spending and allow the current account to adjust endogenously. This is important when we perform the counterfactual experiment of eliminating tariffs. In this case there will be a shortfall in government revenue. Since government expenditure is fixed the difference is met by foreign borrowing. The latter, in turn, could result in appreciation of the real exchange rate -- another factor left out in standard ERP calculations. The final significant departure from the model in II.B. is that the CGE model has two factors of production, labor and capital.

The model has been calibrated to data from Thailand for 1984. The substitution elasticities used and the observed import-to-domestic supply ratios are given in Table 1. The model was implemented on the computer using the "transactions-value" (TV) approach pioneered by Drud, <u>et al</u>., see Drud and Kendrick (1986) . It is solved using the algorithen SAMLIB, and takes about 40 minutes to find a solution on a microcomputer.

Before proceeding to the model results, one more issue needs to be clarified. This is the appropriate analogue to the effective rate of protection in a CGE framework. In the standard approach, the ERP is a ratio of two prices -- the price of value added with and without tariffs. However, what we are interested in is quantities: by how much will value added change in the absence of tariffs? The point is that, given the assumptions underpinning the standard formula, the price of value added is an accurate signal of the quantity shifts that will occur when tariffs are removed. When these assumptions are relaxed, as they are in a CGE model, the price of value added is no longer an accurate signal. But wth a CGE model, no signal is needed since we can compute the actual change in value added in the presence and absence of tariffs. Hence, we present the percentage change in value added as the appropriate analogue to the standard ERP calculation.

Table 2 displays these effective rates of protection for the base case, using the elasticities in Table 1, as well as for the cases when the elasticities were set equal across the board to 4, 6, 8 and 10. There is a clear amplification of the ERP's as the substitution elasticity is increased. Sectors with positive ERP's become more positive and those with negative ERP's become more negative. This has to do with the starting point. Sectors that end up with enormous ERP's when $\sigma = 10$, like Glass, VGFR and Pottery, had high nominal rates of protection (NRP) to begin with. The effect of increasing σ is to accent the impact of this tariff rate until it dwarfs all other possible countervailing effects. In the base case, VGFR's effective protection rate is low even though its NRP is high. This is because the share of imports in domestic output is about five percent. When the elasticity is raised to 10, however, the effect of this low import share is overcome. Liberalizing tariffs causes imports to rush in at 10 times the rate they did in thst base case, and value added in this sectors comes crashing down to one-tenth its initial value.

The sectors whose ERP's become increasingly negative as σ increases fall into two categories. Some, like Fertilizer and Other Services, have low NRP's at the outset. Increasing the substitution elasticity does little for raising their output price because it cannot rise very far. By contrast, their input prices are now rising by leaps and bounds as the prices of their intermediate goods approach cum-tariff world prices. The result is that their ERP's deteriorate sharply as σ grows.

For other sectors with increasingly negative ERP's, like Tyre-Rubber and Milling, the nominal rate is quite high: 43 percent for Tyre-Rubber and 27 percent for Milling. Again, though, the share of imports in domestic production is quite small for Tyre-Rubber (9.5 percent) and tiny for Milling (0.34 percent). This is an example where the blind use of nominal -- or effective for that matter (see below)

-- rate of protection coefficients calculated in the traditional manner would misstate not just the magnitude but the sign of the degree of protection afforded these sectors.

As we said earlier, higher elasticities tend not just to make ERP's higher but also to make them more divergent. This is borne out by Table 2 where almost all of the magnitudes in the base case were amplified in the higher elasticity case. These points are also corroborated by the frequency distribution in Figures 1-4. As the elasticity increases, the distribution gets more spread out. In addition, the distribution appears to be shifting to the right, confirming the fact that more often than not the ERP increased with elasticity.

How do the ERP's from the CGE model compare with those calculated by the standard method? Table 3 displays the ERP's computed using the formula in section I and the same data set as the CGE model. Notice first that the pattern of ERP's does not differ markedly from that of NRP's. In most cases, the rate of protection is magnified when the ERP is calculated. Thus, again one would expect a widening of the distribution when going from NRP's to ERP's.

As for a comparison with the CGE results, the two differ markedly, especially in that base case. The rate of effective protection for Milling, which was negative in the

CGE framework, is even higher in the traditional ERP calculation. As we noted earlier, this is clearly misleading given the share of imports to domestic output in this sector. Similarly, the Tyre-Rubber sector has an ERP of 84 percent when calculated by standard methods whereas the CGE model gives it a negative ERP. Again, recall that much of this 84 percent comes from the high nominal rate for this sector (43 percent) which again affects only 9 percent of domestic output.

Even if the magnitudes obtained by the two approaches are different, it may be that the ranking of sectors would be similar. Table 4 shows this is far from the case. While the ranking of NRP's compared with that of standard-method-ERP's appears similar, they both differ from the CGE base case. As noted earlier, some of the most highly protected sectors according to the standard ERP calculation appear to be the least protected according to the CGE model.

Finally, we note that the ranking of model-generated ERP's gradually approaches that of the standard calculation when $\sigma = 10$. However, the match is not perfect. This is so for two reasons. First, as mentioned earlier, the CGE model deviates in many ways from the implicit general equilibrium model of the standard ERP approach. Hence, even if domestic and imported goods were perfect substitutes, the fact that the CGE model has two factors could lead to a divergence.

Secondly, an elasticity of ten is still not large enough to eliminate the role of the import share in domestic supply. As we showed in section II.B., it is product of this share and the substitution elasticity that drives the model's results. When the share is below one percent, as in the case of Milling, even an elasticity of ten will not have a countervailing effect. By contrast, the standard ERP calculation represents a knife-edge situation where the share does not matter. It is hard to believe that this situation represents Thailand today.

Conclusion

In this paper we have examined effective rates of protection in Thailand when domestic and imported goods are imperfect substitutes. Observing that the standard ERP appraoch assumes the two types of goods are perfect substitutes, we presented a family of general equilibrium models that showed how the ERP varies with the elasticity of substitution. In particular, we noted that when the elasticity is finite, the share of imports in domestic supply plays a crucial role in determining the effective rate of protection. Finally, we compared the ERP's derived from a 54-sector CGE model of Thailand under different assumptions about substitution elasticities. These were in turn compared with ERP's and NRP's derived using standard methods. We showed that the CGE model's ERP's grow in magnitude and variance as the substitution elasticity increases. Moreover, the pattern of ERP's begins to resemble that obtained from the standard calculation as the elasticity nears 10. For several sectors, however, the ERP differs sharply between that two approaches. This is explained by the role of the import share as well as the interindustry structure of production.

Our overall impression is that the standard method for calculating ERP's can be seriously misleading if domestic and foreign goods are imperfect substitutes. Not only will a less-than-finite elasticity alter the results, but the minute the perfect substitutabity assumption is relaxed several other factors come into play. Crucial among these is the import share in domestic supply.

More generally, dropping the perfect substitutability assumption -- or, for that matter, any of the other assumptions underpinning the standard ERP approach -- forces one to solve a full-blown general equilibrium model. This paper shows that such an exercise is feasible, even at the level of disaggregation required for most ERP studies.

In addition, with a general equilibrium model in hand, we can ask a richer set of questions about industrial policy. ERP calculations have often been criticized because they have little -- if any -- normative content. They tell you what the situation is but now what you shuld do about it. A CGE model of the type described in this paper not only permits more refined ERP calculations but enables the analyst to simulate different policy responses to a country's tariff structure.

TABLE 1

		import share in domestic supply	substitution elasticity
MJCROP		0.01	4
VGFR		0.05	1.2
OTHER	CROPS	0.35	4
LIVSTOK		0.22	4
FOREST		0.12	4
CHARCOAL		0.00	4
FISHING		0.00	4
COAL-LIG		0.27	4
CRUDE	PETROL	0.85	4
MINING		0.16	4
SLAUGH		0.01	4
C-PFOOD		0.21	1.2
MILL		0.01	1.2
ANIMAL	FEED	0.02	1.2
BEVERAGE		0.04	1.2
TOBACCO	PROCESS	0.07	1.2
OTHER	FOODS	0.21	1.2
SPIN	WEAVE	0.16	1.2
OTHER	TEXTILE	0.08	1.2
WOOD		0.14	1.2
PAPER		0.48	1.2
PRINTING		0.04	1.2
BASIC	CHEMIC	0.89	1.2
FERTIL		0.85	1.2
PLASTIC	CHEMIC	0.91	1.2
TYRE-RUB		0.22	1.2
OTHER	CHEMIC	0.42	1.2
PLASTIC	WARES	0.36	1.2
POTTERY		0.13	1.2
GLASS		0.26	1.2
CEMENT		0.00	1.2
CONCRETE		0.01	1.2
OTHER	NON-META	0.17	1.2
IRONSTL		0.74	1.2
MANUF	FABMET	0.37	1.2
ENGINES		0.63	1.2
ELECTR	MACHIN	0.66	1.2
OTHER	MACHIN	0.63	1.2
MOTOR	VEHICLE	0.25	1.2
AIRCRAFT		0.81	1.2
OTHER	MET-PROD	0.42	1.2
OTHER	MANUF	0.58	1.2
FUEL		0.27	1.2
UTILS		0.01	0.7
HOT-RES		0.09	0.7
TRANSP		0.02	0.7
MSERV		0.03	0.7
ENTERM		0.03	0.7
OTHER	SERVICE	0.09	0.7

TABLE 2

EFFECTIVE RATES OF PROTECTION FROM THE CGE MODEL

NRP			BASE	ELAST=4	ELAST=6	ELAST=8	ELAST=10
6.56	MJCROP		3.44	-5.42	-11.25	-13.67	-10.81
68.26	VGFR		0.70	25.07	94.36	315.35	942.67
8.93	OTHER	CROPS	26.06	31.30	58.61	98.10	152.39
6.09	LIVSTOK		-1.44	-1.48	-1.23	-0.82	-0.18
7.18	FOREST		12.58	20.06	35.49	58.05	91.05
6.29	CHARCOAL		-2.17	-2.91	-3.75	-4.71	-5.68
3.99	FISHING		-1.47	-1.60	-1.66	-1.66	-1.60
8.13	COAL-LIG		19.60	26.21	48.20	81.41	133.54
0.01	CRUDE	PETROL	16.53	30.39	55.39	89.48	136.36
13.01	MINING		30.10	40.11	55.57	74.30	95.61
8.80	SLAUGH		-2.03	-2.36	-2.40	-2.28	-1.89
8.81	C-PFOOD		9.04	17.36	25.43	35.84	49.15
26.87	MILL		-29.25	-47.83	-56.93	-62.87	-66.78
1.73	ANIMAL	FEED	-0.76	-1.32	-1.49	-1.45	-1.18
32.52	BEVERAGE		-3.13	2.50	11.85	30.80	68.97
13.01	TOBACCO	PROCESS	0.79	6.32	13.19	24.57	43.51
20.39	OTHER	FOODS	0.38	16.24	33.70	59.48	97.34
16.86	SPIN	WEAVE	3.27	19.97	40.35	72.23	118.76
27.81	OTHER	TEXTILE	0.43	9.61	23.18	47.89	90.41
12.74	WOOD		6.96	19.87	34.34	55.75	87.23
16.26	PAPER		9.89	54.84	105.73	181.61	294.31
10.38	PRINTING		-2.78	-1.59	-0.30	1.70	4.81
11.85	BASIC	CHEMIC	12.03	58.44	102.56	155.91	216.46
3.78	FERTIL		-18.79	-33.32	-44.73	-54.71	-62.34
9.94	PLASTIC	CHEMIC	18.71	67.64	110.71	157.15	201.18
42.98	TYRE-RUB		-39.23	-61.64	-71.45	-77.27	-80.82
21.96	OTHER	CHEMIC	3.85	48.04	104.29	196.51	346.78
58.32	PLASTIC	WARES	11.84	85.61	164.42	234.18	278.06
53.53	POTTERY		7.47	48.85	131.16	294.60	516.67
36.55	GLASS		11.04	78.84	199.67	460.22	943.30
0.00	CEMENT		3.33	6.18	8.66	11.29	13.78
19.55	CONCRETE		2.67	4.66	6.79	10.07	15.31
27.54	OTHER	NON-META	9.06	38.40	81.75	162.85	310.09
7.52	IRONSTL		8.06	25.21	36.82	47.32	56.10
26.25	MANUF	FABMET	9.26	56.20	117.89	219.68	380.99
12.27	ENGINES		7.13	46.67	89.39	150.36	237.85
18.64	ELECTR	MACHIN	5.90	35.46	60.58	87.80	115.35
9.86	OTHER	MACHIN	3.13	26.54	49.46	79.86	120.35
13.59	MOTOR	VEHICLE	0.05	11.56	22.79	37.72	57.78
0.04	AIRCRAFT		3.05	10.78	18.48	28.70	41.78
12.41	OTHER	MET-PROD	13.75	36.35	57.61	83.07	111.73
40.42	OTHER	MANUF	5.43	59.83	108.79	156.44	194.71
8.51	FUEL		1.71	11.64	20.66	31.86	45.81
0.00	UTILS		-1.35	-0.98	-0.90	-0.60	-0.03
0.00	HOT-RES		-1.45	-0.32	0.51	2.03	4.52
0.00	TRANSP		-1.46	-2.01	-2.63	-3.25	-3.86
0.00	MSERV		-1.07	-2.54	-4.03	-5.64	-7.10
12.48	ENTERM		-3.10	-1.55	0.15	3.06	7.93
0.00	OTHER	SERVICE	-11.06	-24.72	-37.10	-48.50	-57.50

Figure 1.

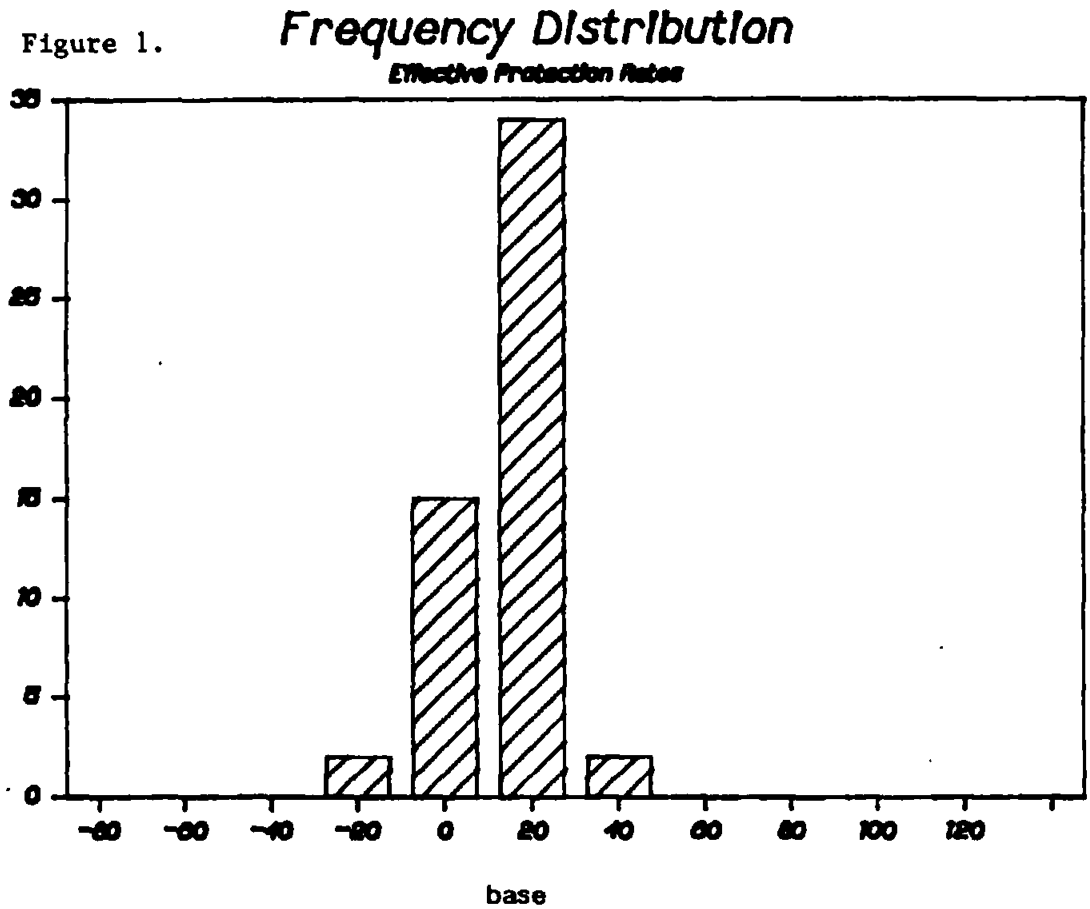


Figure 2.

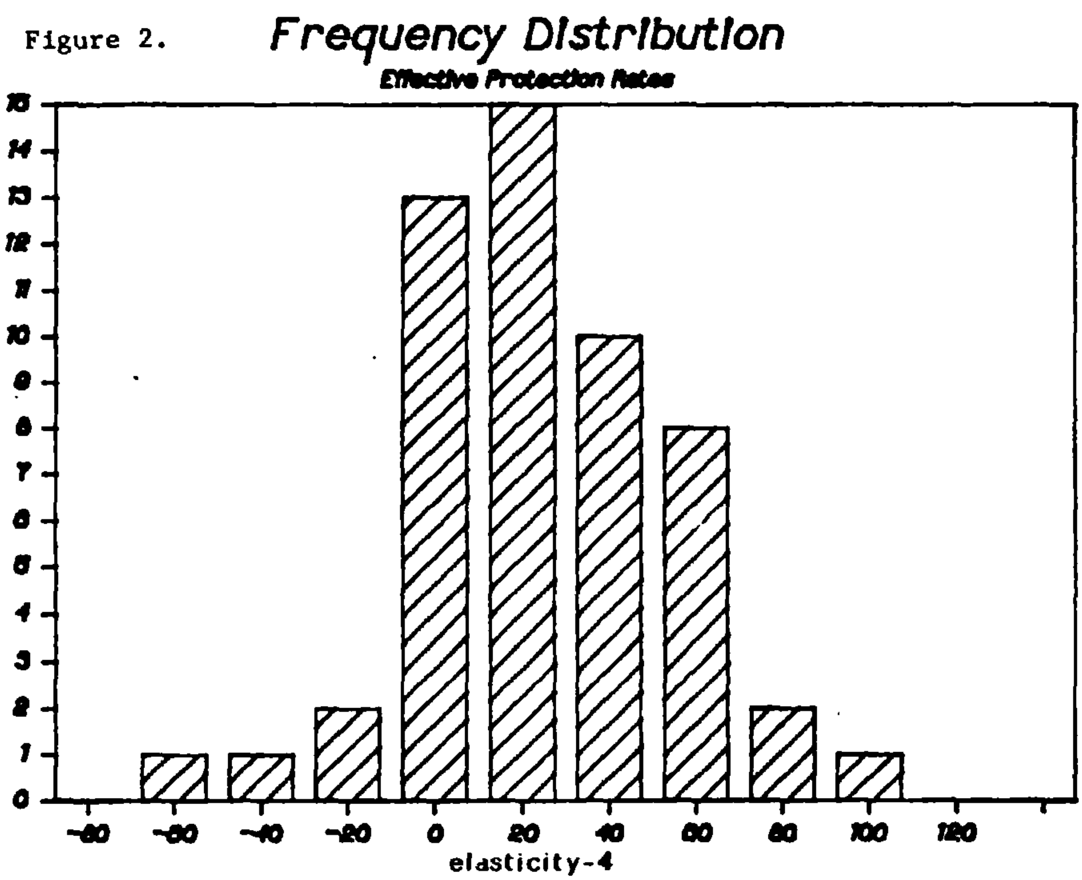


Figure 3. Frequency Distribution

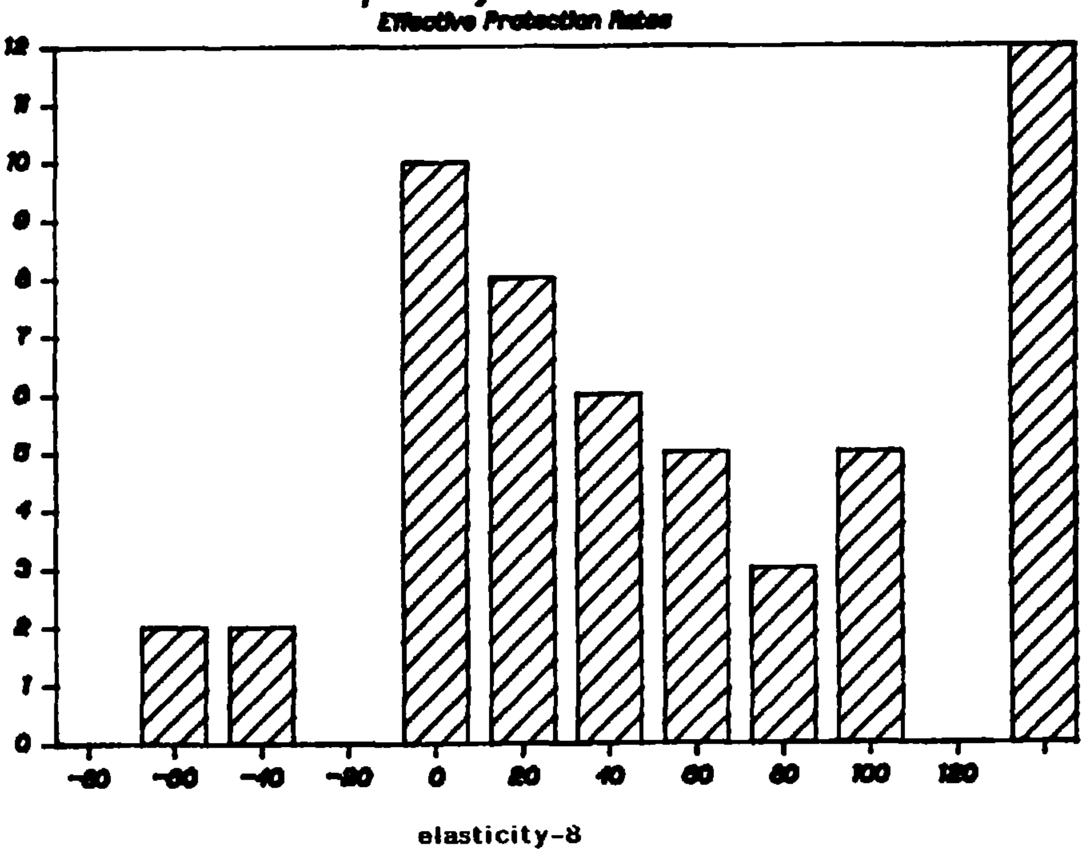


Figure 4. Frequency Distribution

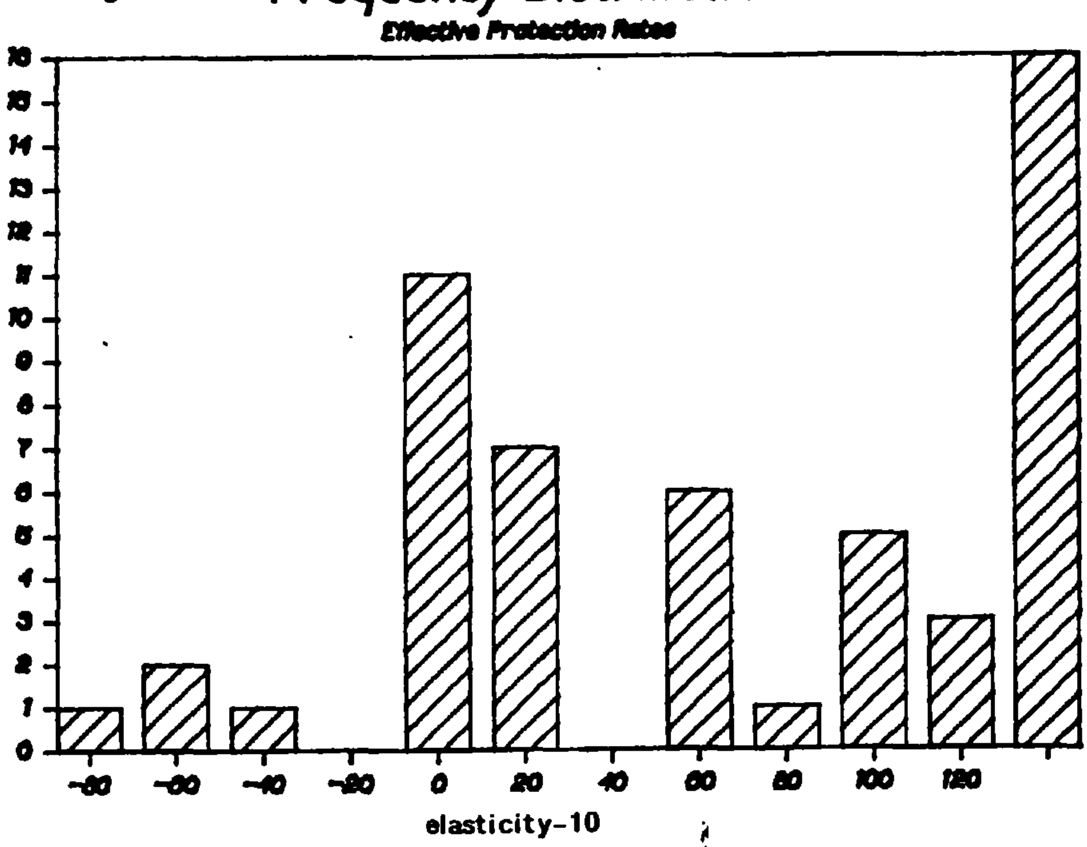


TABLE 3

NOMINAL (NRP) AND EFFECTIVE (ERP) RATES OF PROTECTION

	NRP	ERP
MJCROP	6.56	5.75
VGFR	68.26	226.03
OTHER CROPS	8.93	8.89
LIVSTOK	6.09	-3.36
FOREST	7.18	6.75
CHARCOAL	6.29	15.00
FISHING	3.99	8.37
COAL-LIG	8.13	9.00
CRUDE PETROL	0.01	-0.63
MINING	13.01	16.49
SLAUGH	8.80	9.33
C-PFOOD	8.81	6.78
MILL	26.87	44.97
ANIMAL FEED	1.73	-2.52
BEVERAGE	32.52	58.15
TOBACCO PROCESS	13.01	14.33
OTHER FOODS	20.39	26.89
SPIN WEAVE	16.86	23.97
OTHER TEXTILE	27.81	46.84
WOOD	12.74	21.70
PAPER	16.26	31.20
PRINTING	10.38	19.48
BASIC CHEMIC	11.85	20.73
FERTIL	3.78	1.42
PLASTIC CHEMIC	9.94	9.85
TYRE-RUB	42.98	84.35
OTHER CHEMIC	21.96	36.72
PLASTIC WARES	58.32	88.34
POTTERY	53.53	173.98
GLASS	36.55	130.45
CEMENT	0.00	-4.84
CONCRETE	19.55	71.55
OTHER NON-META	27.54	54.43
IRONSTL	7.52	3.50
MANUF FABMET	26.25	59.66
ENGINES	12.27	16.59
ELECTR MACHIN	18.64	27.41
OTHER MACHIN	9.86	14.81
MOTOR VEHICLE	13.59	15.32
AIRCRAFT	0.04	-19.76
OTHER MET-PROD	12.41	69.11
OTHER MANUF	40.42	69.13
FUEL	8.51	8.57
UTILS	0.00	-0.76
HOT-RES	0.00	-6.51
TRANSP	0.00	-8.21
MSERV	0.00	-1.43
ENTERM	12.48	12.80
OTHER SERVICE	0.00	-3.25

TABLE 4

A COMPARISON OF RANKINGS FOR BASE, ELASTICITY = 10, NRP AND ERP

	BASE		ELAST=10		NRP		ERP
MINING	30 10	GLASS	943.30	VGFR	68.26	VGFR	226.03
OTHER CROPS	26.06	VGFR	942.67	PLASTIC WARES	58.32	POTTERY	173.98
COAL-LIG	19.60	POTTERY	516.67	POTTERY	53.53	GLASS	130.45
PLASTIC CHEMIC	18 71	MANUF FABMET	380.99	TYRE-RUB	42.98	PLASTIC WARES	88.34
CRUDE PETROL	16.53	OTHER CHEMIC	346.78	OTHER MANUF	40.42	TYRE-RUB	84.35
OTHER MET-PR	13.75	OTHER NON-ME	310.09	GLASS	36.55	CONCRETE	71.55
FOREST	12 58	PAPER	294.31	BEVERAGE	32.52	OTHER MANUF	69.13
BASIC CHEMIC	12.03	PLASTIC WARES	278.06	OTHER TEXTIL	27.81	OTHER MET-PR	69.11
PLASTIC WARES	11.84	ENGINES	237.85	OTHER NON-ME	27.54	MANUF FABMET	59.66
GLASS	11 04	BASIC CHEMIC	216.46	MILL	26.87	BEVERAGE	58.15
PAPER	9.89	PLASTIC CHEMIC	201.18	MANUF FABMET	26.25	OTHER NON-ME	54.43
MANUF FABMET	9 26	OTHER MANUF	194.71	OTHER CHEMIC	21.96	OTHER TEXTIL	46.84
OTHER NON-ME	9.06	OTHER CROPS	152.38	OTHER FOODS	20.39	MILL	44.97
C-PFOOD	9 04	CRUDE PETROL	136.36	CONCRETE	19.55	OTHER CHEMIC	36.72
IRONSTL	8.06	COAL-LIG	133.54	ELECTR MACHIN	18.64	PAPER	31.20
POTTERY	7.47	OTHER MACHIN	120.35	SPIN WEAVE	16.86	ELECTR MACHIN	27.41
ENGINES	7.13	SPIN WEAVE	118.76	PAPER	16.26	OTHER FOODS	26.89
WOOD	6.96	ELECTR MACHIN	115.35	MOTOR VEHICL	13.59	SPIN WEAVE	23.97
ELECTR MACHIN	5.90	OTHER MET-PR	111.73	TOBACCO PROCES	13.01	WOOD	21.70
OTHER MANUF	5.43	OTHER FOODS	97.34	MINING	13.01	BASIC CHEMIC	20.73
OTHER CHEMIC	3.85	MINING	95.61	WOOD	12.74	PRINTING	19.48
MJCROP	3.44	FOREST	91.05	ENTERM	12.48	ENGINES	16.59
CEMENT	3.33	OTHER TEXTIL	90.41	OTHER MET-PR	12.41	MINING	16.49
SPIN WEAVE	3.27	WOOD	87.23	ENGINES	12.27	MOTOR VEHICL	15.32
OTHER MACHIN	3.13	BEVERAGE	68.97	BASIC CHEMIC	11.85	CHARCOAL	15.00
AIRCRAFT	3.05	MOTOR VEHICL	57.78	PRINTING	10.38	OTHER MACHIN	14.81
CONSTR	2.68	IRONSTL	56.10	PLASTIC CHEMIC	9.94	TOBACCO PROCES	14.33
CONCRETE	2.67	C-PFOOD	49.15	OTHER MACHIN	9.86	ENTERM	12.80
FUEL	1.71	FUEL	45.81	OTHER CROPS	8.93	PLASTIC CHEMIC	9.85
WS-RT	0.89	TOBACCO PROCES	43.51	C-PFOOD	8.81	SLAUGH	9.33
TOBACCO PROCES	0.79	AIRCRAFT	41.78	SLAUGH	8.80	COAL-LIG	9.00
VGFR	0.70	CONCRETE	15.31	FUEL	8.51	OTHER CROPS	8.89
TOBACC	0.62	CEMENT	13.78	COAL-LIG	8.13	FUEL	8.57
OTHER TEXTIL	0.43	ENTERM	7.93	IRONSTL	7.52	FISHING	8.37
OTHER FOODS	0.38	CONSTR	5.85	FOREST	7.18	C-PFOOD	6.78
MOTOR VEHICL	0.05	PRINTING	4.81	MJCROP	6.56	FOREST	6.75
ANIMAL FEED	-0.76	HOT-RES	4.52	CHARCOAL	6.29	MJCROP	5.75
MSERV	-1.07	TOBACC	2.40	LIVSTOK	6.09	IRONSTL	3.50
UTILS	-1.35	UTILS	-0.03	FISHING	3.99	FERTIL	1.42
NATURAL GAS	-1.36	NATURAL GAS	-0.05	FERTIL	3.78	CRUDE PETROL	-0.63
LIVSTOK	-1.44	WS-RT	-0.09	ANIMAL FEED	1.73	UTILS	-0.76
HOT-RES	-1.45	LIVSTOK	-0.18	AIRCRAFT	0.04	MSERV	-1.43
TRANSP	-1.46	ANIMAL FEED	-1.18	CRUDE PETROL	0.01	ANIMAL FEED	-2.52
FISHING	-1.47	FISHING	-1.60	UTILS	0.00	OTHER SERVIC	-3.25
SLAUGH	-2.03	SLAUGH	-1.89	MSERV	0.00	LIVSTOK	-3.36
CHARCOAL	-2.17	TRANSP	-3.86	TRANSP	0.00	CEMENT	-4.84
PRINTING	-2.78	CHARCOAL	-5.68	HOT-RES	0.00	HOT-RES	-8.51
ENTERM	-3 10	MSERV	-7.10	CEMENT	0.00	TRANSP	-8.21
BEVERAGE	-3.13	MJCROP	-10.81	OTHER SERVIC	0.00	AIRCRAFT	-19.76
OTHER SERVIC	-11.06	OTHER SERVIC	-57.50				
FERTIL	-18.79	FERTIL	-62.34				
MILL	-29.25	MILL	-66.78				
TYRE-RUB	-39 23	TYRE-RUB	-80.82				

References

Balassa, B. : "Tariff Protection in Industrial Countries: An Evaluation", Journal of Political Economy, 1965.

Balassa, B. : "Development Strategies in Semi-Industrial Economies", John Hopkins Press, 1982.

Drud, A., and D. Kendrick : "Hercules: A System for Large Economywide Models", Mimeo, Development Research Department, World Bank, 1986.

Ethier, W. : "The Theory of Effective Protection in General Equilibrium : Effective Rate Analogues to Nominal Rates", Canadian Journal of Economics, 1977.

Tambunlertchai, S. : "Development of the Manufacturing Sector in Thailand", Paper Presented at the International Conference on Thai Studies, Anv, Canberra, 1987.