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Negotiating Group on Market Access

FORMULA APPROACHES TO TARIFF NEGOTIATIONS

Note by the Secretariat[1]

Addendum

1. Introduction

1. This document has been prepared to assist Members to better understand the various proposals for modalities that include a formula approach for tariff negotiations. It adds to the material contained in TN/MA/S/3/Rev.1 and complements the document TN/MA/6 entitled "Overview of Proposals Submitted". It confines itself to illustrating the properties of several formulae using a hypothetical tariff profile and with numerical examples presented in tables and graphs.

2. The document does not address the specifics of the various proposals such as the base period, implementation, product coverage, treatment of *non-ad valorem* duties and their application by Members. It also does not present all the formula proposals listed in document TN/MA/6 because not all of them include a clearly defined functional form and explicitly specified parameters or coefficients. It is not possible to calculate the reductions for given initial tariff rates without such information.

2. Methodology

3. The methodology for presenting the various proposals is similar to that used in TN/MA/S/3/Rev.1. A hypothetical tariff profile is used to evaluate the effect of implementing a specific proposal, including the effects on a benchmark tariff escalation scenario. This approach allows the reader to use the intuition behind the general formulaic expressions illustrated in TN/MA/S/3/Rev.1 to interpret the proposals for formula modalities. For the proposals that include the tariff average as a parameter, the average tariff of the hypothetical tariff profile is used. This means that the reductions calculated for the various initial duty rates do not apply to real tariff profiles, where the average is lower or higher than the average of the hypothetical tariff profile. In these cases, where possible, the properties of the formula with respect to the different profiles are discussed.

4. It should be noted that for presentation purposes, the notation for the formulae in this paper has been standardised. In all cases the original tariff rate is denoted as t_0 and the final rate as t_1. The text does not distinguish between bound and applied rates, since the purpose of the document is to illustrate the use of different formula methodologies.

5. Formulae that propose a reduction of the average weighted tariff have to be distinguished from those that propose a methodology for a line by line reduction. Following the classification made in document TN/MA/6 regarding weighted tariff average reductions and line by line reductions, they have been presented in different figures and tables.

[1] This document has been prepared under the Secretariat's own responsibility and without prejudice to the positions of Members and to their rights and obligations under the WTO.

3. Proposals

(a) China[2]

6. The Chinese formula is specified as:

$$t_1 = \frac{(t_a + (B \times P)) \times t_0}{(t_a + P^2) + t_0}$$

where,
t_a is the simple average of the base rates (*A* in TN/MA/20).
P is a peak factor defined as the ratio of the tariff rate over the average rate (t_0 / t_a)
B is an adjusting coefficient for the year of implementation. *B*=1 for 2015 or *B*=3 for 2010.

7. The formula is very similar to the well known Swiss formula but instead of a fixed coefficient, a variable factor based on the simple average of the base rates t_a , a peak factor and an additional parameter for the year of implementation has been used. The properties of the Chinese formula are similar to what is known about the properties of the Swiss formula discussed in Section III.B.2.b of TN/MA/S/3 Rev.1, such as higher cuts for higher rates. Furthermore it can be shown that for *B*=1 the formula reduces any initial tariff rate below a maximum level which is the current average of the base rates. This is equivalent in its effect to the standard Swiss formula using the tariff average as coefficient.

8. The percentage cuts for any given tariff rate will depend on the tariff average of the Member concerned. For the same tariff rate, Members with lower tariff averages will experience relatively higher reduction rates than Members with higher tariff averages. Therefore, the overall result of applying this formula will depend on the statistical properties of different Members' tariff profiles.

(b) European Communities[3]

9. The EC proposal is within the class of linear tariff dependent formulae, however, with an adjustment, which gives it the properties of a step-wise linear function. The formula is applied across a set of ranges and the overall cuts depend upon the upper and lower bound of the applicable range.

10. The formula is specified as:

$$t_1 = B_1^L + (t_0 - B_0^L) \times \left[\frac{B_1^U - B_1^L}{B_0^U - B_0^L} \right]$$

where B_j^i are the upper and lower bounds of the respective bands. The subscripted number represents the applicable range. The superscripted letters *U* and *L* are, respectively, the upper and lower bounds of the range. Technically, the number of ranges that can be specified is unlimited. In the most simple case two ranges could be used.

11. The EC submission did not parameterise the formula but presented a chart showing a possible 'Duty Reduction Scenario.[4] Nevertheless, it is still possible to examine the properties of the proposed EC formula without precise, values given the specification of the formula. For example, the term in

[2] TN/MA/W/20.
[3] TN/MA/W/11/Add.1.
[4] Reproduced in document TN/MA/M/4.

the first set of brackets must be greater than zero, since a given tariff within a range must be greater than or equal to the value of the lower bound of the range within which it falls.[5] The term in the square brackets is simply a constant since the upper and lower bands of the ranges are given as constants. Furthermore, its value must be less than one, since the overall objective of the formula is to 'compress' the tariff rates. That is, any given range will be smaller with the application of the formula.[6] The expression also indicates how the cut in the tariff is sensitive to the specification of the bands. For example, high tariffs within the same band are reduced by more than low tariffs within the same band.[7] Technically, the number of ranges that can be specified is unlimited. For the application of the formula the upper and lower limits of the old and new ranges need to be clearly specified.

(c) Japan[8]

12. Japan proposes that each Member sets a target level of a trade-weighted tariff average according to a formula and that each Member reduce its trade-weighted tariff average to that target level. Each Member will retain flexibility on ways to realize the target tariff level. The formula is specified as:

$$t_{1a}^{w} = \frac{A \times t_{0a}^{w}}{A + t_{0a}^{w}} + a$$

where, t_{0a}^{w} is the weighted tariff average prior to the application of the formula and t_{1a}^{w} is the weighted average after the application of the formula. *A* is a constant whose values varies as follows:

$t_{0a}^{w} \leq 10\%$, $A = 10$

$10\% < t_{0a}^{w} \leq 20\%$, $A = 20$

$20\% < t_{0a}^{w} \leq 30\%$, $A = 30$

$30\% < t_{0a}^{w}$, $A = 40$

13. The term a in this specification has been proposed as a constant equal to 0.3.

14. The formula applies to the reduction of the trade-weighted *tariff average* as opposed to a reduction of the tariff rates on a line by line basis. This means that the formula is used to determine the end result, or the objective of the tariff negotiations. A lower coefficient will yield a higher cut and a higher coefficient a lower cut. The Japanese proposal can, therefore, be summarised as

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[5] Intuitively, if $t_0 < B_0^L$ it would be in another band.

[6] Using this information the EC formula can be rewritten as:

$$t_1 = B_1^L + \left(t_0 - B_0^L\right) \times g_1 \quad \text{where} \quad g_1 = \left[\frac{B_1^U - B_1^L}{B_0^U - B_0^L}\right] \quad \text{and} \quad 0 < g_1 \leq 1$$

The above expression makes it easier to understand the intuition behind the EC proposal. It says that the new tariff is the sum of the lower bound of the new range (lower than the lower bound of the old range), plus weighted difference between the original tariff and the old lower bound.

[7] The intuition behind this is that a unit increase in the original tariff rate will increase the new tariff rate above the lower bound of a specified range by less than unity (since the constant is less than one). Accordingly, the greater the increase in the tariff rate, the smaller will be the proportionate increase to the lower bound of the specified range.

[8] TN/MA/W/15.

proposing that Members with higher weighted tariff averages face a lower reduction than those with lower rates.[9]

(d) Republic of Korea[10]

15. The objective of this proposal is to lower the weighted tariff average of Members by 40 percent. This is achieved by applying a reduction formula that results in a higher reduction of tariff peaks. The starting point is a 20 percent minimum reduction by tariff line, which is followed by a further reduction aimed at harmonizing the tariff profile. Two criteria are used to distinguish which tariffs should be addressed and the applicable methodology. These are twice the national average and 25 percent.

16. For the case where tariffs are above twice the national average *after* the minimum reduction of 20 percent, the following formula is applicable which includes the initial 20 per cent reduction:

$$t_1 = (t_0 \times 0.8) - (0.7 \times (t_0 - 2 \times t_a))$$

17. If the tariff rate is less than twice the national average, but still above 25 percent the following formula is applicable which includes the initial 20 per cent reduction:

$$t_1 = (t_0 \times 0.8) - (0.7 \times (t_0 - 25))$$

18. In cases where the tariff rate is above two times the simple national average and at the same time above 25 percent, the final tariff rate shall be whichever is lower after the reduction.

19. The formula reduces higher tariff rates in a way that takes into account individual tariff profiles since the cut is dependent on the tariff average. This means tariff profiles that have duties predominantly below 25 percent but above twice the national average will still be subject to further tariff reductions. Alternatively, profiles with duties predominantly above 25 percent, but with high overall averages will still be subject to reductions since the 25 percent rule will apply.

20. The overall result of applying this formula will, therefore, depend on the statistical properties of each Members' tariff profile. It should be noted though that for all tariff profiles with an average of above 12.5 percent the tariff rate reductions in percentage are identical for a given tariff rate because the 25 percent rule applies in all cases where twice the national average is greater than 25 percent.

21. The Korean proposal is similar to the Japanese proposal in that both seek a reduction of the weighted tariff average. However, the application of the Korean formula for the targeted reduction of weighted tariff averages differs slightly from that of the Japanese proposal as illustrated in figure 3.

[9] The high rates in the lowest band (up to 10%) would have a lower percentage reduction than the higher rates in higher bands.

[10] TN/MA/W/6/Add.1.

(e) United States[11]

22. The United States has proposed a modality which includes the elimination of tariffs at or below 5 percent and the application of a Swiss formula on the tariff profile for all other tariff rates. The proposed coefficient is 8, which converts the general Swiss Formula into the following specification:

$$t_1 = \frac{8 \times t_0}{8 + t_0}$$

23. The general properties of this formula are described in TN/MA/S/3/Rev.1. What is important to note about the US proposal is the value of 8 for the coefficient. This implies a maximum tariff rate of 8 percent after tariff reductions for any tariff profile.

4. Tariff reduction simulations with hypothetical tariff profile

24. The reduction effects of the formulae presented above applied to a hypothetical tariff profile similar to the one used in TN/MA/S/3/Rev.1 are illustrated in tables 1 to 3 and figures 1 to 3. The proposals using line by line reductions and those targeting reductions of average weighted tariff rates are shown separately because they are not strictly comparable in their implications.

25. Table 1 shows, based on the hypothetical tariff profile, the base rates before and after application of the various formulae. For those formulae that use the tariff average as parameter the average of the hypothetical tariff profile has been used, i.e. t_a=30. The application of the Chinese proposal to tariff profiles with lower/higher tariff averages would, for a given tariff rate, result in a higher/lower cut than that shown in the tables and figures. In the case of the Korean proposal for line by line cuts, tariff profiles with a tariff average below 12.5 percent would be subject to higher cuts than those shown in the examples given in the tables and figures. Descriptive statistics before and after reduction highlight the overall effects of the application of the various proposals on the hypothetical tariff profile.

26. Table 2 illustrates how the application of the formulae results in different percentage reductions for the different tariff rates and indicates also the reduction of the simple average of the hypothetical tariff profile. For sake of comparison only, the tables and figures also include the effects of a hypothetical 50% linear reduction. Table 3 illustrates the same point for the formulae for reductions of weighted tariff averages.

27. The information shown in the tables is also displayed in graphical form in figures 1 to 3 corresponding to tables 1 to 3. In figures 1 and 2 for the Chinese formula only, the version with coefficient B=1 has been included.

5. General Observations

28. Formulae by their very nature are technical. Nevertheless, it is extremely important to understand their properties in the context of their application to the tariff profiles of Members. In this regard, despite the diversity of innovative proposals on the use of formulae as a modality for market access negotiations, some common elements can be highlighted.

[11] TN/MA/W/18.

29. The following general observations can be made:

- All the proposals make the reduction rate dependent on the initial tariff rate.
- All proposals reduce higher rates by proportionately more than lower rates. This is accomplished through different specifications.
- All proposals have similar effects at higher levels of tariffs, although with different absolute impacts due to different parameters.
- Some proposals take into account the diversity of the Members profiles via an explicit provision in the functional design of the formula for the current level of base rates.
- The treatment of the lower tariff rates differs significantly amongst the proposals.

Table 1

Impact on tariff rates of various line by line formula proposals on the hypothetical tariff profile

Tariff line	Initial tariff rate	China t_a=30, B=1	China t_a=30, B=3	European Communities	Korea t_a=30	USA	Linear cut 50%
Line 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line 2	2.5	2.3	2.3	1.7	2.0	0.0	1.3
Line 3	5.0	4.3	4.4	3.3	4.0	0.0	2.5
Line 4	7.5	6.0	6.1	5.0	6.0	3.9	3.8
Line 5	10.0	7.6	7.7	6.7	8.0	4.4	5.0
Line 6	12.5	8.9	9.2	8.3	10.0	4.9	6.3
Line 7	15.0	10.1	10.4	10.0	12.0	5.2	7.5
Line 8	17.5	11.2	11.6	11.1	14.0	5.5	8.8
Line 9	20.0	12.2	12.7	12.1	16.0	5.7	10.0
Line 10	22.5	13.0	13.7	13.2	18.0	5.9	11.3
Line 11	25.0	13.8	14.6	14.3	20.0	6.1	12.5
Line 12	27.5	14.6	15.4	15.4	20.3	6.2	13.8
Line 13	30.0	15.2	16.2	16.4	20.5	6.3	15.0
Line 14	32.5	15.9	17.0	17.5	20.8	6.4	16.3
Line 15	35.0	16.4	17.7	18.6	21.0	6.5	17.5
Line 16	37.5	17.0	18.3	19.6	21.3	6.6	18.8
Line 17	40.0	17.5	18.9	20.7	21.5	6.7	20.0
Line 18	42.5	17.9	19.5	21.8	21.8	6.7	21.3
Line 19	45.0	18.3	20.1	22.9	22.0	6.8	22.5
Line 20	47.5	18.8	20.6	23.9	22.3	6.8	23.8
Line 21	50.0	19.1	21.1	25.0	22.5	6.9	25.0
Line 22	52.5	19.5	21.6	25.0	22.8	6.9	26.3
Line 23	55.0	19.8	22.1	25.0	23.0	7.0	27.5
Line 24	57.5	20.1	22.5	25.0	23.3	7.0	28.8
Line 25	60.0	20.4	23.0	25.0	23.5	7.1	30.0
Average	30.0	13.6	14.7	15.5	16.7	5.4	15.0
Maximum	60.0	20.4	23.0	25.0	23.5	7.1	30.0
Std. Dev	18.4	5.9	6.7	8.1	7.4	2.2	9.2
Coeff. Var.	61.3	43.5	45.5	52.0	44.6	40.7	61.3
Escalation (line13/line5)	3.0	2.0	2.1	2.5	2.6	1.4	3.0

Note:
Std. Dev: *Standard Deviation* is a measure of absolute dispersion of the tariff profile. It is dependent on the average level of the tariffs.
Coeff. Var: *Coefficient of Variation* is a measure of relative dispersion. It is defined as the standard deviation divided by the average and usually presented in percent, i.e. multiplied by 100. It is not affected by the average levels of tariffs.

Table 2

Percentage reduction arising from the application of various line by line formula proposals

Tariff line	Initial tariff rate	China t_a=30, B=1	China t_a=30, B=3	European Communities	Korea t_a=30	USA	Linear cut 50%
Line 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line 2	2.5	7.5	6.9	33.3	20.0	100.0	50.0
Line 3	5.0	13.9	12.9	33.3	20.0	100.0	50.0
Line 4	7.5	19.5	18.1	33.3	20.0	48.4	50.0
Line 5	10.0	24.4	22.7	33.3	20.0	55.6	50.0
Line 6	12.5	28.7	26.8	33.3	20.0	61.0	50.0
Line 7	15.0	32.6	30.4	33.3	20.0	65.2	50.0
Line 8	17.5	36.1	33.6	36.7	20.0	68.6	50.0
Line 9	20.0	39.2	36.6	39.3	20.0	71.4	50.0
Line 10	22.5	42.0	39.2	41.3	20.0	73.8	50.0
Line 11	25.0	44.6	41.6	42.9	20.0	75.8	50.0
Line 12	27.5	47.0	43.9	44.2	26.4	77.5	50.0
Line 13	30.0	49.2	45.9	45.2	31.7	78.9	50.0
Line 14	32.5	51.2	47.8	46.2	36.2	80.2	50.0
Line 15	35.0	53.0	49.5	46.9	40.0	81.4	50.0
Line 16	37.5	54.8	51.1	47.6	43.3	82.4	50.0
Line 17	40.0	56.3	52.6	48.2	46.3	83.3	50.0
Line 18	42.5	57.8	54.0	48.7	48.8	84.2	50.0
Line 19	45.0	59.2	55.3	49.2	51.1	84.9	50.0
Line 20	47.5	60.5	56.6	49.6	53.2	85.6	50.0
Line 21	50.0	61.7	57.7	50.0	55.0	86.2	50.0
Line 22	52.5	62.9	58.8	52.4	56.7	86.8	50.0
Line 23	55.0	64.0	59.8	54.5	58.2	87.3	50.0
Line 24	57.5	65.0	60.8	56.5	59.6	87.8	50.0
Line 25	60.0	66.0	61.7	58.3	60.8	88.2	50.0
Average	30.0	43.9	41.0	42.3	34.7	75.8	48.0

Table 3

Applying different formulae to hypothetical weighted tariff averages

(Initial and final tariff rate and reductions by case in percent)

Hypothetical cases	Initial weighted average	Weighted average rates after reduction			Reductions in percent		
		Japan	Korea cut 40%	Linear cut 50%	Japan	Korea cut 40%	Linear cut 50%
Case 1	0.0	0.3	0.0	0.0	n.a	0.0	0.0
Case 2	2.5	2.3	1.5	1.3	8.0	40.0	50.0
Case 3	5.0	3.6	3.0	2.5	27.3	40.0	50.0
Case 4	7.5	4.6	4.5	3.8	38.9	40.0	50.0
Case 5	10.0	5.3	6.0	5.0	47.0	40.0	50.0
Case 6	12.5	8.0	7.5	6.3	36.1	40.0	50.0
Case 7	15.0	8.9	9.0	7.5	40.9	40.0	50.0
Case 8	17.5	9.6	10.5	8.8	45.0	40.0	50.0
Case 9	20.0	10.3	12.0	10.0	48.5	40.0	50.0
Case 10	22.5	13.2	13.5	11.3	41.5	40.0	50.0
Case 11	25.0	13.9	15.0	12.5	44.3	40.0	50.0
Case 12	27.5	14.6	16.5	13.8	46.7	40.0	50.0
Case 13	30.0	15.3	18.0	15.0	49.0	40.0	50.0
Case 14	32.5	18.2	19.5	16.3	43.9	40.0	50.0
Case 15	35.0	19.0	21.0	17.5	45.8	40.0	50.0
Case 16	37.5	19.7	22.5	18.8	47.6	40.0	50.0
Case 17	40.0	20.3	24.0	20.0	49.3	40.0	50.0
Case 18	42.5	20.9	25.5	21.3	50.8	40.0	50.0
Case 19	45.0	21.5	27.0	22.5	52.3	40.0	50.0
Case 20	47.5	22.0	28.5	23.8	53.7	40.0	50.0
Case 21	50.0	22.5	30.0	25.0	55.0	40.0	50.0
Case 22	52.5	23.0	31.5	26.3	56.2	40.0	50.0
Case 23	55.0	23.5	33.0	27.5	57.3	40.0	50.0
Case 24	57.5	23.9	34.5	28.8	58.5	40.0	50.0
Case 25	60.0	24.3	36.0	30.0	59.5	40.0	50.0

Figure 1: Comparison of formula proposals for line by line reductions

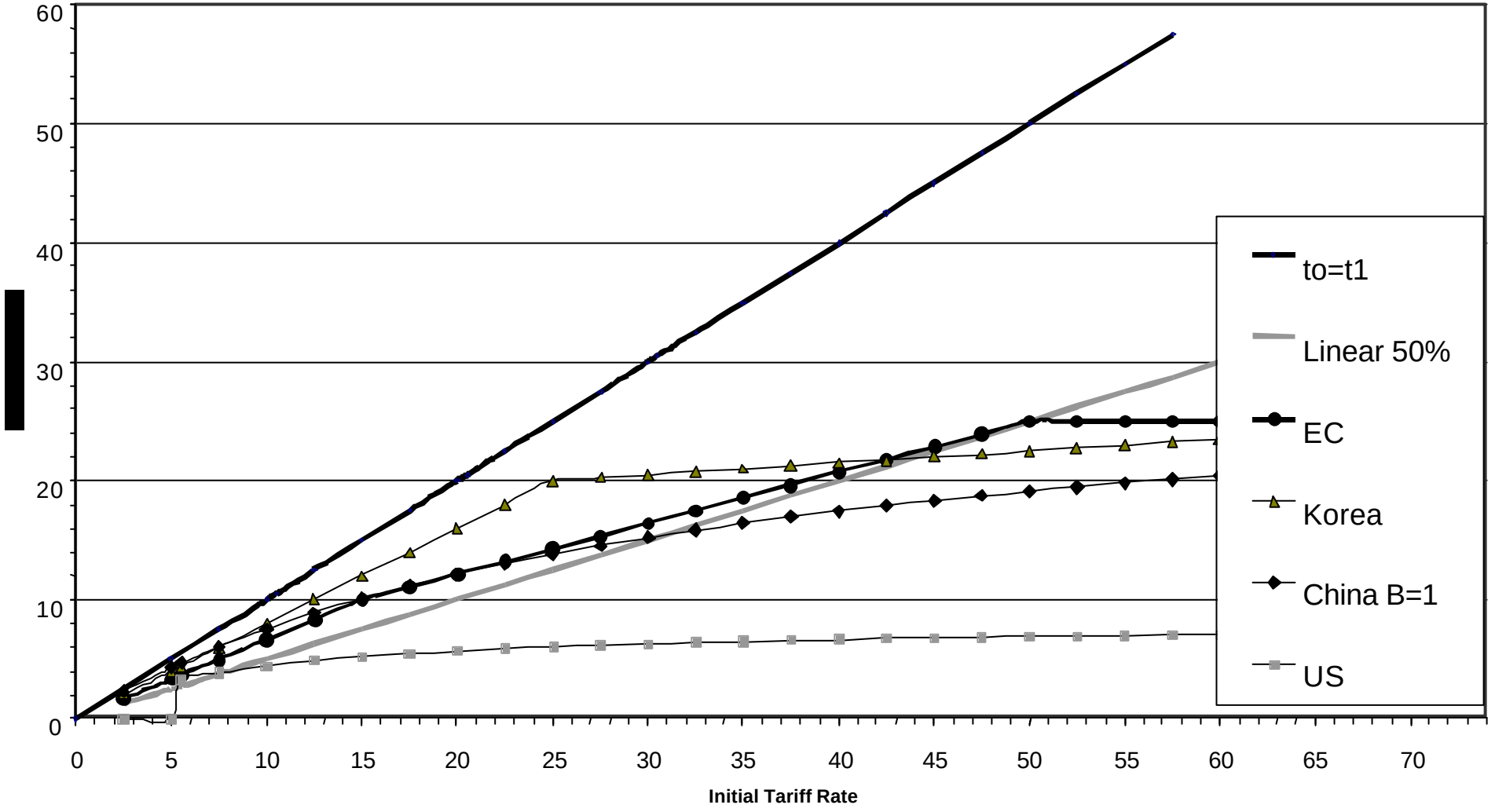

Figure 2: Reductions in percent of initial tariff rates

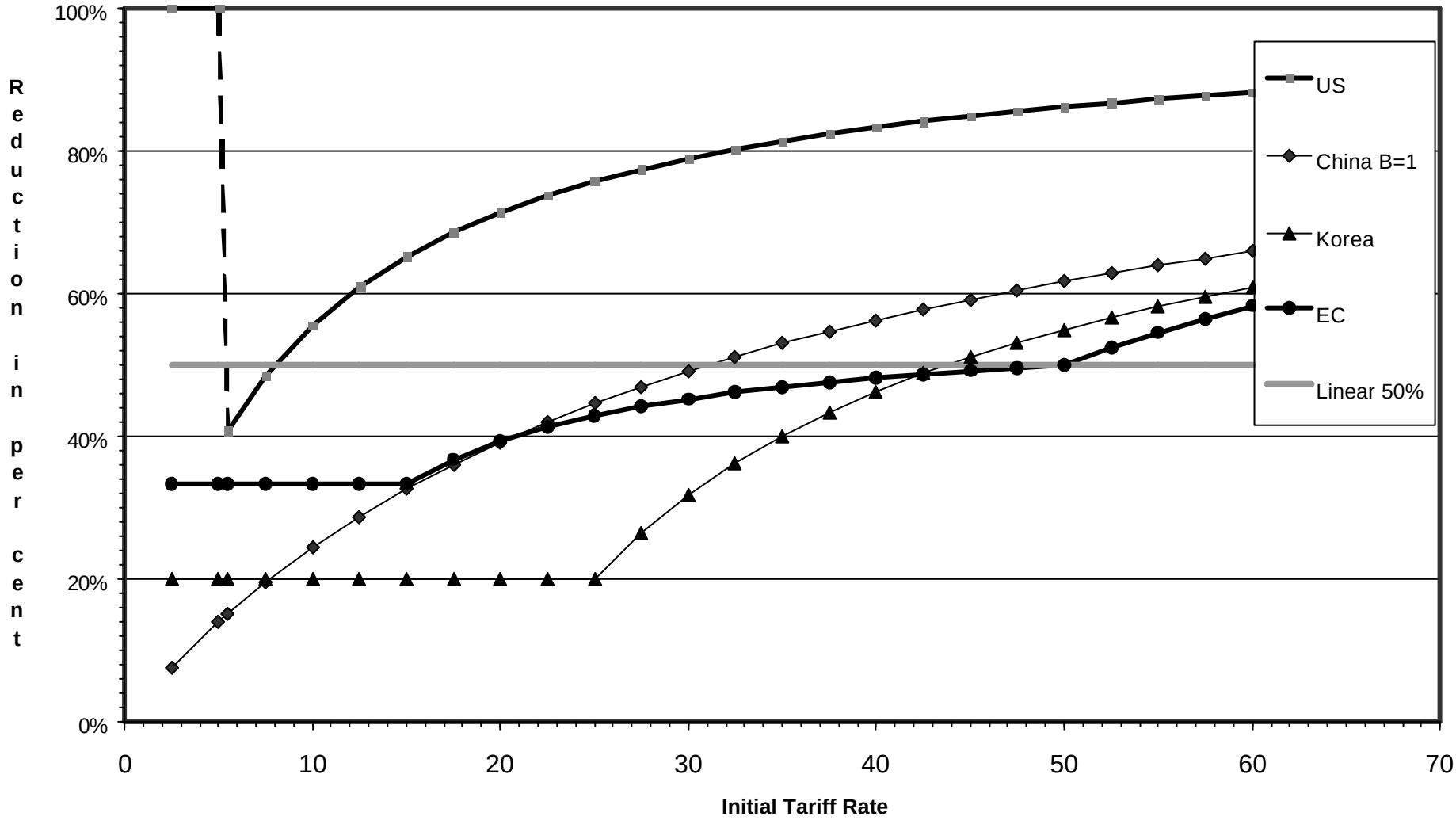

Figure 3: Comparison of formula proposals for weighted average tariff reductions