Conceptual
Profit Shifting Matrix
Transfer Pricing Methodology

Introduction

The 1995 OECD Transfer Pricing Guidelines indicate that the allocation of profits on international dealings between associated enterprises should accord with the internationally accepted arm's length principle.[1] There are a number of OECD accepted transfer pricing methodologies (TPMs) used to apply the arm's length principle, as well as, techniques to determine the contribution of an associated enterprise to the global profits of the Multi National Enterprise (MNE). However, there is a lack of conceptual mathematical approach to transfer pricing analysis. In essence, the Profit Shifting Matrix (PSM) is a conceptual three-dimensional transfer-pricing model that would assist in the application of TPMs and their analysis, as well as being able to be applied statically or dynamically to the global transfer pricing of a MNE.

The Profit Shifting Matrix

The PSM itself is based on a new three-dimensional matrix theory, which uses the three axes, six sides and limitless fields of the matrix to model data and the outcome of any TPM.[2]

As the PSM is three-dimensional it is possible to have two depth axes. The first depth axis is the multi-layered fields of internal, external and TPM analysis data. The second depth axis accommodates the measurement of *time* by multi-tiering fields of data at points in time. Having two depth axes means that the application of any TPM can be performed statically (at a point in time) or, dynamically (over any period of time or, combination of time periods.)

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[1] The Glossary to the 1995 OECD Transfer Pricing Guidelines (1995 OECD Guidelines) states in respect of the arm's length principle:

> "The international standard that OECD Member countries have agreed should be used for determining transfer prices for tax purposes. It is set forth in Article 9 of the OECD Model Tax Convention as follows: where "conditions are made or imposed between the two enterprises in their commercial or financial relations which differ from those which would be made between independent enterprises, then any profits which would, but for those conditions, have accrued to one of the enterprises, but, by reason of those conditions, have not so accrued, may be included in the profits of the enterprise and taxed accordingly".

The 1995 OECD Transfer Pricing Guidelines do not accept Global Formulary Apportionment as an alternative to the arm's length principle, nevertheless, such methods can be accommodated in the PSM.

[2] Traditional matrix theory uses columns and rows (a square matrix has equal numbers of columns and rows) to facilitate the study of problems in which the relationship between elements is important, for example, in the study of coefficients of systems of linear equations.

The multi-layered data is presented as a bar chart statically and as a six-sided graphic equalizer dynamically on each side of the PSM. The multi-tiered fields of data allow the PSM to be made dynamic, much like a comic is made into a picture. It is therefore possible to view the patterns, trends and flows of data over any time period or combination of time periods.

The PSM is also multi-dimensional as the examination of internal, external and TPM analysis data can be applied at any level of the group. For example, an examination of the profit split outcomes of the group can be undertaken at the corporation, lower entity, division, and segment or product line level. Further, the PSM has input and output capabilities that allow any entity in the group to be the test entity for TPM analysis purposes.

Traditional two-dimensional TPM analyses techniques are used when building the PSM. Although the PSM presents a new three-dimensional way to view data (as a model), it can also be manipulated to present data two dimensionally as we are accustomed to presently, for example, when doing economic analysis diagrams. An advantage with the PSM is that the two-dimensional data presentation when manipulated can itself be made dynamic by plotting time on the depth axis.

How a PSM is built

The six sides and three axes of the PSM accommodate the fields of numerical data and the transfer pricing analysis. The fields store the positive, negative or zero value of data and when multi-layered form the three axes of the PSM.

The first axis in the PSM is used to capture the internal data of the entity which is having its profits determined (the test entity). In the PSM internal data would include accounting and any other relevant numerical information necessary to perform the TPM analysis to determine the amount of the arm's length outcome of the test entity.

The second axis captures the external data of the associated entity(ies) and includes similar information to the internal data in respect of the test entity. Where necessary external data would also include comparable independent third party data for benchmarking purposes (if any).[3] Each entity can be compared much like a fingerprint, only three-dimensionally.

The third axis in the PSM is used to accommodate the TPM analyses, including the profit split formula to determine the profit split between the test entity and the other associate entity or entities. As well, this axes contains the reverse mathematical formula to return from the TPM analysis back to the data. This enables the PSM to be reverse engineered. Where there is a need to adjust data to perform the TPM analysis the value of the adjusted data is stored on this side of the PSM.

The TPM analysis axis of the PSM contains the allocation key or profit split formula (reduced to a mathematical equation) linked to internal and external data fields so that the cost/income allocation or profit split can be determined. The profit shift formula is used to determine the profit split outcome, while an allocation key is used to determine the allocation of income and expenses.

[3] It is not the purpose of this paper to discuss the concept of comparability beyond indicating that any truly comparable entity can be accommodated in the PSM analysis in the same way that an external associate entity(ies) is accommodated.

Diagram 1

The diagram shows that there are two ways to look at the same lines. Imagine Line (2) on the edges of a sheet of paper:

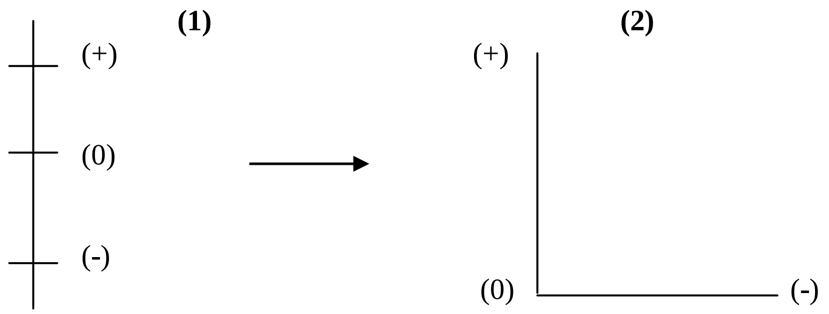


Diagram 2

The PSM has six sides and three axes internal, external and TPM analysis data:

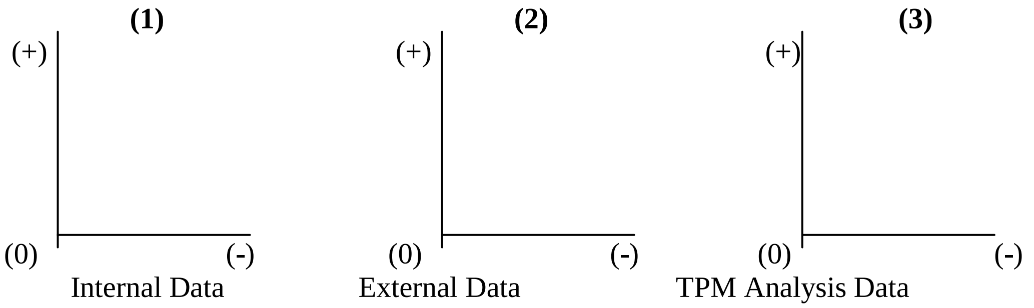


Diagram 3

The axes can be layered three ways (depth, width and height) into the PSM thus forming the first depth axis of multi-layered data:

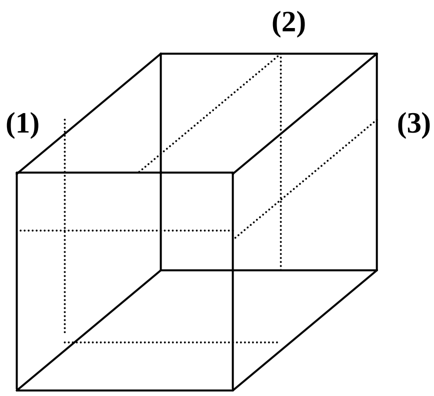


Diagram 4

Each axes of the PSM is able to accommodate multi-layered fields of data and is each axes is able to accommodate limitless fields of data at a point in time:

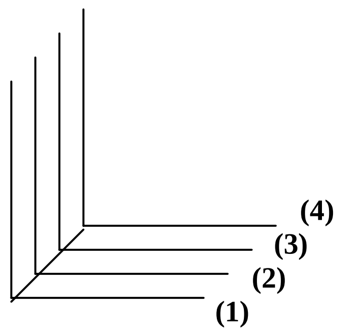


Diagram 5

The model is made dynamic by layering data (represented by the dot on the field) on each field as shown. This diagram shows the second depth axis built by multi-tiering data.

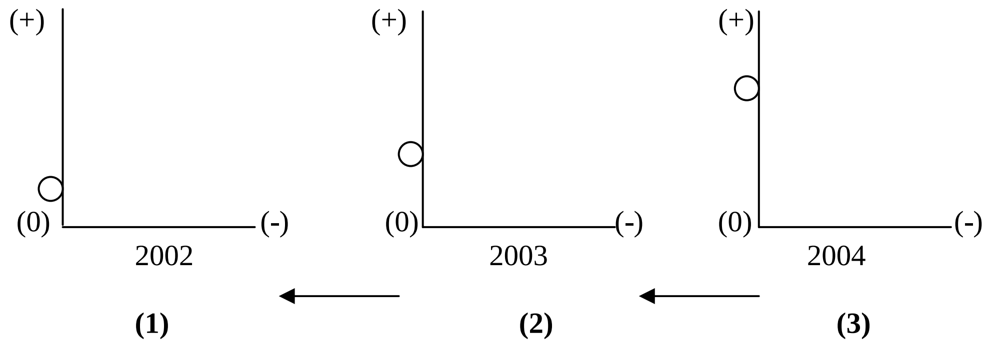
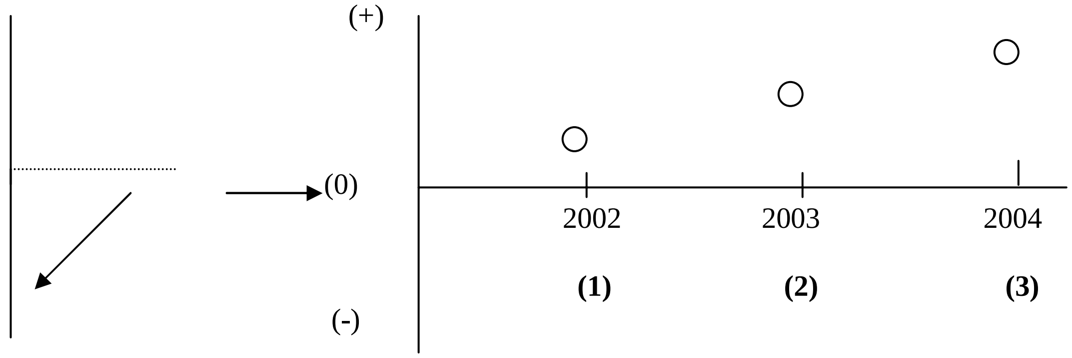


Diagram 6

If the negative axis is rotated 90 degree in Diagram 5 then it is possible to view a time line of data as we traditionally do two dimensionally below:



Profit Methods

The Profit Split method allocates channel profits (the identified profits to split) on the basis of an application of *linear calibration regression analysis*, which uses the same estimation equations as *linear regression analysis* to determine the variable relationship. Usually profit split formulas or allocation keys are based on an economic technique called *collaborative linear regression analysis*. This economic technique examines the relationship between two variables to determine the line of regression that is then used to split the channel profits to determine an operating outcome for the test entity.

The Residual Profit method is a refinement of the PS method as it incorporates a normal range of channel profits, as well as, ranges outside the normal range of channel profits. Channel profits are allocated on the same basis as for the PS method. The rational for a RP method is that there are usually intangible assets that explain the higher or lower channel profits. Therefore the entity in the group that contributes more to the development of those intangible assets should be rewarded for its contribution.

Profit Methods rely on a Profit Split Formula to split consolidated channel profits ("channel profits") in such a way as to achieve an arm's length outcome. The formula usually approximates a contribution analysis, the theory being that the more an entity contributes to profits relative to its associate the greater should be its share of those profit. It is for this reason that the consolidated profit or loss is usually suitably split by reference to operating expenses or resources employed by the entities.

When performing the Profit Split method the profit split ratio is usually determined by the variable relationship between resources employed and/or operating expenses of the test and associated entity. The variable relationship is then used to determine the test entities operating margin as a percentage or fraction of channel profits expressed as percentage or fraction of total channel income. When performing a Residual Profit Split method the Profit Split method is further refined by determining a mathematical formula for each lineal regression line corresponding with the different channel profit range to determine the operating margin of the test entity.

When performing a Profit Method analysis it is customary to analyse the less complex entity (the test entity). Ideally the outcomes of profit methods should be benchmarked against the outcomes of comparable independent entities.[4] However, Profit Methods can still be applied in the absence of such third party benchmarking, although the outcome will be more subjective or theoretical.

The Hybrid Profit Split Methods incorporates parameters, by layering on the Profit Split method a Net Transactional Margin Analysis so that the operating margin of the test entity may only range between certain determined percentages.

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4 See Footnote 3.

Diagram 7

The Profit Split method can be depicted in a diagram like this:

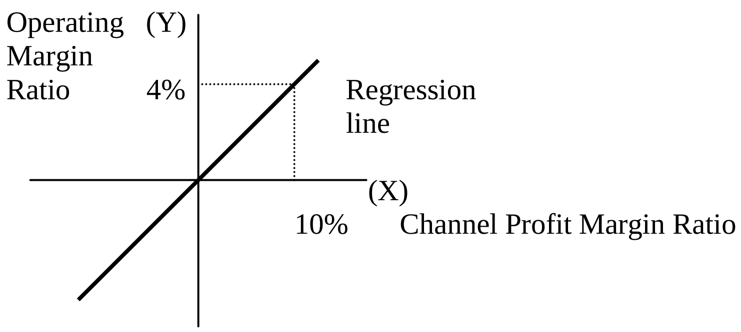


Diagram 8

The method can be depicted in a diagram like this:

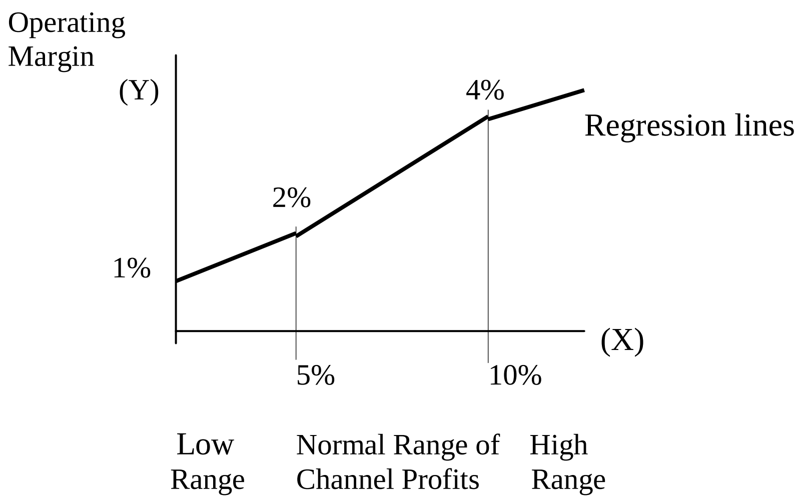
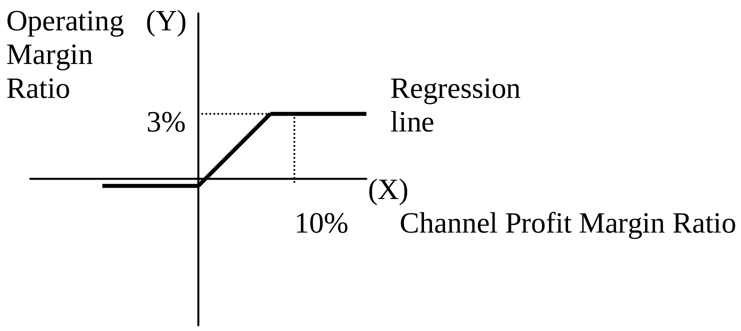


Diagram 9

The Hybrid Profit Split method can be depicted in a diagram like this:



A worked Example – Profit Split method

PSM Field / Axis Field A = Internal data (test entity) Field B = External data (assoc. entity) Field C = Analysis data	Year 1	Year 2
Field A Field B Field C	*Step 1 – Determine (β) of test entity* (β) Where DL 1 = 40% = $40 DL 2 = 60% = $60 1 = Test entity 2 = Associate DL 1 = depreciation and labour DL 2 = depreciation and labour (β) = DL 1 : DL 2 = 40 : 60 = 40% or 0.4	*Step 1* (β) Where DL 1 = 40% = $50 DL 2 = 60% = $50 1 = Test entity 2 = Associate DL 1 = depreciation and labour DL 2 = depreciation and labour (β) = DL 1 : DL 2 = 50 : 50 = 50% or 0.5
	Step 2 – assumption made about (y) operating margin – based on the known variable (x) channel profits	*Step 2*
Field C Field C	Where Channel Profits (cp): (α) = 0 (x) = 10% = 0.1 *Formula: Test entity* y = α + (β)(x) = 0 + (40%)(10%) = 4% *or* y = 0 + (0.4)(0.1) = 0.04	Where Channel Profits (cp): (α) = 0 (x) = 10% = 0.1 *Formula: Test entity* y = α + (β)(x) = 0 + (50%)(10%) = 5% *or* y = 0 + (0.5)(0.1) = 0.05
Field A & B Field C	*Test entity:* OM 1 – Share of consolidated channel profits (cp) (assumed cp = $100) OM 1 = (y ÷ x) ∗ cp = (4% ÷ 10%) ∗ $100 = 40% ∗ $100 = $40 *or* = (0.04 ÷ 0.1) ∗ $100 = (0.4) ∗ $100 = $40	*Test entity:* OM 1 – Share of consolidated chann profits (assumed cp = $200) OM 1 = (y ÷ x) ∗ cp = (5% ÷ 10%) ∗ $200 = 50% ∗ $200 = $100 *or* = (0.05 ÷ 0.1) ∗ $200 = (0.5) ∗ $200 = $100

	Reverse	Reverse
Field C Field A	There is only one step back as all the variables are known. *Test entity:* cp = (x ÷ y) ∗ OM 1 Where y = α + (β)(x) = 4% α2 = 0 β = 40% x = 10% OM 1 = $40 *Proof:* cp = (10% ÷ 4%) ∗ $40 = (250%) ∗ $40 = $100 or = (0.10 ÷ 0.04) ∗ $40 = 2.5 ∗ $40 = $100	There is only one step back as all the variables are known. *Test entity:* cp = (x ÷ y) ∗ OM 1 Where y = α + (β)(x) = 5% α2 = 0 β = 50% x = 10% OM 1 = $100 *Proof:* cp = (10% ÷ 5%) ∗ $100 = (200%) ∗ $100 = $200 or = (0.10 ÷ 0.05) ∗ $40 = 2.0 ∗ $100 = $200

How the PSM accommodates economic analysis

The PSM is able to accommodate any type of two-dimensional economic analysis.

Economic theory dictates that the *explanatory independent variable* is plotted on the horizontal axis and shows the value of the known variable, for example, consolidated channel profits as a percentage or decimal of total channel income. The *dependent variable* is plotted on the vertical axis and shows the value of the unknown variable.

The PSM can be manipulated by rotating the negative or positive axis of the relevant fields 90 degree to view the *explanatory independent variable* and *dependent variable* as we traditionally do for economic analysis purposes. As time is plotted on the depth axis in the PSM two-dimensional economic relationships can also be viewed dynamically over time.

Diagram 10

This diagram shows that if the negative or positive axis is rotated 90 degree a straight line is formed (Steps (1) and (2)). A vertical and horizontal line can be layered on top of each other (Step (3) and (4)). This technique is used to plot the relationship between the *explanatory independent* and *dependent* variables. The static relationship of the variables can be made dynamic as depicted in Diagram 11.

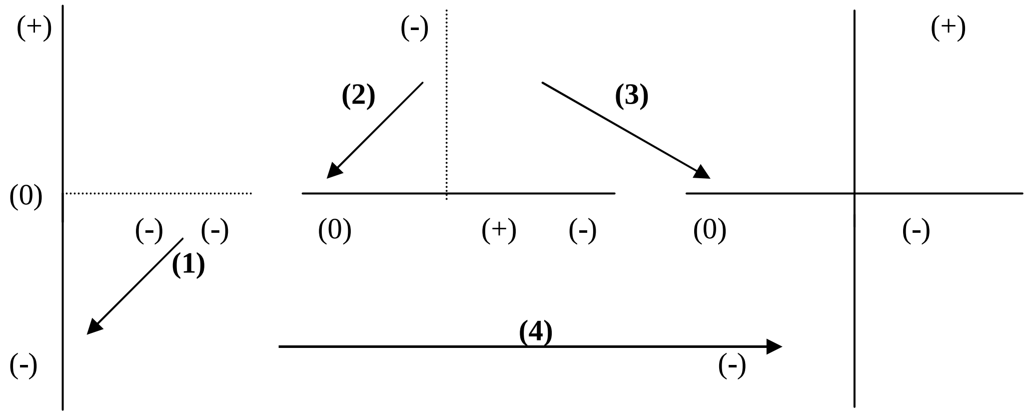


Diagram 11

This diagram demonstrates that time can be plotted on the depth axis of the vortex of the vertical and horizontal lines. This diagram shows how traditional two-dimensional economic analysis is made dynamic.