PRINCIPLES OF TAX MODELING: A BRIEF INTRODUCTION

José-Manuel MARTIN CORONADO, ADIT[1]

In many macroeconomic books, taxation is reduced to a percentage of GDP in a wider macroeconomic model. However, taxation itself is deep enough to elaborate longer modeling. In this introduction, I will try to explain how modern taxation works and how economists should face tax issues before applying any recommendation of fiscal or tax policy.

The first idea of taxation in macroeconomics is the well known equation of disposable income, like this: ***YD = Y – T = Y – Y.t = (1-t).Y.*** While this equation might seem correct, it assumes that the GDP (Y) is equal to the taxable base. The main issue here is that it isn't. However, that equation might be useful to create the indicator of effective tax burden, where "t" becomes endogenous rather than exogenous.

Normally, the taxable base (***TB***) is supposed to be equal to the net income (***NI***), though the first is a definition from tax law and the latter from accounting. So, here I must make an assumption which I will break later. Therefore, the net income is simply the result of this equation: ***NI = IN – EX***, where "***IN***" represents the Income and "***EX***" the expenses. The reader can see now that this approach will be from an Income Tax perspective and, as it may be simpler, a Corporate Income Tax point of view.

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[1] ADIT (CIOT, UK). Msc. Spanish & European Taxation. (C.E. Garrigues). Msc Ex. International Taxation (C.E. Garrigues). Tax Postgraduate studies UTC Leiden (NL). Econometrists (U. Rotterdam, UNI, INEI).) Senior Tax Associate at EMAE.

To sum up, our multi-equational model will look like this:

$$(1) \qquad NI = IN - EX$$

$$(2) \qquad TB = NI$$

$$(3) \qquad TD = t.TB$$

As you can suspect, "***TD***" mean the Tax Due, which is the tax rate (***t***) multiplied by the Tax Base (***TB***). Having said that, some assumptions can be dropped now. First, as one can expect, ***TB*** is not equal to ***NI***. One of many differences is given by the Non-Deductible Expenses (NDE) which is one o many possible adjustments available to obtain a taxable base. So, the equation (2) is as follows:

$$(2a) \quad TB = NI + NDE$$

This suggests that:

$$(4) \quad DEX = EX - NDE$$

This last alternative equation suggests that Deductible Expenses (***DEX***) according to tax law, are the net result of the accounting expenses (***EX***) minus the non deductible expenses (***NDE***).

As a result, the Corporate Income Tax Model (CITM) could be simplified into three alternative global equations.

$$(5a) \quad TD = t.\ (NI + NDE)$$

$$(5b) \quad TD = t.\ (IN - EX + NDE)$$

$$(5c) \quad TD = t.\ (IN - DEX)$$

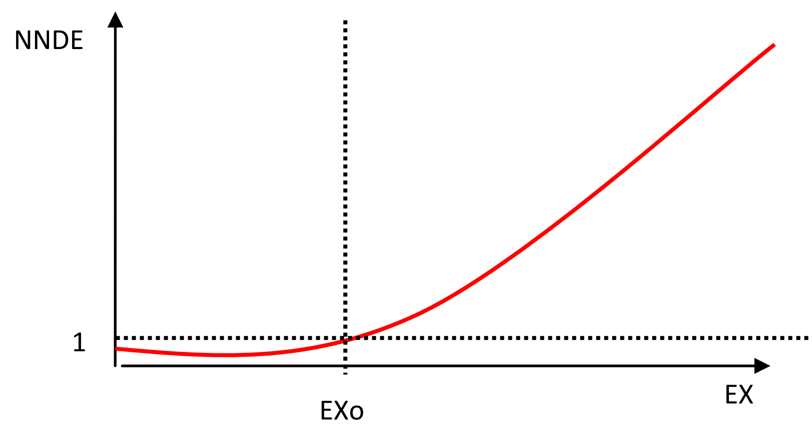
Thus, one can observe that in order to optimize minimize ***TD***, one has to maximize ***DEX***. Or, in other terms, one has to minimize ***NDE***. In this case, we are assuming that Income and Expenses are exogenous, though these assumptions will not hold in real life business. However, the more common approach is to maintain ***IN*** as exogenous and minimize ***DEX***, but in the end, it all depends on your tax optimization strategy (TOS).

Of course, as Tax Administration also know and use this model, their objectives will be symmetrically opposite, that is, the will maximize ***TD***, while minimizing ***DEX*** or maximizing ***NDE***. Thus, it shouldn't be a surprise that this goal is willing to be obtained in a similar aggressive way as the optimization made by corporations, for example, by strict application of document formalities and legal technicalities.

But how this optimization works, you might be asking. Well, this will require some linear programming and/or calculus knowledge which accountants and lawyers may find a little hard to process, the specification of the problem is quite simple. In our case, the endogenous (explained, objective) variable must be at the left side of the equation, and the control variables at the right side, which states the causal relationship between variables.

From that point, modeling creativity arises, as many tax models can be elaborated with various purposes. One of the most common objectives is to minimize the taxable base. If the incomes are exogenous, then the control variables will be the expenses, non-deductible expenses or deductible expenses. But as stated before, this can vary depending on the modeler.

In our case, let's propose that when a corporation increases its expenses, sooner or later, the Tax Administration will increasingly find many of those expenses as non-deductible. The mathematical function of this relationship could take many forms, but one that could be valid is an exponential function. Therefore, $NNDE = e^{EX} - EXo$, where ***EXo*** is the optimum level of expenses that will remain uninteresting for a Tax Administration, and **NNDE** is the number of non deductible expenses. That equation can be shown graphically as it follows:



So, a way to show this equation in full could be, where $A > 1$ and represents the average non deductible expense (or any factor a matter of fact)-

$$(6)\ NDE = A.(e^{EX} - EXo)$$

And, combining (5b) with (6), we obtain.

$$(7)\ TD = t.IN - t.EX + t.NDE$$

$$(7a)\ TD = t.IN - t.EX + t.\ A.(e^{EX} - EXo)$$

$$(7a)\ TD = t.IN - t.[\ A.(e^{EX} - EXo) - EX]$$

Finally, If we assume a constant margin of return, then:

EMAE. Martin Lawyers & Economists | www.martin-emae.com | tax@martin-emae.com
(+511) 722-7481 | (+51) 988-558-849 | Lima, Perú.

$$(7c)\ TD = t.(1+m).EX - t.[A.(e^{EX} - EXo) - EX]$$

$$(7c)\ TD = t[(1+m).EX - A.(e^{EX} - EXo) - EX]$$

$$(7d)\ TD = t[m.EX - A.(e^{EX} - EXo)]$$

Which gives us the final objective function to optimize:

$$(7e)\ TD = t[m.EX - A.e^{EX} + A.EXo]$$

On last thought: While the mathematical function will depend on the assumptions and control variables chosen (in our case it was ***EX***), the final equation and its parameters (for example ***m*** and ***A***) should be obtained through the analysis of the data, especially in the relationship between expenses and non deductible expenses arising. So this last part could vary between enterprises. But the goal is to understand and to propose a function that is likely to be optimized on behalf of the corporation or the Tax Administration, in either case.

EMAE. Martin Lawyers & Economists | www.martin-emae.com | tax@martin-emae.com
(+511) 722-7481 | (+51) 988-558-849 | Lima, Perú.