

Educational note: a full version of the DuPont De Nemours formula, theory and example of business communication

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The educational film devoted to the DuPont formula evokes a technical sophistication making it possible to calculate a “shareholders” oriented ROE while retaining a purely “operational” objective for managers.

This educational note includes 3 parts:

1. Technical development of the formula
2. An application exercise
3. A real case

1 / Technical development of the formula

Let us recall, first of all, that the classic presentation of the formula is in the form:

$$\mathbf{ROE = ROS * ATO * (1 + L)}$$

ROE = net income / equity (Return-On-Equity) (financial profitability)

ROS = net profit / turnover (Return-On-Sales) (commercial profitability)

ATO = turnover / capital employed (Assets Turn-Over) (assets productivity)

L = net financial debt / equity (Gearing) (financial strategy)

The formula has its origins in the work of Franck Donaldson Brown, hired by Pierre Du Pont in 1912 to take the leadership of the financial control of the eponymous firm, and who will implement in 1914 a performance indicator, the ROI (Return-On-Investment) calculated by dividing the operating profit by the firm's industrial assets and breaking down the ROI into ROS and ATO.

ROI = operating profit / industrial assets

ROI = operating profit / sales * sales / industrial assets

ROI = ROS * ATO

In this formula, the ROS is a pure operating indicator, because it divides the operating income by operating revenues, i.e. sales. It differs, therefore, from the ROS presented above which divided the net income by sales.

If Brown's formula was originally intended for operational staff with a double aim, to make them aware of the consumption of capital and push them to favor a transversal

approach in decision-making, this formula has experienced a significant extension in passing from a purely operational ROI to a very financial ROE.

The breakdown of ROE into 3 pillars - commercial operations, industrial operations and financing structure - responded to a concern with Management-By-Objectives (MBO) combining centralization of financial control and decentralization of the objectives assigned to the different activities.

Among the obvious perverse effects of this type of approach, the fact that the net result is the consequence of the operating result, but also of the financial costs generated by the debt and taxes resulting from the taxation. Thus, a manager assessed on his level of net income will be tempted to play with the tax rules to compensate by an attempt to reduce taxes what he or she lacks in the operating income. The consequences of this type of behavior can be dramatic for the company. So, in order to keep ROE as the ultimate product of the formula while removing financial costs and taxes from the managers' objective, the following breakdown has been imagined:

$$ROS = EAT / CA = EAT / EBT * EBT / EBIT * EBIT / CA$$

The net income (EAT) is equal to the earnings before tax from which the tax is deducted, which results in: $EAT = EBT * (1 - T)$ where T is the tax rate on profits.

$$\text{So, } EAT / EBT = EBT * (1 - T) / EBT = 1 - T$$

In addition: $EBT = EBIT$ (operating profit) - I (interest expenses)

$$\text{So: } EBT / EBIT = (EBIT - I) / EBIT = 1 - I / EBIT$$

We know the $EBIT / I$, ratio which is named 'times interest earned' (TIE) calculating how many times interest expenses are paid by the operating profit, an indicator widely used in the debt rating activity.

$$\text{Then: } EBT / EBIT = 1 - 1 / TIE$$

The general formula becomes:

$$ROE = \underset{\text{Tax}}{(1 - T)} * \underset{\text{Finance}}{(1 - 1 / TIE)} * \underset{\text{Commercial operations}}{ROS} * \underset{\text{Industrial operations}}{ATO} * \underset{\text{Finance}}{(1 + L)}$$

The ROS used in the formula is an operating indicator, calculated by dividing the EBIT by the turnover.

Thus, the formula makes it possible to assign the ROE objective to the different functions represented by specific colors, without diverting the manager of his/her operational mission.

The next section applies the formula.

2 / Application exercise

Let's take the case of a company with the following characteristics:

$$CE = 300 = EQ (200) + D (100)$$

$$\text{Sales} = 600$$

$$\text{Debt interest rate (I}_d) = 6\%$$

$$\text{Income tax rate (T)} = 33.33\% = 1/3$$

$$EBIT = 60$$

The income statement is as follows:

$$EBIT \quad 60$$

$$(I) \quad (6) = 6\% * 100$$

$$EBT \quad 54$$

$$(T) \quad (18) = 1/3 * 54$$

$$EAT \quad 36$$

The ROE (financial profitability) is equal to $36/200 = 18\%$.

Mobilizing the formula breaks down this figure.

$$\text{As } T = 1/3, 1 - T \text{ is } 2/3$$

The interest coverage rate (TIE) is equal to $EBIT / I = 60/6 = 10$

$$ROS = EBIT / CA = 60/600 = 10\%$$

$$ATO = CA / CE = 600/300 = 2$$

$$D / CP = 100/200 = 0.5$$

We verify that:

$$ROE = 18\% = (1 - 1/3) * (1 - 1/10) * 10\% * 2 * (1 + 0.5)$$

This formula is quite hard to handle and can only be used for centralized financial control purposes, from a very synthetic perspective of performance.

The following case presents a fairly rare financial communication.

3 / Real case

In its 2017 annual report, the Japanese telecommunications operator NTT DoCoMo presents a comparative analysis of its performance and that of its main domestic competitors in the form of the following table:

Components of ROE (FY2017)

	ROE (%)	Profit attributable to shareholders of the Parent ÷ Income before income taxes × 100 (%)	Income before income taxes ÷ Operating profit × 100 (%)	Operating profit ÷ Operating revenues × 100 (%)	Operating revenues ÷ Total assets (times)	Total assets ÷ Equity attributable to shareholders* (times)
DOCOMO	14.2	69.3	115.7	20.7	0.62	1.37
KDDI	15.6	59.9	99.2	19.1	0.77	1.79
SoftBank Group	23.7	270.1	29.5	14.2	0.29	7.11

*Equity attributable to shareholders is calculated by averaging the total for the previous and current fiscal periods.

Source: Figures announced by each company

The breakdown into 5 factors is identical to that presented in the first section.

We will first take the figures presented in its annual report by KDDI, then comment on the table above.

KDDI communicates in its 2017/2018 annual report in billion JPY:

- Net income attributable to shareholders = 588.3 (1)
- Pre-tax profit = 955.1 (2)
- Operating profit = 962.8 (3)
- Turnover = 5,042.0 (47bn USD) (4)
- Total assets = 6,574.6 (5)
- Equity (group share) = 3,773.7 (6)

We verify that:

- $ROE = (1) / (6) = 15.6\%$
- $EAT / EBT = (1) / (2) = 59.9\%$ (tax rate around 40%)
- $EBT / EBIT = (2) / (3) = 99.2\%$ (debt and / or low interest rate?)
- $EBIT / CA = (3) / (4) = 19.1\%$
- $turnover / total\ assets = (4) / (5) = 0.77$
- $Total\ assets / equity\ (group) = (5) / (6) = 1.74$ (rounded...).

The table presented by NTT DoCoMo is therefore very much in line with KDDI's institutional communication.

The additional question that arises is: how to use such information for financial analysis? The answer is mixed...

Indeed, if we focus the analysis on ROE, therefore on the performance of shareholders, we would be tempted to position Softbank in first place. However, it is more than surprising to read that the after-tax profit represents 270% of the pre-tax profit. Reading the Softbank Holding annual report reveals the existence of a tax credit received by the firm as a result of a modification of the tax rules in force in the United States. Using some sort of "notional" tax rate at 30%, the ROE would drop to 6%, which puts the firm at the bottom of the list. This is normal due to both a lower operating profit (14% vs. 19-20% for its competitors) and a lower assets turnover (0.3 vs. 0.6-0.8). Interestingly, this brings us back to the ROCE (or ROI) privileged by the initial approach of F. Donaldson Brown within the firm Du Pont de Nemours in 1914 (see educational film).

Another remark, which is addressed to the accounts of NTT. Pre-tax income (EBT) represents approximately 116% of operating profit (EBIT). This could be the consequence of abundant cash generating financial products. In fact, reading NTT's annual report (again ...) shows a significant arbitrage profit and recorded in the item "other income" ... In the calculation of ROCE (or ROI), it therefore appears obvious to use the current operating income in order to have relevant information on the company's recurring performance.

In **conclusion**, this approach allows a finer analysis of the sources of financial profitability of the company and makes it possible to identify what comes from the operations, the financing structure, the taxation and exceptional events.

It is, therefore, very useful, in a perspective of centralized financial management of the firm.

But it also reinforces the need to use a simple indicator to assess the operational performance of operational staff. ROCE and ROI (CE excluding "overheads and goodwill" generated by acquisitions, see film) thus appear, after deduction of non-recurring elements, as the most effective contributors to decentralized financial control.