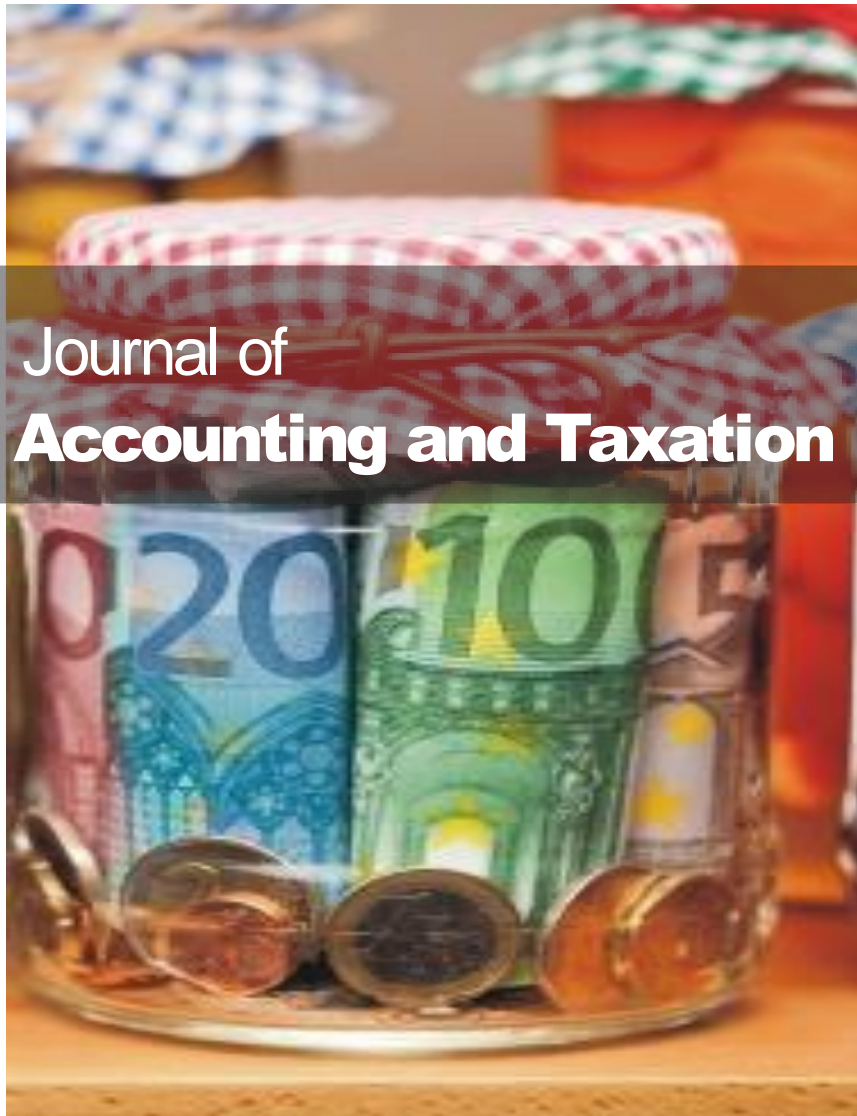


OPEN ACCESS



Journal of  
**Accounting and Taxation**

January-March 2021  
ISSN: 2141-6664  
DOI: 10.5897/JAT  
[www.academicjournals.org](http://www.academicjournals.org)



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*Full Length Research Paper*

# Closed form solution for the valuation of deferred tax assets

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Received 9 October, 2020; Accepted 12 November, 2020

**Deferred tax asset (DTA) is a tax/accounting concept that refers to an asset that may be used to reduce future tax liabilities of the holder. In the banking sector, it usually refers to situations where a bank has either overpaid taxes, paid taxes in advance or has carry-over of losses (the latter being the most common situation). In fact, accounting and tax losses may be used to shield future profits from taxation, through tax loss carry-forwards. In other words, DTAs are contingent claims, whose underlying assets are banks future profits. Consequently, the correct approach to value such rights implies necessarily, the use of a contingent claim valuation framework. Despite that, one common practice consists of valuing DTAs as though they would be used at 100% without even discounting for the time value of money. Another common procedure consists of considering a subjective “valuation allowance”, valuing the deferred tax asset as a certain percentage of the corresponding maximum value, according to future expectations on the company’s financial performance. The purpose of this paper is exactly to propose a precise and conceptually sound mathematical approach to value DTAs, considering future projections of earnings and rates, alongside the DTA’s legal time limit. It will be shown that with the proposed evaluation techniques, the DTA’s expected value will be much lower than the values normally used in today’s practice, and the bank’s financial analysis will lead to much more sound and realistic results.**

**Key words:** Valuation, deferred tax asset, banking sector, balance sheet, binomial.

## INTRODUCTION

There have been many attempts to reach a conformity about the way income tax is treated, that is, to uniformize tax rates and regulations across international entities, but the complexity of this topic has raised some issues and critics; Hanlon and Shevlin (2005) and Atwood et al. (2010) stated that earnings persistence and the association between current earnings and future cash flows are lower when the level of required book-tax conformity is higher.

The potential benefits would include lower compliance costs for reporting income and the potential lowering of incentives to mislead the Internal Revenue Service (IRS) and capital markets (basically deterring entities from engaging into tax shelters and schemes).

The tax return of a company is based on its accounting financial statements. To provide comparable information, financial statements are prepared according to the

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International Financial Reporting Standards (IFRS), issued by the International Accounting Standards Board (IASB). The IASB was formed in 2001 to replace the International Accounting Standards Committee that issued International Accounting Standards (IAS). Since the previously issued IASs remain effective, we have that the main body of standards that are used worldwide by several countries comprised IFRSs and IASs. The companies' income, depicted by the IFRSs and IASs (referred to simply by the Generally Accepted Accounting Principles GAAP) are their accounting profits, but these may be (and are) different from the taxable profit, since the taxable profit is calculated as a function of the tax law inherent to each country. The number of factors that lead to differences between tax and accounting returns is huge and varies from country to country. One of those factors is of relevance to the present work, the deferral of taxes.

### Remove DTAs from the balance sheet

Laux (2013) conducted a study to analyse the relationship between the information content of financial statements and the net deferred taxes account. Naturally, as we evaluate deferred taxes, we may find both deferred tax assets and deferred tax liabilities; the difference will result in net deferred taxes (we will henceforth refer to these net deferred taxes simply as deferred tax assets, or DTAs). The main conclusion was that the exclusion of DTAs from the results helped access the main differences from the different company's performance. This is highly related to the cost/benefit of disclosing information on DTAs since that the cost of acquiring and utilizing this information seems to nullify the benefits. Also, on the same topic, Burgstahler et al. (2002) concluded that in some occasions, managers tend to manipulate the net deferred tax asset account to increase earnings and avoid losses. This possible manipulation is also something that should be kept in mind when evaluating balance sheets where such accounts are present.

The problem of accounting DTAs on a present value basis is that under the actual rules adopted by Financial Accounting Standards Board (FASB), the deferred tax accounts are, in many cases, unlikely to reverse in the foreseeable future, since companies seem to be able to defer taxes indefinitely (Colley et al., 2007). These authors address this statement in the study "Deferred Taxes in the Context of the Unit Problem" where they remove the deferred tax assets from the balance sheets. The authors state that income taxation is an aggregate phenomenon and that an aggregate approach is required, making use of the flow-through accounting method. The main argument states that, if we see taxation as a transaction between the private/public sectors and the governmental authority, then this method would result in an equality of the tax provision and the cash outflow

for a certain period, therefore eliminating deferred tax assets and liabilities. The idea of removing deferred taxes from the balance sheet has been supported by other authors like Chaney (1994) and Ketz (2010) that argue that deferred tax accounting is too complex, too expensive and too inconsistent with the US GAAP.

### Valuation and accounting of DTAs

The valuation and accounting of DTAs is the topic that must be discussed and clarified. The most important thing to notice is that deferred tax assets add value to the balance sheet since they represent the net present value of the future tax benefits (it is important to note that classical accounting relations only hold when the DTA value is indeed adjusted to its net present value (Eli Amir et al., 1997)). To determine the best way to account for deferred taxes, Amir et al. (1997) conducted some research where they introduced net deferred taxes as a completely distinct category of assets, using the market value of equity per share as the dependent value. Amir et al. (1997) found that the valuation coefficient on deferred tax liabilities from depreciation and amortization was close to zero; also, deferred taxes from restructuring charges had valuation coefficients larger than other deferred tax components. They also concluded that the net realizable value of deferred taxes from losses and credits carried forward were negatively correlated with stock prices. In the end they concluded that even though these types of assets are very different in nature from the rest of the assets in the balance sheet, they should nonetheless be accounted for (with some subjective adjustments) in a way like any other asset or liability.

### Focus on bank's DTAs

On the special case of the banking sector, banks are required to maintain certain levels of regulatory capital to provide a buffer against potential future losses (Kim and Santomero, 1988; Ryan, 2007; Baesens and van Gestel, 2009). In many countries (Kara, 2016), banks can count a portion (or all) of their DTAs towards regulatory capital requirements (since the adoption of SFAS<sup>1</sup> No. 109 in 1992 – specifically the establishment of valuation allowances).

Under normal circumstances, a bank's DTAs usually originates in the carry-over of losses (though it can also arise from overpaying some taxes). The corresponding rights are registered in the balance sheet as assets, although in Amir and Sougiannis (1999) it also argued that DTA may have implications for the perception of the firm as a going concern (dubbed as the information

<sup>1</sup> Statement of Financial Accounting Standards

effect), since if the DTA arose from past operating losses, future losses would be likely to incur; this means that future liabilities could be more than likely, and thus such “assets” should be regarded with great suspicion).

### DTAs and European options

DTAs may be hard to value, since they are time-limited and may never be used at all. Their value is contingent on the future earnings of the company, and they can be used to shield these future profits from taxation, IAS 12 states that “a DTA should be recognised for all deductible temporary differences, to the extent that it is probable that taxable profit will be available against which the deductible temporary difference can be utilised”. Since corporate income taxation works on an annual basis, the shielding opportunities occur once a year. This is equivalent to saying that we are faced with a compound European option (or an annual Bermuda option) that might be exercised until the last year in which the law will permit shielding, or until the DTAs value has been completely depleted by its use. Consistent with this line of thinking, there is an ongoing debate regarding the appropriateness of including DTA in the banks’ regulatory capital calculation, since by doing so we are assuming its “full” worth; something that is clearly misleading.

### Basel committee vs. banking industry

Throughout the recent financial crisis (2008-2013), major media outlets routinely drew attention to the banks’ DTA positions, classifying them as tenuous contributions towards regulatory capital. In Reilly (2009), it was noted that tier 1 capital ratios contained “fluff” mentioning DTA as the primary culprit, calling in an “airy asset”. The Basel Committee on Banking Supervision specifically targeted the removal of DTAs as a potential method for improving the ability of regulatory capital to protect banks from losses<sup>2</sup>. At the same time, the banking industry has pushed for the opposite; namely a greater inclusion of DTA in the regulatory capital calculation, in an attempt to “ease” the amount of (real) regulatory capital.

### High DTAs = Low credit worthiness

The relationship of DTAs with the creditworthiness of a company has already deserved some work from academic community. The effects of book-tax differences on a firm’s credit risk were analysed in Crabtree and Maher (2009), Ayers et al. (2010), Edwards (2011) and Gallemore (2011), all agreeing that great amounts of

deferred taxes were associated with higher risks and lower earnings quality, resulting in a decline of creditworthiness. Additionally, studies of the impact of DTAs on credit ratings led to the conclusion that deferred tax positions are substantial for many firms (between 5 and 10% of all assets according to Poterba et al. (2011)).

Gallemore (2011) investigated the credit risk associated with the deferred tax asset component of bank regulatory capital. He hypothesized that banks that have a larger proportion of regulatory capital composed of deferred tax assets were more likely to fail. He employed a hazard model to test a sample of commercial banks and found that the proportion of regulatory capital composed of deferred tax assets which was positively associated with the risk of bank failure during the recent financial crisis. Gallemore (2011) attributed his findings to the fact that the benefits of deferred tax assets could not be realized unless banks generated positive taxable income in the future.

### How to value

It is thus clear that the DTAs must be correctly valued, and that simply adding them to a bank’s or company’s balance sheet in full as an asset might contribute to obfuscate the institution’s true financial condition, even a situation in which the DTA is fully used before its expiration date, we still must account for the cost of capital. Moodys (2015) reported DTAs were considered “a low-quality form of assets, and thus a low-quality source of capital”, and consequently, Moody’s decided to “limit the contribution of DTAs in its calculations of banks’ tangible common equity (TCE)”. As analysed in De Vries (2018), several DTA valuation methods can be used, but they are essentially very subjective, and basically result in a valuation allowance, for which there is no consistent accepted method to calculate, this paper aims to resolve such shortcomings, by solving for the expected value of the DTA, in the sense of calculating exactly which amounts are expected to be discounted as tax payments, and when.

### DTA MATHEMATICAL MODEL

Let us consider a DTA with official book value  $D_{\max}$  and a lifespan of  $T$  (in years). The effective (realistic) value of such DTA is contingent on future profits and shall always be (equal or) lower

than  $D_{\max}$ . The effective value of the considered DTA,  $D$ , can be represented as:

$$D = \sum_{t=1}^T \frac{R_t^+ - R_{t+1}^+}{\prod_{j=1}^t (1 + \tau_j)}, \quad (1)$$

<sup>2</sup> Consultative document of December 2009, entitled “Strengthening the resilience of the banking sector”.

where  $\tau_j$  is the interest yield in year  $j$ ,  $R_t$  is the remaining book value DTA in the beginning of year  $t$  defined as:

$$R_t = D_{\max} - \sum_{i=1}^{t-1} u_i^+ \quad (2)$$

$u_i$  is the profit in year  $i$  multiplied by taxes (basically, it is the tax payment that is discounted from the DTA) and  $(\cdot)^+$  denotes the operation  $x^+ = \max\{x, 0\}$ . Both the yearly profits and yields are assumed to be independently distributed random variables (RVs). Then, the following the objective will be to find the expected value of  $D$  which can be expressed as:

$$\bar{D} = \sum_{t=1}^T E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right] (E[R_t^+] - E[R_{t+1}^+]) \quad (3)$$

$$E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right] = \int_{-\infty}^{+\infty} \dots \int_{-\infty}^{+\infty} \frac{1}{\prod_{j=1}^t (1 + \tau_j)} p_{\tau_1}(\tau_1) \dots p_{\tau_t}(\tau_t) d\tau_1 \dots d\tau_t \quad (4)$$

where  $p_{\tau_j}(\tau_j)$  is the probability density function (PDF) of the interest yield in year  $j$ . We will consider that all the  $\tau_j$  are independently distributed and follow the same PDF but with different means  $\bar{\tau}_j$  and standard deviations  $\sigma_{\tau_j}$ .

According to the Cox-Ingersoll-Ross (CIR) model (Cox et al., 1985), the interest yield would follow a non-central Chi-squared distribution, but in this paper, due to the reduced time spans of the DTAs and ability to limit the estimated variability of the interest yield, we will assume a uniform distribution for the interest yield in order to provide mathematical tractability (and obtain a closed form solution). So being, we have:

$$p_{\tau_j}(\tau_j) = \begin{cases} \frac{1}{2\sqrt{3}\sigma_{\tau_j}}, & \tau_j \in [\bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}, \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}] \\ 0, & \text{otherwise} \end{cases} \quad (5)$$

It is now easy to show that:

$$\int_{-\infty}^{+\infty} \frac{1}{(1 + \tau_j)} p_{\tau_j}(\tau_j) d\tau_j = \frac{1}{2\sqrt{3}\sigma_{\tau_j}} \log \left( \frac{1 + \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}}{1 + \bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}} \right) \quad (6)$$

which results in

$$E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right] = \prod_{j=1}^t \frac{1}{2\sqrt{3}\sigma_{\tau_j}} \log \left( \frac{1 + \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}}{1 + \bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}} \right) \quad (7)$$

Computing  $\bar{D}$  basically requires finding expressions for the expected value of the interest yield weight  $E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right]$  and for the expected value of the positive part of the remaining DTA in the beginning of each year  $t$ ,  $E[R_t^+]$ .

Expected value of the interest yield weight .

In order to compute the expected value  $E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right]$ , we first write it as:

Expected value of remaining DTA

According to Equation 3, the computation of  $\bar{D}$  also requires the evaluation of the expected value of the positive part of the remaining DTA in the beginning of each year  $t$ , that is,  $E[R_t^+]$ . In order to obtain an expression for  $E[R_t^+]$ , we start with the derivation of the PDF of  $R_t$ . First we rewrite Equation 2 as:

$$R_t = D_{\max} - U_t, \quad (8)$$

where  $U_t$  is the sum of all profits multiplied by taxes up until the year  $t-1$ , which is defined as:

$$U_t = \sum_{i=1}^{t-1} u_i^+, \quad (9)$$

comprising a sum of independent, rectified, RVs  $u_i^+$ . If each non rectified RV  $u_i$  is described by a PDF  $p_{u_i}(u_i)$ , then  $u_i^+$  follows the associated rectified PDF which is given by:

$$p_{u_i^+}(u_i^+) = (1 - p_i) \delta(u_i^+) + p_{u_i}(u_i^+) H(u_i^+) \quad (10)$$

where  $\delta(x)$  is the Dirac delta function,  $H(x)$  is the unit step

function:

$$H(x) = \begin{cases} 0, & x \leq 0 \\ 1, & x > 0 \end{cases} \quad (11)$$

and  $p_i$  is the probability of having positive profit, that is,

$$p_i = \int_0^{+\infty} p_{u_i}(u_i) du_i \quad (12)$$

Note that when the second term in Equation 10 is normalized by

$$= \sum_{k_1=0}^1 \cdots \sum_{k_{t-1}=0}^1 p_1^{k_1} \cdots p_t^{k_{t-1}} (1-p_1)^{1-k_1} \cdots (1-p_t)^{1-k_{t-1}} C_{\{k_i\}_{i=1}^{t-1}}(U_t) \quad (14)$$

where  $*$  denotes the convolution operation which, for two functions  $f(x)$  and  $g(x)$  is defined as:

$$(f * g)(x) = \int_{-\infty}^{+\infty} f(v)g(x-v)dv \quad (15)$$

$$C_{\{k_i\}_{i=1}^{t-1}}(U_t) = \left[ \left( (1-k_1)\delta + k_1 p_{u_i|u_i>0} \right) * \cdots * \left( (1-k_{t-1})\delta + k_{t-1} p_{u_{t-1}|u_{t-1}>0} \right) \right] (U_t). \quad (16)$$

The second form in Equation 14 makes it explicit all the possible outcomes in terms of years with positive profit and with loss during the timeframe in use. Combining Equation 8 and 14, we can

$$p_{R_t}(R_t) = \sum_{k_1=0}^1 \cdots \sum_{k_{t-1}=0}^1 p_1^{k_1} \cdots p_t^{k_{t-1}} (1-p_1)^{1-k_1} \cdots (1-p_t)^{1-k_{t-1}} C_{\{k_i\}_{i=1}^{t-1}}(D_{\max} - R_t) \quad (17)$$

which allows us to compute  $E[R_t^+]$  using

$$= \sum_{k_1=0}^1 \cdots \sum_{k_{t-1}=0}^1 p_1^{k_1} \cdots p_t^{k_{t-1}} (1-p_1)^{1-k_1} \cdots (1-p_t)^{1-k_{t-1}} I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) \quad (18)$$

where we defined the following auxiliary coefficient required for the summation terms:

$$I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) = \int_0^{+\infty} R_t C_{\{k_i\}_{i=1}^{t-1}}(D_{\max} - R_t) dR_t \quad (19)$$

In order to evaluate the integral in Equation 19 we will consider four different cases in terms of number of years with positive profit (that is,  $\#\{i: k_i \neq 0\}$ , where  $\#$  denotes the cardinality of the set): no

$p_i$ , it represents the truncated PDF associated with  $p_{u_i}(u_i)$  which can be written as:

$$p_{u_i|u_i>0}(u_i) = p_{u_i}(u_i)H(u_i)/p_i \quad (13)$$

Knowing that the PDF of a sum of independent RVs can be found using the convolution of the individual PDFs (Hogg et al., 2004), we can write the PDF of  $U_t$  as:

$$p_{U_t}(U_t) = (p_{u_1^+} * \cdots * p_{u_{t-1}^+})(U_t)$$

Therefore, in Equation 14  $C_{\{k_i\}_{i=1}^{t-1}}(U_t)$  corresponds to the  $(t-1)$ -fold convolution:

express the PDF of  $R_t$  as:

$$E[R_t^+] = \int_{-\infty}^{+\infty} \max\{R_t, 0\} p_{R_t}(R_t) dR_t$$

years with profit, one year with profit, two years with profit and three or more years with profit. A uniform distribution with mean  $\bar{u}_i$  and standard deviation  $\sigma_{u_i}$  will be assumed for each yearly profit,  $u_i$ , with the PDF expressed as:

$$p_{u_i}(u_i) = \begin{cases} \frac{1}{b_i - a_i}, & u_i \in [a_i, b_i] \\ 0, & \text{otherwise} \end{cases} \quad (20)$$

where

$$a_i = \bar{u}_i - \sqrt{3}\sigma_{u_i} \quad (21)$$

and

$$b_i = \bar{u}_i + \sqrt{3}\sigma_{u_i}. \quad (22)$$

For this PDF the probability of having positive profit, Equation 12, is simply:

$$p_i = \frac{b_i - a_i^+}{b_i - a_i} \quad (23)$$

#### Case of no years with positive profit

The sequence without positive profit years ( $\#\{i : k_i \neq 0\} = \emptyset$ ) results in a trivial convolution of Dirac delta functions in Equation 16

$$I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) = \frac{1}{2(b_i - a_i^+)} \left\{ \left[ (D_{\max} - a_i^+)^+ \right]^2 - \left[ (D_{\max} - b_i)^+ \right]^2 \right\}. \quad (26)$$

#### Case of two years, $i$ and $j$ , with positive profit

For the sequences with only two positive profit years ( $\#\{i : k_i \neq 0\} = 2$ ), indexed by  $i$  and  $j$ , Equation 16 simplifies to

$$C_{\{k_i\}_{i=1}^{t-1}}(D_{\max} - R_t) = \frac{1}{l_i l_j} \begin{cases} D_{\max} - R_t - a_i^+ - a_j^+, & D_{\max} - a_i^+ - a_j^+ - \min\{l_i, l_j\} \leq R_t < D_{\max} - a_i^+ - a_j^+ \\ \min\{l_i, l_j\}, & D_{\max} - a_i^+ - a_j^+ - \max\{l_i, l_j\} \leq R_t < D_{\max} - a_i^+ - a_j^+ - \min\{l_i, l_j\} \\ R_t - D_{\max} + b_i + b_j, & D_{\max} - b_i - b_j \leq R_t < D_{\max} - a_i^+ - a_j^+ - \max\{l_i, l_j\} \\ 0, & \text{otherwise} \end{cases} \quad (27)$$

where

$$l_i = b_i - a_i^+. \quad (28)$$

$$I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) = \frac{1}{l_i l_j} \left[ \left( \frac{1}{3} R_t^3 + \frac{(b_i + b_j - D_{\max})}{2} R_t^2 \right) \Bigg|_{(D_{\max} - b_i - b_j)^+}^{(D_{\max} - a_i^+ - a_j^+ - \max\{l_i, l_j\})^+} + \left( \frac{\min\{l_i, l_j\}}{2} R_t^2 \right) \Bigg|_{(D_{\max} - a_i^+ - a_j^+ - \max\{l_i, l_j\})^+}^{(D_{\max} - a_i^+ - a_j^+ - \min\{l_i, l_j\})^+} + \left( -\frac{1}{3} R_t^3 + \frac{(D_{\max} - a_i^+ - a_j^+)}{2} R_t^2 \right) \Bigg|_{(D_{\max} - a_i^+ - a_j^+ - \min\{l_i, l_j\})^+}^{(D_{\max} - a_i^+ - a_j^+)^+} \right] \quad (29)$$

which is also a Dirac delta function. Therefore Equation 19 results simply in:

$$I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) = D_{\max}. \quad (24)$$

#### Case of only one year, $i$ , with positive profit

The convolution in Equation 16 is also trivial to compute for the sequences with only one year with positive profit ( $\#\{i : k_i \neq 0\} = 1$ ) as it consists in the convolution of Dirac delta functions with a single truncated (and normalized) PDF obtained from Equation 20, resulting in:

$$C_{\{k_i\}_{i=1}^{t-1}}(D_{\max} - R_t) = p_{u_i | u_i > 0}(D_{\max} - R_t). \quad (25)$$

Inserting Equation 25 into Equation 19, then gives:

a convolution of two truncated (and normalized) PDFs obtained from Equation 20, whose resulting expression can be written as:

After inserting Equation 27 into Equation 19 and performing the integral we obtain:

where we adopt the notation  $(f(x)) \Big|_c^d = f(d) - f(c)$ .

### Case of three or more years with positive profit

For all the sequences with three or more years with profit ( $\#\{i: k_i \neq 0\} \geq 3$ ), instead of trying to compute all subsequent convolutions we can apply the Central Limit Theorem (CLT) and approximate the sum of the nonzero  $u_i^+$  as a Gaussian distribution

with mean  $\sum_{i=1}^{t-1} k_i \bar{u}_i^+$  and squared standard deviation  $\sum_{i=1}^{t-1} k_i \sigma_{u_i^+}^2$

where

$$\sigma_{u_i^+}^2 = \frac{(b_i - a_i^+)^2}{12} \quad (30)$$

and

$$\bar{u}_i^+ = \frac{a_i^+ + b_i}{2}. \quad (31)$$

In this case we can write:

$$C_{\{k_i\}_{i=1}^{t-1}}(D_{\max} - R_t) = \frac{1}{\sqrt{2\pi\sigma'^2}} e^{-\frac{(R_t - \mu')^2}{2\sigma'^2}} \quad (32)$$

where

$$\sigma'^2 = \sum_{i=1}^{t-1} k_i \sigma_{u_i^+}^2 \quad (33)$$

and

$$\mu' = D_{\max} - \sum_{i=1}^{t-1} k_i \bar{u}_i^+ \quad (34)$$

Performing the integration in Equation 19 then results in

$$I_{\{k_i\}_{i=1}^{t-1}}(D_{\max}) = \frac{\sigma'}{\sqrt{2\pi}} e^{-\frac{\mu'^2}{2\sigma'^2}} + \frac{1}{2} \mu' \operatorname{erfc}\left(-\frac{\mu'}{\sqrt{2\pi}\sigma'}\right) \quad (35)$$

where  $\operatorname{erfc}(x)$  is the complementary error function defined as:

$$\operatorname{erfc}(x) = \frac{2}{\sqrt{\pi}} \int_x^{+\infty} e^{-v^2} dv \quad (36)$$

$$I_2(D_{\max}) = \frac{1}{(b-a^+)^2} \left[ \frac{2}{3} \left( (D_{\max} - b - a^+)^+ \right)^3 - \frac{(D_{\max} - 2b)}{2} \left( (D_{\max} - b - a^+)^+ \right)^2 - \frac{1}{3} \left( (D_{\max} - 2b)^+ \right)^3 - \frac{1}{3} \left( (D_{\max} - 2a^+)^+ \right)^3 + \frac{(D_{\max} - 2b) \left( (D_{\max} - 2b)^+ \right)^2}{2} + \right.$$

### Case of independent and identically distributed profits

If we assume that the RVs  $u_i$  are not only independent but also identically distributed with mean  $\bar{u}$ , standard deviation  $\sigma_u$  and

PDF  $p_u(u)$ , then most of the previous expressions can be simplified. In this case Equation 18 becomes:

$$E[R_t^+] = \sum_{k=0}^{t-1} \binom{t-1}{k} p^k (1-p)^{t-1-k} I_k(D_{\max}) \quad (37)$$

where  $\binom{t-1}{k}$  denotes number of combinations of  $t-1$  elements

taken  $k$  at a time,  $p = \int_0^{+\infty} p_u(u) du$ ,

$$I_k(D_{\max}) = \int_0^{+\infty} R_t C_k(D_{\max} - R_t) dR_t, \quad (38)$$

$C_k(U_t)$  is simply the  $k$ -fold convolution of the truncated PDF  $p_{u|u>0}(u)$  with itself and  $p$  is the probability of having positive profit which, for uniformly distributed RVs (23), simplifies to

$$p = \frac{b - a^+}{b - a}. \quad (39)$$

Repeating the explicit computation of Equation 38 for the four different cases in terms of years with positive profit we obtain:

$$I_0(D_{\max}) = D_{\max} \quad (40)$$

for the sequences of no years with positive profit,

$$I_1(D_{\max}) = \frac{1}{2(b-a^+)} \left\{ \left[ (D_{\max} - a^+)^+ \right]^2 - \left[ (D_{\max} - b)^+ \right]^2 \right\}, \quad (41)$$

for the sequences with only one year with positive profit,



$$+ \frac{(D_{\max} - 2a^+) \left( (D_{\max} - 2a^+)^+ \right)^2}{2} - \frac{(D_{\max} - 2a^+) \left( (D_{\max} - b - a^+)^+ \right)^2}{2} \Bigg], \quad (42)$$

for the sequences with two years with positive profit and (approximately):

$$I_{k \geq 3}(D_{\max}) = \frac{\sigma'}{\sqrt{2\pi}} e^{-\frac{\mu'^2}{2\sigma'^2}} + \frac{1}{2} \mu' \operatorname{erfc} \left( -\frac{\mu'}{\sqrt{2\pi}\sigma'} \right) \quad (43)$$

for all the remaining sequences (three or more years with positive profit). In Equation 43, we use  $\sigma'^2 = k\sigma_{u^+}^2$  and  $\mu' = D_{\max} - ku^+$ .

#### Putting the mathematical model to use

In order to clarify the use of the presented expressions, we describe

$$E[R_2^+] = \left( \frac{a^+ - a}{b - a} \right) D_{\max} + \frac{1}{2(b-a)} \left\{ \left[ (D_{\max} - a^+)^+ \right]^2 - \left[ (D_{\max} - b)^+ \right]^2 \right\}, \quad (46)$$

(obtained from Equations 37, 40 and 41),

$$E[R_3^+] = \left( \frac{a^+ - a}{b - a} \right)^2 D_{\max} + \frac{(a^+ - a)}{(b - a)^2} \left\{ \left[ (D_{\max} - a^+)^+ \right]^2 - \left[ (D_{\max} - b)^+ \right]^2 \right\} + \left( \frac{b - a^+}{b - a} \right)^2 I_2(D_{\max}) \quad (47)$$

(obtained from Equations 40, 41, and 42), and

$$E[R_4^+] = \left( \frac{a^+ - a}{b - a} \right)^3 D_{\max} + \frac{3(a^+ - a)^2}{2(b-a)^3} \left\{ \left[ (D_{\max} - a^+)^+ \right]^2 - \left[ (D_{\max} - b)^+ \right]^2 \right\} + 3 \frac{(b - a^+)^2 (a^+ - a)}{(b - a)^3} I_2(D_{\max}) + \left( \frac{b - a^+}{b - a} \right)^3 \left( \sqrt{\frac{3}{2\pi}} \sigma_{u^+} e^{-\frac{(D_{\max} - 3u^+)^2}{6\sigma_{u^+}^2}} + \frac{1}{2} (D_{\max} - 3u^+) \operatorname{erfc} \left( -\frac{D_{\max} - 3u^+}{\sqrt{6\pi}\sigma_{u^+}} \right) \right) \quad (48)$$

(obtained from Equations 37, 40, 41, 42, and 43).

a simple example of the computation of the expected value of a DTA with a lifespan of  $T=3$  years, considering independent and identically distributed uniform RVs for the profits. In this case, according to Equation 3, the intended value is computed using:

$$\bar{D} = \sum_{t=1}^3 E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right] (E[R_t^+] - E[R_{t+1}^+]). \quad (44)$$

where the terms inside the summation are

$$E[R_1^+] = D_{\max}, \quad (45)$$

(obtained from Equations 37 and 40),

Therefore, the expected value for the DTA is given as:

$$\begin{aligned} \bar{D} &= \sum_{t=1}^3 E \left[ \frac{1}{\prod_{j=1}^t (1 + \tau_j)} \right] (E[R_t^+] - E[R_{t+1}^+]) = \sum_{t=1}^3 \left[ \prod_{j=1}^t \frac{1}{2\sqrt{3}\sigma_{\tau_j}} \log \left( \frac{1 + \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}}{1 + \bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}} \right) \right] (E[R_t^+] - E[R_{t+1}^+]) = \\ &= \frac{1}{2\sqrt{3}\sigma_{\tau_1}} \log \left( \frac{1 + \bar{\tau}_1 + \sqrt{3}\sigma_{\tau_1}}{1 + \bar{\tau}_1 - \sqrt{3}\sigma_{\tau_1}} \right) (E[R_1^+] - E[R_2^+]) + \prod_{j=1}^2 \left[ \frac{1}{2\sqrt{3}\sigma_{\tau_j}} \log \left( \frac{1 + \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}}{1 + \bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}} \right) \right] (E[R_2^+] - E[R_3^+]) + \\ &+ \prod_{j=1}^3 \left[ \frac{1}{2\sqrt{3}\sigma_{\tau_j}} \log \left( \frac{1 + \bar{\tau}_j + \sqrt{3}\sigma_{\tau_j}}{1 + \bar{\tau}_j - \sqrt{3}\sigma_{\tau_j}} \right) \right] (E[R_3^+] - E[R_4^+]) \end{aligned}$$

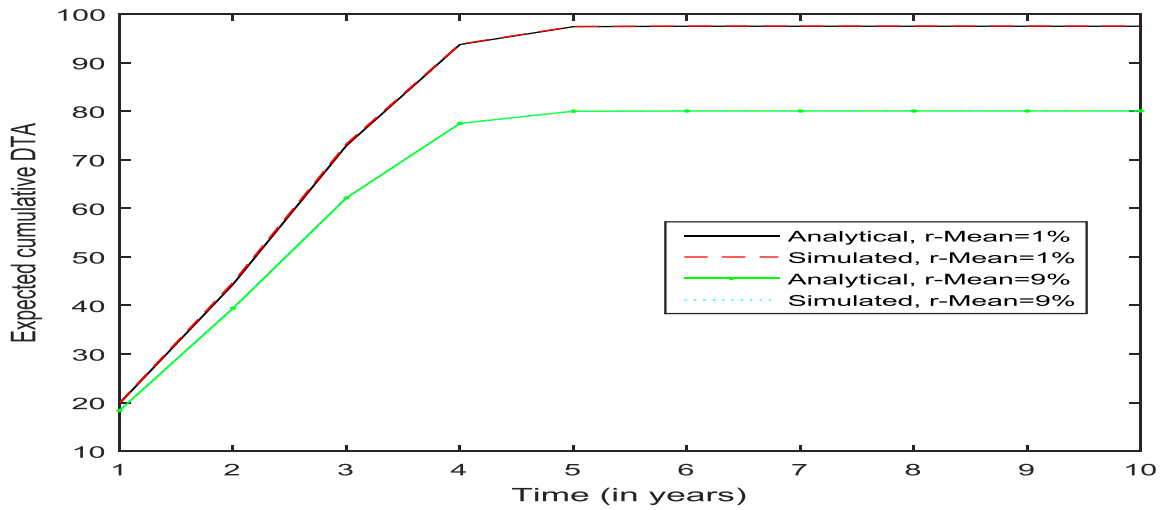


Figure 1. Expected cumulated DTA; increasing mean profits – analytical vs. simulated results.

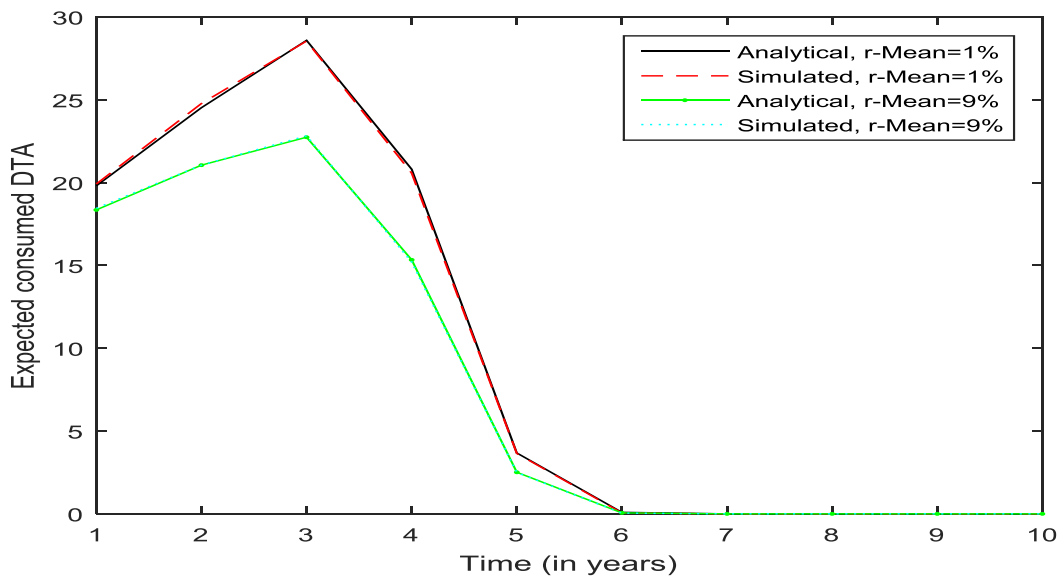


Figure 2. Expected yearly DTA consumption; increasing mean profits – analytical vs simulated results.

**SIMULATION RESULTS**

Monte Carlo simulations were run for 10.000 loops, and the DTA’s lifespan was assumed to be 10 years, with book value  $D_{max}=100$  (a dimensional). Both the yearly interest yield and each year’s mean expected profit multiplied by the tax,  $u_i$ , assumed a uniform distribution (that  $u_i=10$  is equivalent to a profit of 50 and tax rate of 20%, for instance). In

Figure 11, we compare the simulated values to the analytical values obtained by the deduced formulas, to find that they coincide. This test was actually executed for all figures and it was observed that the analytical values

always matched the simulated values almost to perfection, proving that the CLT based approximation adopted for 3 or more years with positive profit proved to be very accurate. The curves of

Figure 11 represent the cumulated DTA usage (to the present value) at the end of each year<sup>3</sup>; whereas the curves of

Figure 22 portray the yearly DTA consumption under the same conditions.

<sup>3</sup> Note that only the annual results are simulated, and thus the results could be represented only by points; lines joining the points were chosen in order to improve the readability of the results

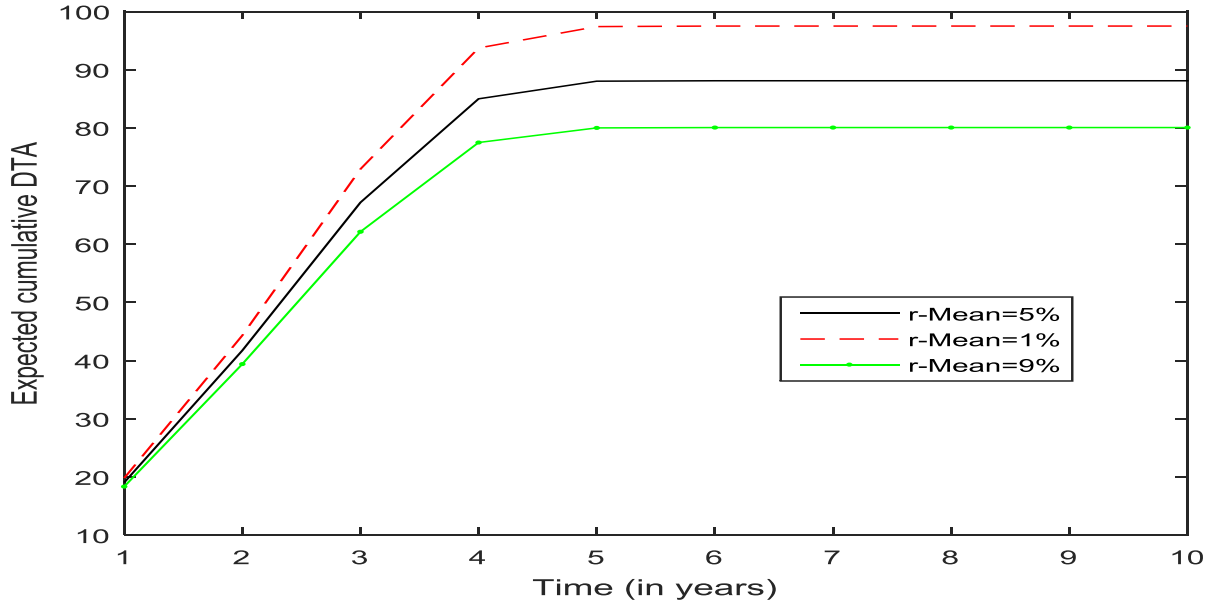


Figure 3. Expected cumulated DTA; increasing mean profits.

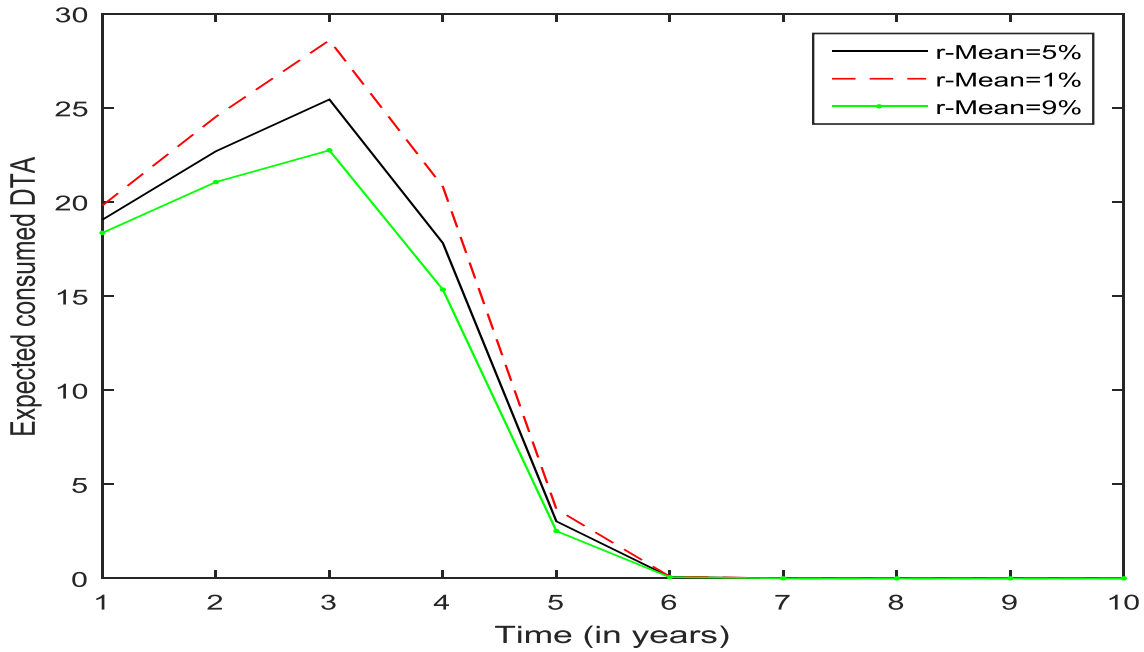


Figure 4. Expected yearly DTA consumption; increasing mean profits.

Figure 3 and Figure 4 present the same simulations present in Figure 1 and Figure 2, but now with only the simulated results. The variable  $\bar{u}_i$  was made to increase from 20 (adimensional) with increments of 5 units each year; all having a fixed standard deviation  $\delta_{u_i}$  of 10. From Figure 3, it was noticed that the initial DTA value is a bit less than 20 (due to the discount factor), climbing up to

almost 100 (if there was no discount factor, the cumulated DTA would reach 100). As expected, the higher yield will output the lowest DTA value. Looking at Figure 4, we can see that by year 6 the DTA was all used up, which means that it only took 5 years for these DTA to be fully used, each with different present values due to the different yields.

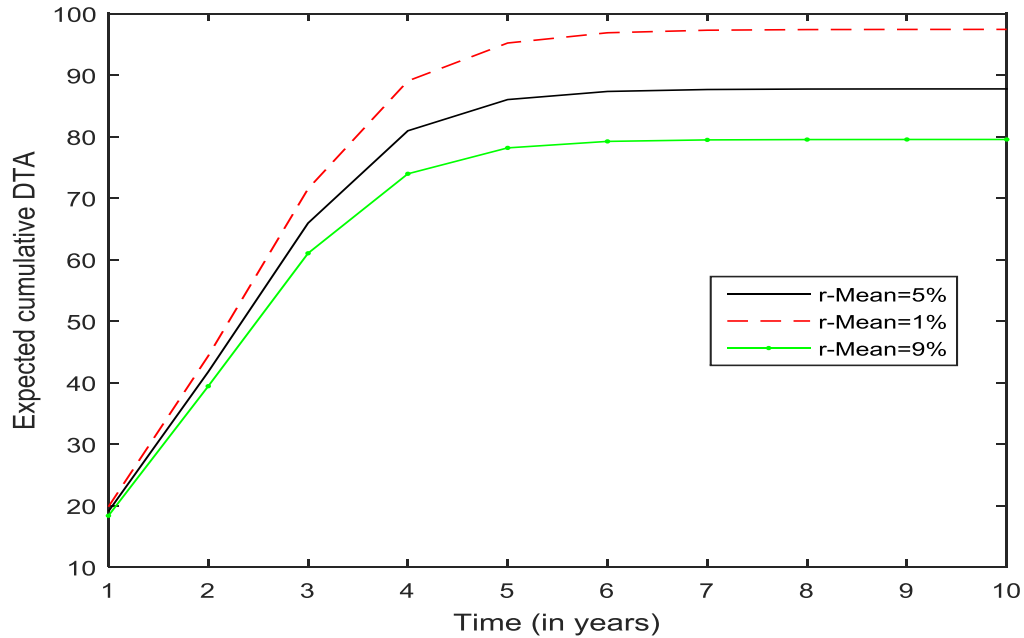


Figure 3. Expected cumulated DTA; increasing mean profits and profit deviation.

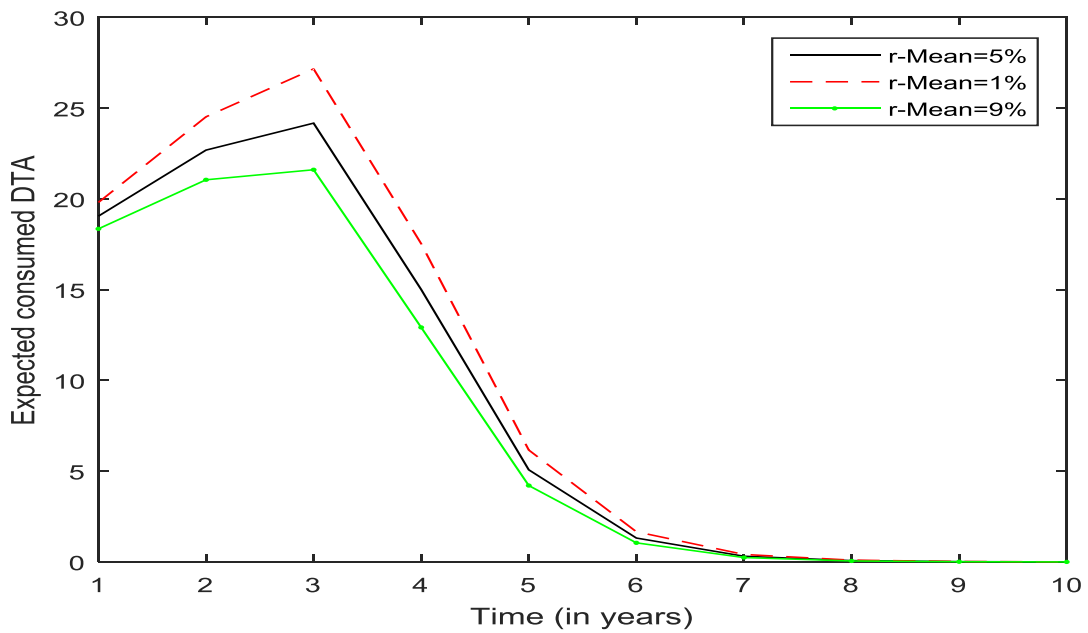


Figure 4. Expected yearly DTA consumption; increasing mean profits and profit deviation.

In Figure 5 and Figure 6, we have a similar situation as before, but now with the standard deviation  $\sigma_{u_i}$  starting at 10 and increasing 4 units each year. With this increasing deviation, note that the expected use of the totality of the DTA is deferred to the seventh year (previously it was the fifth year).

In Figure 7, we have conditions of independent and

identical distributions (IID), meaning that both  $u_i$  and the interest yield follow the same distribution and have the same mean and variance throughout all the years. Comparing to the previous case, we can see that most of the DTA is used in the fourth year, with just a small remainder being used in the fifth year.

The rest of the figures explore different combinations.

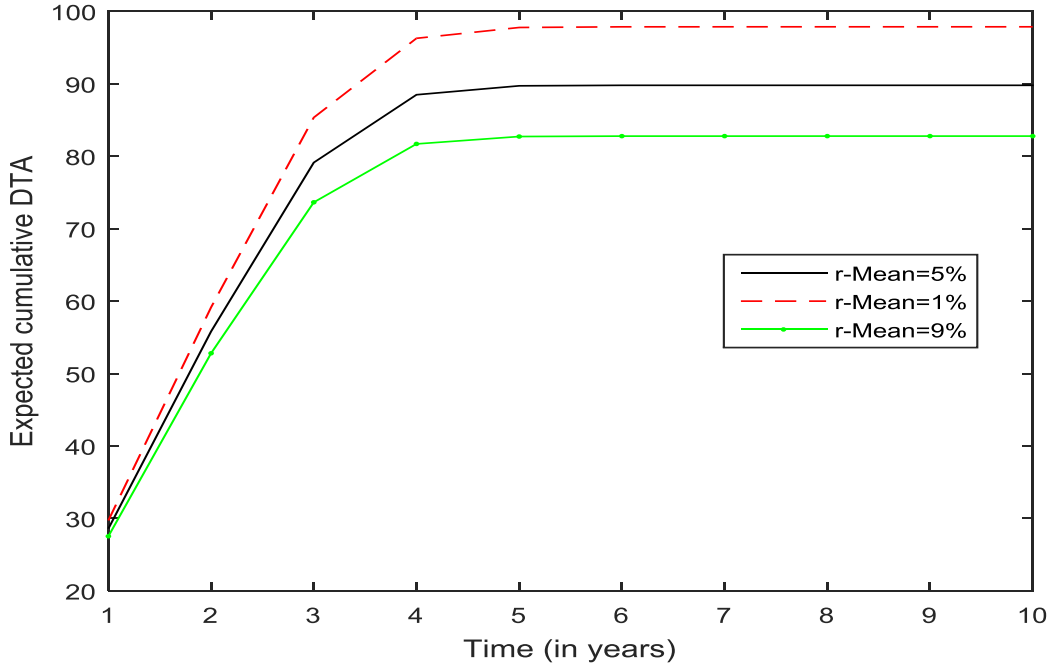


Figure 5. Expected yearly DTA consumption; IID.

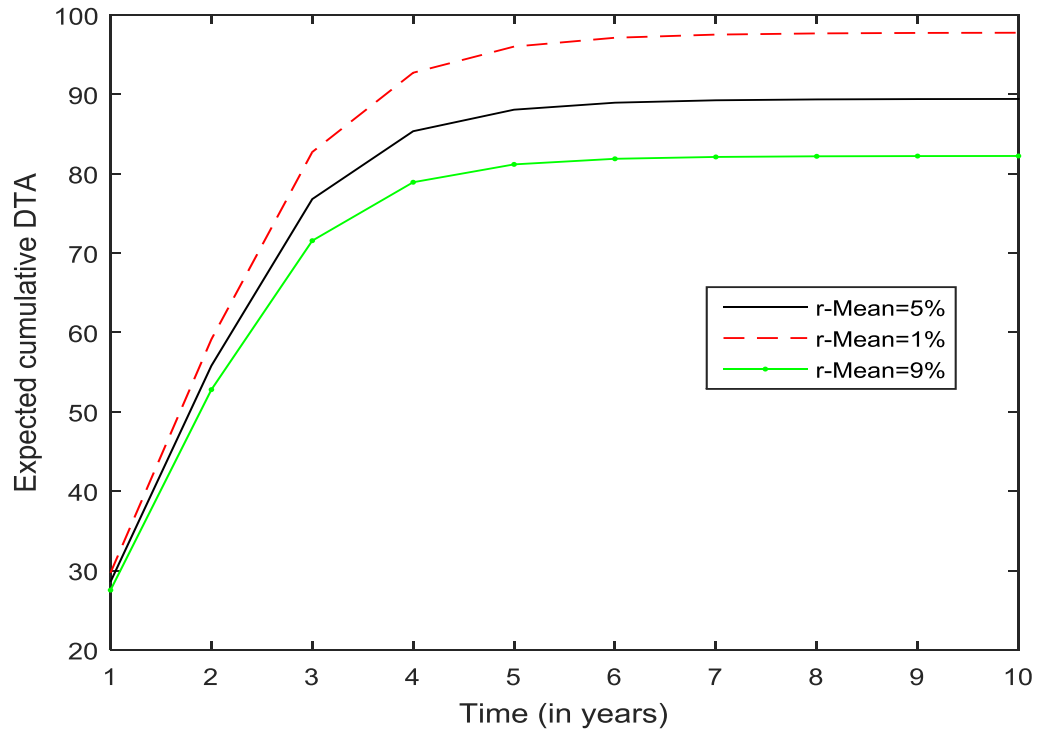


Figure 6. Expected yearly DTA consumption; increasing profit deviation.

In Figure 8 we have identical means for the  $u_i$  and the interest yield, but also have an increasing profit deviation, delaying the DTA's full use to year 7. In Figure 9 we

simulated the mean interest yield varying throughout the years (all other component remaining identical), and saw a little loss of value for the DTA compared to the IID

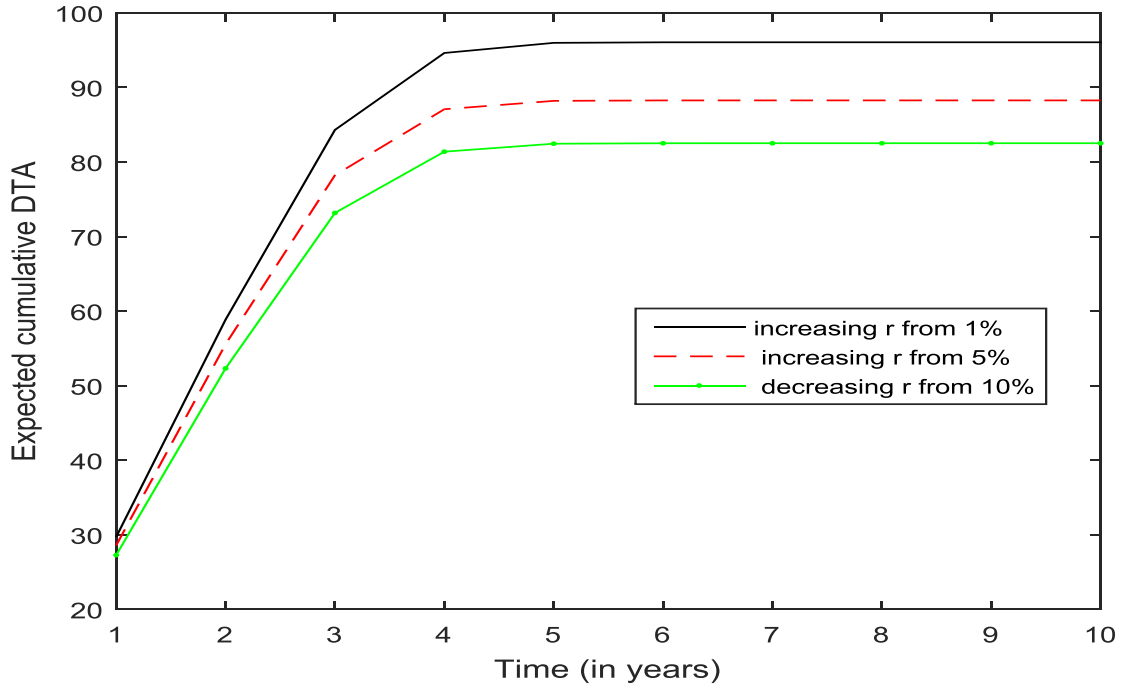


Figure 7. Expected yearly DTA consumption; varying mean yield.

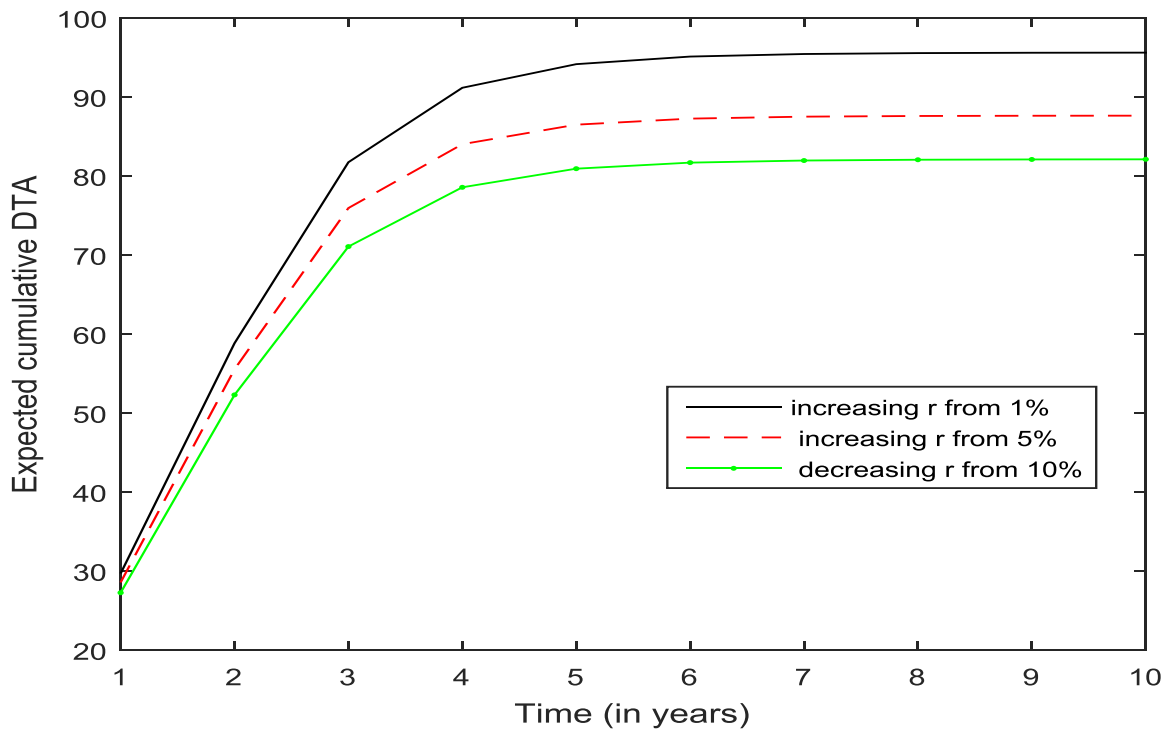


Figure 8. Expected yearly DTA consumption; varying mean yield and increasing profit deviation.

of Figure 7, as expected. In Figure 10, we reproduce the scenario of Figure 9 with increasing profit variance,

noticing a delay in the time the DTA is fully used up. In Figure 11 we reproduced the scenario of Figure 9, but

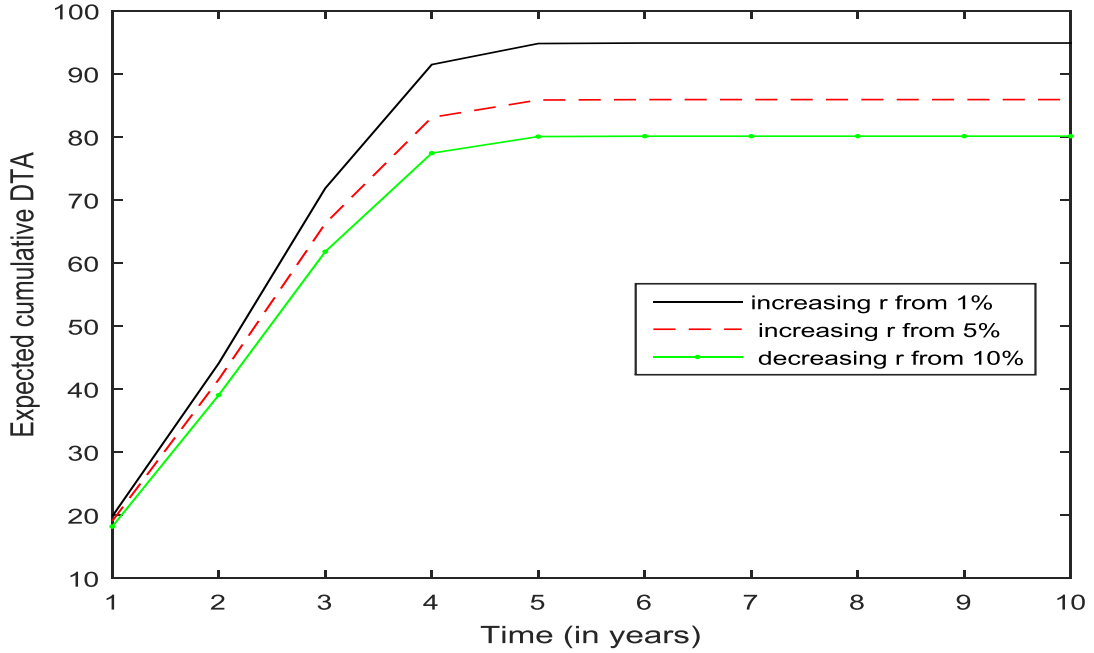


Figure 9. Expected yearly DTA consumption; varying mean yield and increasing profits.

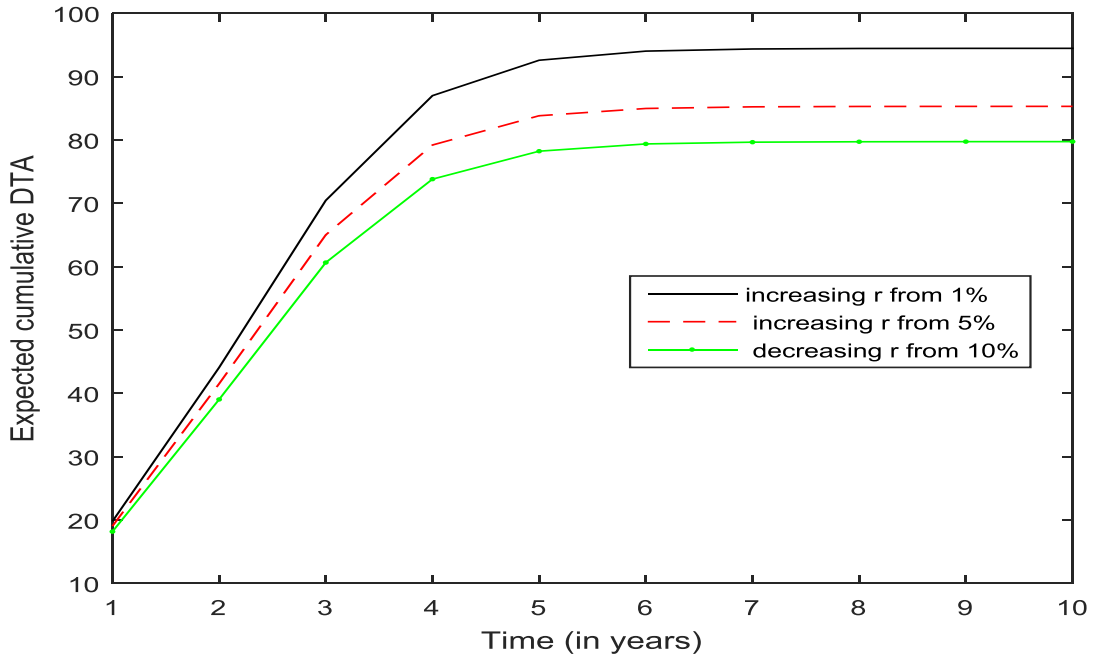


Figure 10. Expected yearly DTA consumption; varying mean yield and increasing mean profit and profit deviation.

now also with increasing mean  $u_i$  each year, allowing the curves to peak a bit earlier. Finally, in Figure 12, we have varying mean yields and profit alongside a varying standard deviation, with some subtle differences from the two previous cases.

### Conclusions

In this work, we valued Deferred Tax Assets (DTAs) according to future projected profits, which is the only correct way that they should be valued. Using this

valuation technique, the DTA's value on the balance sheet would always be smaller than its nominal value used nowadays and reflect its realistic value, providing all stakeholders with the company's real asset worth, henceforth preventing future (unavoidable) disappointments. Via the projection of future profits and yields using a uniform distribution with associated standard deviations, we account for the most likely scenarios and reach precise deterministic values for the DTAs, allowing the company and its shareholders to possess all necessary information to correctly estimate the company's financial stance and allow for a realistic strategy for the future.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## ACKNOWLEDGEMENT

We gratefully acknowledge financial support from FCT-Fundação para a Ciência e Tecnologia (Portugal), national funding through research grant UIDB/04521/2020".

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*Full Length Research Paper*

## **Internal audit as an optimization tool for educational monitoring organizations**

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Received 29 September 2020; Accepted 4 January, 2021

**Organizations that oversee education institutes contribute to the quality of education. Audit as a tool can support the optimization of processes for these organizations. However, literature was scarce regarding audit in educational monitoring organizations. This research attempts to understand the position that audit holds in educational monitoring and how it optimizes their processes. A questionnaire based on audit literature was prepared with the aid of experts to fill in the gaps regarding education. A total of 199 responses were collected from senior executives of educational monitoring organizations. The data were analyzed through SPSS and a factor analysis was initially used. The correlations between the factors were discerned using a regression analysis. The research produced 4 factors that measure the process optimization, ability to support external audits, support given by audit and the reorganization of processes after the audit. The results showed that audit is used supportively and not proactively. The interesting finding is in reorganization caused by the need of optimization before the audit's execution. Audit is thus not only considered a tool for optimizing processes, but as a means of stimulation. Therefore, its healing properties are not fully utilized, despite the perceived importance of audit to organizations and states.**

**Key words:** Internal audit, education, educational institutes, educational monitoring organizations, public sector.

### **INTRODUCTION**

The science of Auditing has proven in recent years its importance in the efficiency of processes and improvements of results, both in the private and public

sector. Through audit, companies and organizations can identify and rectify issues, impossible to determine otherwise due to the speed of their daily processes. At

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the same time, the inclusion of an internal audit department is increasingly applied for faster detection of problematic activities and incidents (Papastathis, 2014).

In educational organizations, quality, resource management and operational improvements are profound factors for losses prevention and reduction; improve efficiency and achieve teaching quality. There is a growing need to apply optimal management practices in both private and public education (Sorros et al., 2017). Regardless of the country, educational institutions are subject of public organizations that promote knowledge, research and innovation. The latter bodies are responsible for proper conduct of training, and provision of support for students, faculty and employees of educational institutions. Through proper management exercised by these educational monitoring organizations, evolution and renewal of educational processes is promoted; as well as the knowledge acquired by new students or pupils. It should be mentioned that monitoring, management and consulting services are provided to both private and public educational institutions, regardless of level (primary, secondary or higher education).

Due to its complexity, as well as importance of the educational system of institutions they supervise, public bodies are in need of occasional reorganizations. This change in activities, procedures and resources must be thorough and made through careful planning (Aikins, 2011; Badara and Saidin, 2012; Enofe et al., 2013). The importance of audit is crucial regarding successful amendments in organizational charts as well as changes in activities (Drogalas et al., 2020).

The changes can have a direct impact on swiftness and efficiency of affairs performed by educational institutions. At the same time, through their modern and improved operation, educational support organizations can focus on goals of renewal and implementation of innovations in the educational process (Sorros et al., 2017).

The consulting significance of internal audit in the management of educational organizations is found in strategies of effectiveness, efficiency, quality and transparency. This paper treats internal audit as an operational management implementation tool in educational organizations. Beyond its contribution to existing studies, it highlights the relationship between internal and external audit with educational supportive institutions. At the same time, a scarcity of in-depth analyses in the literature, regarding internal audit in education and its support services was evident. Educational supporting organizations and as a result educational institutions can achieve added value from their activities (Aikins, 2011; Badara and Saidin, 2012; Enofe et al., 2013).

The main objective of the research is to create a research tool that will identify the causal relationships of a theoretical model, reflecting the factors that influence

management of operations. The model implements quality, effectiveness and efficiency of educational organizations in relation to internal audit. The theoretical model incorporates factors based on information from the relevant literature and from interviews with accounting experts. The model was composed with the aid of a questionnaire that reflects the interactions of internal audit-related tool applied to educational organizations.

## LITERATURE REVIEW

### Internal audit

According to the Institute of Internal Audit, internal audit as an independent, reassuring and consulting activity is designed to add value and improve operations (Badara and Saidin, 2012; Vassiliou et al., 2017). A broader definition defines it "as the Administration Consultant" not limited to the traditional financial audit based on financial statements. Internal audit integrates audit principles to an entity's philosophy and practices. With the absence of obstacles or constraints, internal audit works as a tool to heighten perception (Papastathis, 2014).

The basic principles of internal audit provide a framework that implements and organizes the basis for evaluating the performance of internal audit and promotes improved organizational processes (Papastathis, 2014; Dascalu et al., 2016). Independence and objectivity are key elements of a successful internal audit department. Furthermore, the close collaboration between management and internal audit department leaders must not undermine the objectivity of this relationship. Auditors should be able to execute their projects professionally, while at the same time, audit executives ought to maintain an assurance of quality improvements (Vassiliou et al., 2017).

Additionally, effective internal audit management should aim for proper evaluation and contribute to improved processes adopting systematic and prudent approaches. To that extent, the ability of an internal auditor to understand and improve the design of each project is of grave importance. Translating objectives, scopes, timing and allocation of resources into a set of activities is audit's main long term goal in order to facilitate an organization's performance (Dascalu et al., 2016; Morrish and Sauntson, 2016).

For that reason, the internal auditor processes and evaluates available information. The data that would reach audit departments undergo analysis and are recorded to achieve the various objectives of a project. The proper communication of results to upper management levels is vital for the regularization and integration of these results into everyday business activities (Vassiliou et al., 2017; Drent, 2002).

### **Public organizations and the principles of modern management**

For most educational systems, primary and secondary education is the first two mandatory educational stages. In these two levels of education, the division of duties, domains and responsibilities for employees and staff, present a hierarchical structure. It is a bureaucratic system that aims to ensure uniformity in the implementation of educational policies and processes. Primary and secondary education management frameworks, for both public and private sectors, pursue effective coordination and a certain degree of control by local or state monitoring organizations. Different rules or responsibilities apply depending on country or state; however, the organizational structure and function, administration, supervision and educative guidance of primary and secondary education are determined by the decisions of the state. In Greece, the Ministry of Education have a set of detailed laws and decrees that covers all aspects of the educational process (Katsaros, 2008).

The current goal of management is to implement principles of efficiency, productivity and effectiveness. To these principle's quality and economy are interpreted as a continuous effort to optimize the organization's production and offer of services. Operational management, recognizing complexity of activities, highlights the importance of human relationships. Also, human resources within organizations should be treated as separate social groups (Garza, 2013).

The need for administrative reform is strongly expressed by many scientific institutions and organizations. Today, outdated bureaucratic and inefficient public administration is met with cutting-edge technological developments. Furthermore, the globalization of economy brought increased requirements of students and scholars for better quality in educational services. The fast pace of life and the rapid developments disrupted by unexpected fiscal deficiencies make the need for the appliance of modern public management principles in educational organizations (Borins, 1995; Ferlie et al., 2011).

Modern public management consist of substantial administration reforms of public services. It emphasizes on effective management of human and material resources. Through modern public management, states aim to achieve quality objectives through the design, redesign and implementation of long-term strategies (Ferlie et al., 2011). Modern public management is the evolution of public administration, with a marked differentiation from current situations (Aikins, 2011; Badara and Saidin, 2012; Enofe et al., 2013).

The management of educational organizations, under the new circumstances brought substantial objective related differentiations. It incorporates elements of administrative practices that favor efficiency, flexibility,

and the ability to achieve predetermined goals. Furthermore, it introduces productivity, effectiveness and better conditions of a working environment, into the public sector (Vischer, 2003). However, given the requirement for more cost-effective results, emphasis is placed on the need for more rational management of resources. In addition, risks and shortcomings become more obvious in the event of economic deficiencies such as in 2009 brought by banking crisis or in 2020 due to Corona virus. For these probabilities, the need to apply principles of modern public management is maximized (Karagiorgos et al., 2019).

According to Fanariotis (1999), "Public management as a functioning system of modern public administration and techniques, is wide and covers a great range of activities. The latter are carried out in the field of public administration, while at the same time required to bring significant results from the application of specialized methods. Aikins (2011) examined internal audit and its possible improvements in a country's financial performance. Furthermore, public management has been successfully implemented in many EU Members State administrations. It was found that it carries the potential to achieve objectives such as enhancing efficiency and effectiveness of public services. Public management utilizes specialized practices in line with current administrative frameworks implemented in the private sector. Furthermore, it allows when possible to reconstruct public administration through radical administrative reforms aimed at efficiency and effectiveness. It is interesting that this rationalization of management, focuses on results and performance, rather than plain reconstruction of procedures (Pierre, 2012; Dascalu et al., 2016). The necessity of implementing modern public management is imperative. With administrative reforms adapted to the theoretical foundations and principles of modern operational management, the public sector is in need of a tool capable of designing and controlling the potential changes.

### **Implementation of internal audit in educational organizations**

One of the major challenges of this study was the scarcity of available literature focused on internal audit implementation regarding educational institutes. However, internal audit has made a significant impact in various governmental activities and in the public sector (Enofe et al., 2013). Internal audit proves to be a necessary tool of modern administration in educational organizations. In order for the public sector, to provide high quality specialized services and formulate strategies for educational purposes, audit is necessary. However, the structural barriers of public administration described previously should be successfully addressed.

The inspiration for the administrative transformation of the public sector has been operational management and its success in private companies. Application of business administration principles to public sector has upgraded the level of services provided (Morrish and Sauntson, 2016). It evolved the traditional bureaucratic educational system. For example, in an Italian university, a survey by Arena (2013) argues that internal audit in higher education institutes aided in discerning certain patterns and characteristics. Prior to the latter's research, Arena and Azzone (2007) argued that there is a limited diffusion of internal audit as well as a trend for development similar to that of the private sector. In private sector, internal audit focuses on financial auditing and compliance. It gradually broadens to operational auditing, risk management and corporate governance (Fernández-Laviada, 2007; Arena et al., 2006; Spira and Page, 2003). In educational institutes, modern management should take into consideration these patterns in order to predict successfully differences in results from private sector companies (Sorros et al., 2017). Similar conclusions can be drawn from Fischer and Montondon (2005), in their research for qualifications and diversities found in the workplace. They examined cases of Higher Education institutes and found the importance of the internal audit departments as regards promoting academic goals. Farahsa and Tabrizi (2015) argue how audit can be implemented and aid educational organizations in terms of evaluating frameworks and procedures. According to Papastathis (2014), in order for internal audit to successfully fulfill its role, an organization must first reach an adequate level of managing its operations. It is understandable that for internal audit to be used as a strategy of control, it must be accepted and supported from management and staff. Thus, an approved operating regulation can be drawn and implemented.

It goes without saying that in the case of education related institutions and organizations, internal audit should be in line with the lifelong learning philosophy, training and development of its employees. As in traditional auditing, a better understanding of the organization's processes, activities and culture is good management practice. After the common understanding between audit and education has been met, the necessary resources should be secured (e.g. human resources, equipment, and infrastructure) (Morrish and Sauntson, 2016). Finally, in audit, its value is not found in controlling running costs and activities, but in the additional value given to an organization (Papastathis, 2014).

### **Disadvantages, weaknesses and malfunctions in the management of educational organizations**

In introducing audit in educational institutes and education related organizations, certain issues can arise

that could lead to inefficiency. Education could be managed by centralized decision-making, or present a large number of different administrative bodies and services (Papastathis, 2014; Sorros et al., 2017). The possibility of inefficient administrative functions, poor quality of services offered to citizens and students could present a challenging situation for audit. It is expected that when applied in education, two of audit's goals related to i) the organizations necessity for contributions to society and ii) managing resources to be of critical importance are difficult to ignore. Furthermore, internal audit does not always achieve the desired results in the absence or inefficiency of an existing strategic plan. If the audit is self-centered or does not seek substantive examination, the auditors' relationship with the organization under audit may hinder the expected results. It goes without saying that the unreliability of audits due to the poor quality of services and lack of support from the administration would lead to a pointless disruption of activities.

Despite its disadvantages, weaknesses or possible malfunctions, audit as part of administrative reforms in educational institutions have been satisfactory. However, as in private sector audits, an educational audit should be carefully performed, especially in events of external fiscal deficiencies and sociological pressure (Papastathis, 2014).

## **RESEARCH METHODS**

The study adopted a mixed method approach of qualitative and quantitative techniques. By combining quantitative and qualitative models, the research aims at a comprehensive understanding of the research problem, since the findings are based on more than one research approaches (Creswell, 2009). The aim was to develop and validate a multi-item scale to measure the proposed theoretical framework and investigate the causal relationships between empirically tested theoretical constructs (Churchill, 1979; Hinkin, 1995; DeVellis, 2003).

The first stage of scale construction includes the item generation process and the scale purification. In the second and main stage, stratified random sampling was used in selecting respondents and to distribute web-based questionnaires. In scale validation, initially exploratory and then confirmatory analysis was employed to identify the factor structure of the measurement items (construct validity). The last stage proposes a conceptual model which depicts the theoretical causal relationships among variables and the derived hypothesis. Statistical procedures and analysis were conducted with the use of SPSS.

### **Deductive item generation for the questionnaire**

In this study, the items generation is driven by the deductive approach to analyze and organize information and data. Template thematic analysis was used to systematically identify, organize, and offer an insight into patterns across a data set. Template analysis balances a relatively high degree of structure in the process of analyzing textual data with the flexibility to adapt it to needs of a particular study (Braun and Clark, 2012). It is widely used for interview transcripts (King, 2012).

For generating the items, the first step was to create a pool of

**Table 1.** Theoretical framework of questionnaire based on literature review.

Theoretical fields	Literature review	Key words
1 Procedures and- Functions	Badara and Saidin (2012), Papastathis (2014), Vassiliou et al. (2017), Drent (2002), Dascalu et al. (2016), and Morrish and Sauntson (2016).	Level of perception; Value added audit services; Evaluating performance; Promote improved organizational processes and functions; Independence and objectivity; Ability of auditors to execute projects; Develop and maintain assurance and quality; Identify, analyze, evaluate and record sufficient information; Timing and allocation of resources.
2 Public Organizations' current Audit Capability implementation	Fernández-Laviada (2007), Arena et al. (2006), Spira and Page (2003), Fanariotis (1999), Pierre (2012), Vischer (2003), Aikins (2011), Badara and Saidin (2012), Enofe et al. (2013), Dascalu et al. (2016), and Morrish and Sauntson (2016).	Familiarization time; Delays due to audit; Facilitating audit; Audit inconveniences; Staff allocation; Personnel training; audit efficiency; Management centralization; Decision-making inefficiency; Resources; Lack of support from the central administration.
3 Usefulness of Internal Audit	Badara and Saidin (2012), Papastathis (2014), Garza (2013), Borins (1995), Ferlie et al. (2011), Aikins (2011), Enofe et al. (2013), Fanariotis (1999), and Arena and Azzone (2007).	Reassuring consulting; Added value; Operational Improvements; Sophisticated operational management; Need for administrative reform; Modern public management principles in educational organizations; Rapid developments; Fiscal crisis; Technological development; Globalization; Citizens' demand of quality.
4 Educational Institutes opportunities from audit Improvements	Enofe et al. (2013), Arena (2013), Arena and Azzone (2007), Fernández-Laviada (2007), Arena et al. (2006), Spira and Page (2003), Papastathis (2014), and Farahsa and Tabrizi (2015).	Improved Resources Allocation; Human resources; Training; Management facilitation; Efficiency, productivity, effectiveness; provide high quality specialized services, added value, Society Contributions; Philosophy of learning; Training and development; Qualifications; Research, Teaching and Academic goals.

items that would characterize the theoretical constructs. Items can be drawn either inductively (eg. interviews, focus groups) due to lack of available theories or deductively based on literature review and on existing instruments (Hinkin, 1995).

The absence of pre-existing validated instruments about the audit in educational institutes directed the researchers toward available theoretical frameworks related to audit, public organizations and educational efficiency. At this point, a sample of 40 items was created reflecting four theoretical constructs derived from literature. The second step involved the effort to refine the theoretical constructs through semi-structured interviews from 9 experts in the field (Heads of accounting departments; Accounting or audit scholars, Auditors). The process of interviewing was based on Minichiello et al. (1995) combining the "funnel" and "story telling" methods. The interviews were guided by a list of 10 prepared questions that adhered to the themes of the identified theoretical constructs. In order to analyze information from the interviews, a template of themes and codes (conceptual labels) was prepared. The data collected from interviews combined with the information gathered from literature, was used in constructing a list of 35 measurement items which is assumed to represent a sound proxy of the four theoretical constructs depicted in Table 1.

To establish item validity, the developed questionnaire was subject to expert assessments. Five experts from high education institutes and audit organizations assessed the relevance of the items to the theoretical constructs and provided suggestions on comprehension, clarity and simplicity. Their remarks contributed to the purification of the items and resulted in a set of 32 items measured on a five-point scale (1= "strongly disagree"; 5= "strongly agree").

### **Sampling and questionnaire composition**

The target population was administrators, educators and executives who hold positions of responsibility in public educational monitoring services (N= 2.381). The survey's sample frame was made up of the 500 educational personnel. A proportionate stratified random sample procedure was used according to the type of employee. An invitation e-mail was sent to the 500 educational organizations with a direct link to the web-based questionnaire. A consent form and information was included stating the reasons and goals of this research. After two e-mail reminders to non-responders, a total of 199 completed questionnaires was returned (39.8% response rate) which was deemed adequate. Educational systems may differ regarding countries. However, educational and audit standards demonstrate great similarities regarding their control procedures. The questionnaire was divided into 5 sections. Four sections depicted the theoretical model and the 32 items while the last section contains six demographic questions. The analysis of the findings was based on the "inferential logic for discovering and confirming a set of probabilistic causal laws, for predicting general patterns of human activity" (Neuman, 2003).

## **RESULTS**

### **Scale validation**

Investigative factor analysis (IFA) was used to determine the latent structure of the data set. Pearson product-

**Table 2.** Classified variables after factor analysis.

Questionnaire details (variables)	1	2	3	4
<b>“Optimal Process Utilization” (OPU)</b>				
To what extent do you think management is allocating staff properly per procedure? (OPU1)	0.860			
Is the degree of distribution of the Organization's staff per procedure good? (OPU2)	0.855			
Is the Organization's management aware of the functions and procedures of each part of it? (OPU3)	0.837			
To what extent do you think management is allocating activities properly per department? (OPU4)	0.830			
Is the degree of distribution of the tasks and responsibilities in your Organization per department good? (OPU5)	0.828			
Does Management provide full information on how to perform procedures? (OPU6)	0.773			
Does the Personnel Department know the steps to follow for each procedure? (OPU7)	0.730			
Is the staff rationally distributed among the departments? (OPU8)	0.700			
To what extent do you think resources are properly distributed to the departments? (OPU9)	0.643			
Has the right time been given to familiarize oneself with the organization chart? (OPU10)	0.508			
Does the respective department provide the employee with full information on how to perform the procedures? (OPU11)	0.507			
<b>“Operational Audit Assistance” (AOA)</b>				
Better distribution of material resources in the departments. (AOA 1)		0.821		
Reduction of errors in daily processes. (AOA 2)		0.747		
Better distribution of staff in the departments (AOA 3)		0.709		
Creating better evaluation criteria of staff. (AOA 4)		0.508		
<b>“External Audit Supportability” (EAS)</b>				
Doesn't external audit delay you from your daily tasks? (EAS1)			0.658	
Do the existing information systems have taken the necessary safety precautions to ensure their proper, smooth and seamless operation? (EAS2)			0.648	
Is the collection of data, that the external audit needs, done easily? (EAS3)			0.593	
Do the existing information systems work efficiently and effectively in terms of achieving their goals, in the respective departments of your workplace? (EAS4)			0.585	
Is the department well-staffed by individuals? (EAS5)			0.512	
Are the procedures performed without errors (without the need for corrections)? (EAS6)			0.417	
<b>“Audit Originated Redesign”(AOR)</b>				
Re-designing of existing services. (AOR1)				0.797
Development of new services and processes. (AOR2)				0.787
Achieving better audit of Processes (AOR3)				0.706
Reduction of lead time to citizen's requests (AOR4)				0.470
<b>Total of Eigen Values: 64,316</b>				

moment correlation coefficients were estimated to detect uncorrelated items. Twenty five items exhibited correlations above 0.40 and were deemed acceptable for further analysis. Seven (7) items of the questionnaire were excluded from the factors as they did not show factor loadings with values above 0.4.

The principal factor analysis with varimax rotation suggested 4 factors (with eigen values >1) which explained 64.31% of the total variance. The chosen items (variables) retained in the factors since their loadings were found to be greater or equal to 0.4 (Hair et al., 1998). An inspection of the scree plot also maintained a four-factor structure. Table 2 contains the items of the four factors, their loadings and the associated statistics of factor analysis.

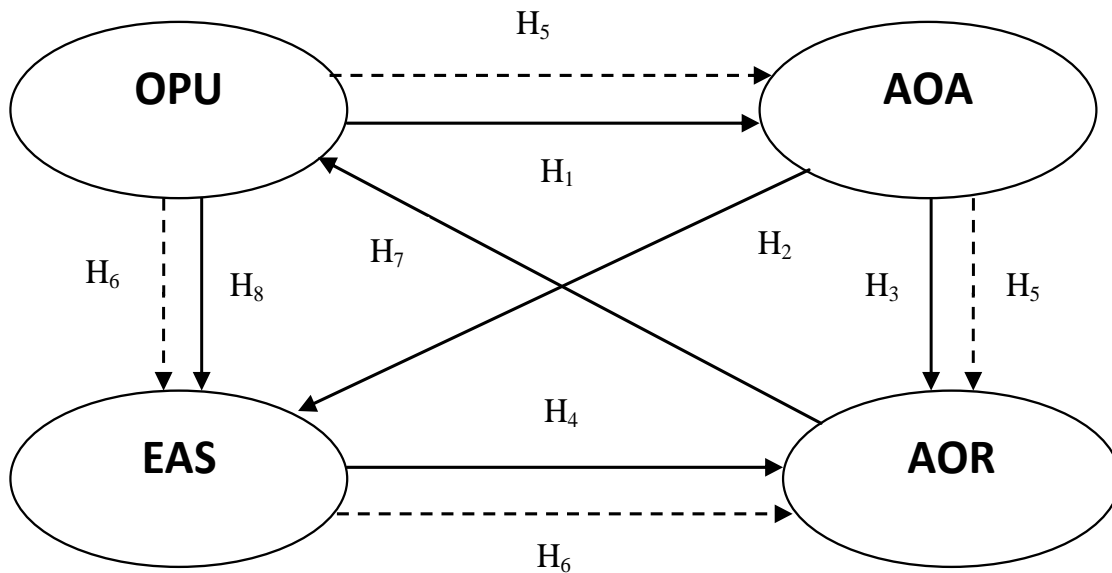
After identification of the factors, the items that they are composed of aided the labeling process. Eleven items

formed the first factor related to the “Optimal Process Utilization” (OPU) that explains the organizations' ability to distribute its resources or facilitate its procedure. Generally, the factor measures the current managerial and operational capability of an organization. It demonstrated the successful allocation of different resources in the various departments and activities. It is the ability of organization to use efficiently and perform its basic and everyday operations.

The second factor was named “Audit's Operational Assistance” (AOA) in order to measure the part audit plays in the organization. This four-item factor explains how audit can help improve management reduction of errors in its everyday activities, allocate resources efficiently and properly evaluate employees. The third factor was formed by six items. It was named “External Audit Supportability” (EAS) and explains external audit's

**Table 3.** Reliability analysis conducted on the items of each factor to evaluate the adequacy of the model.

Factor	No. of variables	Cronbach's alpha
"Optimal Process Utilization" (OPU)	11	0.931
"Audit's Operational Assistance" (AOA)	4	0.815
"External Audit Supportability" (EAS)	6	0.724
"Audit Originated Redesign" (AOR)	4	0.763
All variables	25	3.233



**Figure 1.** Hypothesized causal relationships between latent constructs. (a) Factors: "Optimal Process Utilization" (OPU), "Audit's Operational Assistance" (AOA), "External Audit Supportability" (EAS), "Audit Originated Redesign" (AOR). (b) Solid lines denote direct correlation; intermittent lines denote indirect correlation. (c) Hypotheses-paths: H1: OPU→AOA; H2: AOA→EAS; H3: AOA→AOR; H4: EAS→AOR; H5: OPU→AOA→AOR; H6: OPU→EAS→AOR; H7: AOR→OPU; H8: OPU→EAS.

ability to locate problematic areas and issues within the organization without hindrances to the everyday activities and performance. The last factor, "Audit Originated Redesign" (AOR) was formed by four items, measuring necessary and possible implementations. These changes may refer to existing activities or the redesign of services. It explains the effort the organization puts to improve quality of work and the services offered.

All individual items loaded onto their identified latent variables had significant ( $p < 0.01$ ) regression weights. Moreover, the estimated values of the employed goodness-of-fit indices indicated that the data provided a good fit to the model. To further evaluate the adequacy of the model, a reliability analysis was conducted on the items of each factor. Cronbach's alpha coefficients for the four factors were found to be above the recommended standard value of 0.70 (Hair et al., 1998) as seen in Table 3.

Following literature and interviews, a theoretical model is specified. Figure 1 depicts the proposed model, which

describes the relationships among the theoretical concepts derived from the questionnaire. The model posits that the external and internal audit will impact optimization. It is expected that three independent variables may interact with each other. Consequently, it is left to the regression analysis to investigate and capture pathways among the three variables.

**Conceptual model and research hypothesis**

Based on the results of the conceptual reasoning, the interviews and literature review of a conceptual model was created that proposed hypothesized relationships, through its latent variables. The model was conceptualized so that the External Audit Supportability, Audit Operational Assistance and External Audit Supportability would work as predictors of the Optimal Process Utilization. Figure 1 demonstrates the conceptual

model with the associated hypothesized causal relationships.

The first hypothesized relationship ( $H_1$ ) was that "Optimal Process Utilization" (OPU) would directly affect "Audit's Operational Assistance" (AOA). The hypothesis was based on the facilitation of internal audits offered by an optimized or properly organized set of activities within an organization.

Thereafter, the model hypothesizes ( $H_2$ ) that AOA should also demonstrate a direct relationship and affect "External Audit Supportability" (EAS), since the ability of an internal audit's department can significantly facilitate procedures and investigations performed by external auditors.

The third hypothesis ( $H_3$ ) states that AOA should also have a similar and direct relationship with "Audit Originated Redesign" (AOR). Similarly, it is expected for EAS to also affect directly AOR ( $H_4$ ). However, by using EAS and AOA as mediators, OPU could also indirectly affect AOR through these two paths ( $H_5$  and  $H_6$ ). The latter two hypotheses are based on literature's solid expectations that an audit department (either external or internal) consults an organization regarding its decision making. Furthermore, audit offers possible redesigns of procedures in order to increase effectiveness and discern added value activities.

The fifth Hypothesis ( $H_7$ ) involved the expected relationship between AOR and OPU, since suggested redesigns and improvements offered by auditors should aim into the organization's optimization of processes and activities.

The last Hypothesis ( $H_8$ ) was a possible relationship between OPU affecting EAS in order to cover the possibility of an organization lacking an autonomous internal auditing department. This relationship explains the possible results of an interaction between an organization and an external auditor as the sole audit mechanism. Figure 1 depicts the proposed conceptual model with the associated hypothesized causal relationships among variables. The five hypotheses deriving from the conceptual model are listed semantically below:

$H_1$ : "Optimal Process Utilization" (OPU) directly affects "Audit's Operational Assistance" (AOA);  $H_1$ : OPU→AOA.

$H_2$ : "Audit's Operational Assistance" (AOA) directly affects "External Audit Supportability" (EAS);  $H_2$ : AOA→EAS.

$H_3$ : "Audit's Operational Assistance" (AOA) directly affects "Audit Originated Redesign" (AOR);  $H_3$ : AOA→AOR.

$H_4$ : "External Audit Supportability" (EAS) directly affects "Audit Originated Redesign" (AOR);  $H_4$ : EAS→AOR.

$H_5$ : "Optimal Process Utilization" (OPU) indirectly affects "Audit Originated Redesign" (AOR) through "Audit's Operational Assistance" (AOA);  $H_5$ : OPU→AOA→AOR.

$H_6$ : "Optimal Process Utilization" (OPU) indirectly affects "Audit Originated Redesign" (AOR) through "External

Audit Supportability" (EAS);  $H_6$ : OPU→EAS→AOR.

$H_7$ : "Audit Originated Redesign" (AOR) directly affects "Optimal Process Utilization" (OPU);  $H_7$ : AOR→OPU.

$H_8$ : "Optimal Process Utilization" (OPU) directly affects "External Audit Supportability" (EAS);  $H_8$ : OPU→EAS.

### Validation of the conceptual model

Having obtained a factors' solution for the observed data, a regression analysis was employed to ensure the relationship between the dependent variable (OPU) and the three independent variables (AOA, EAS, AOR). In this case, the multiple regression function takes the following form:

$$Y_i = \alpha + \beta_1 * X_1 + \beta_2 * X_2 + \dots + \beta_v * X_i$$

The correlation coefficient  $R^2$  shows the percentage of variance of the dependent variable explained by the independent variables. The model explains 39.6% of the total variability.

The value of adjusted  $R^2$  shows that the model can be generalized to the population. It is concluded that 38.6% of the variance of the OPU variable is explained by the independent variables. The value of Durbin-Watson is close to 2, so the errors are independent.

According to Table 4, the Analysis of Variance (ANOVA) gave an F-test with a value of 42.34, so the model is statistically highly significant, at the level of statistical significance  $\alpha = 0.001$ . Based on the table of factors, the regression equation of the model is:

$$OPU = 18.293 - 0.552 * AOA + 1.302 * EAS + 0.150 * AOR$$

The regression explains that when the AOA value increases by one unit, the OPU value will decrease by 0.552, whereas when the EAS and AOR values increase by one unit, the OPU value will increase by 1.302 and 0.150 respectively. The value of  $t$  indicates that EAS is the most important factor in the model, while the other two factors (AOA and AOR) are less important. It also appears that the tolerance values do not approach the value 0 and therefore there is no problem of multicollinearity in the model. This fact is also confirmed by the value of VIF, which in all cases is less than 10. Finally, from the normal probability plot, it appears that the distribution of residues is normal since the points are concentrated around the 45° line. Overall, the fit of the model to the data can be considered satisfactory.

The results show that the proposed direct relationship between OPU and AOA is negative and significant, thus supporting hypothesis  $H_1$ . On the other hand, OPU has a significant positive effect on EAS ( $H_8$ ). The path coefficients showing the influence of EAS to AOR and AOR to OPU were not significant ( $p > 0.05$ ) and therefore deleted from the model; as a result, hypotheses  $H_4$  and



**Table 4.** Model analysis of variance (ANOVA) and coefficients analysis of demonstrating pathways of influences between independent, mediating and dependent variables.

Model summary <sup>b</sup>								
R	R Square	Adjusted R square			Std. error of the estimate	Durbin-Watson		
0.629 <sup>a</sup>	0.396	0.386			7.196	2.035		
ANOVA <sup>a</sup>								
Model		Sum of squares	df	Mean square	F	Sig.		
1	Regression	6576.710	3	2192.237	42.340	0.000 <sup>b</sup>		
	Residual	10044.830	194	51.777				
	Total	16621.540	197					
Coefficients <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	OPU (Constant)	18.293	4.076		4.488	0.000		
	AOA	-0.552	0.205	-0.183	-2.695	0.008	0.679	1.474
	EAS	1.302	0.124	0.590	10.493	0.000	0.986	1.014
	AOR	0.150	0.211	0.048	0.709	0.479	0.686	1.458

<sup>a</sup>: Dependent Variable: OPU; <sup>b</sup>: Predictors: (Constant), AOR, EAS, AOA.

H7 are not supported. Furthermore, an indirect effect of OPU to AOR through AOA and EAS was not supported by results, thus H5 and H6 were not validated by the model. AOA has a significant positive impact on AOR (H3), and a significant but opposing effect on EAS (H2).

Furthermore, the supported hypotheses and the relationships between the factors deriving from the validated model are shown in Figure 2 and listed semantically below:

H<sub>1</sub>: “Optimal Process Utilization” (OPU) has a direct negative effect on “Audit’s Operational Assistance” (AOA); (EAS); H<sub>1</sub>: OPU→AOA.

H<sub>2</sub>: “Audit’s Operational Assistance” (AOA) has a direct opposing effect on “External Audit Supportability” (EAS); H<sub>2</sub>: AOA→EAS.

H<sub>3</sub>: “Audit’s Operational Assistance” (AOA) directly affects “Audit Originated Redesign” (AOR); H<sub>3</sub>: AOA→AOR.

H<sub>8</sub>: “Optimal Process Utilization” (OPU) directly and positively affects “External Audit Supportability” (EAS); H<sub>8</sub>: OPU→EAS.

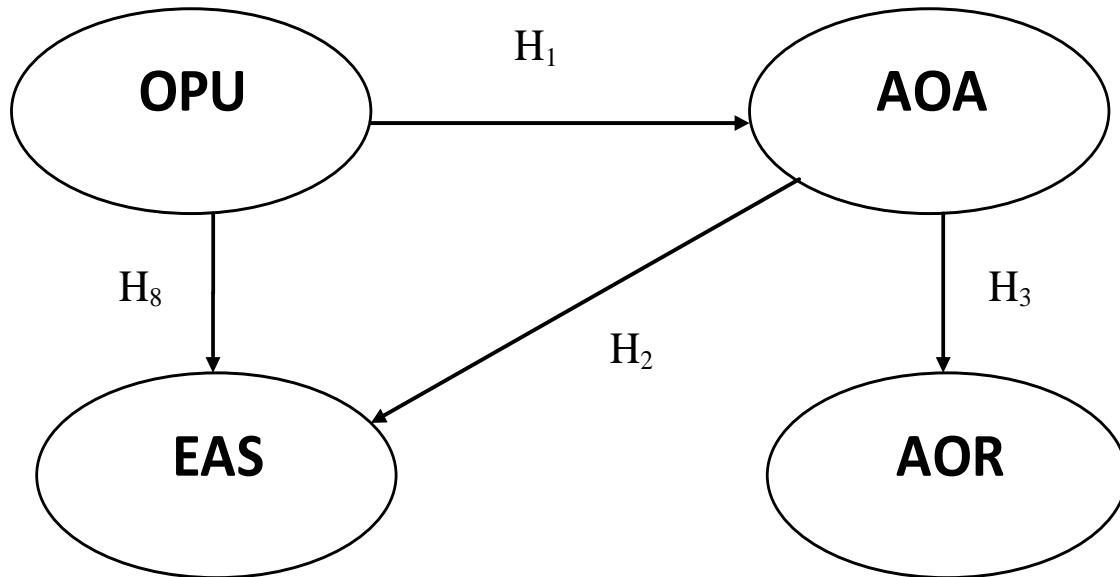
## DISCUSSION

Some correlations between factors normally interpreted by literature were not found significant. The hypotheses related to these paths cannot be supported. Education is a field of interesting exemptions regarding the appliance of traditional management principles. Administrations for

both educational institutions and monitoring organizations require quality and careful planning of procedures (Morrish and Sauntson, 2016). It is understood that auditing should likewise be applied to educational subjects with caution. Primarily, the results and procedures of an audit should be provided with the aim of promoting educational purposes (Dascalu et al., 2016; Morrish and Sauntson, 2016). On the one hand, institutions manage a valuable intangible asset and ensure the quality of education’s transmission to students. On the other hand, indiscriminate audits and hasty changes in procedures can disrupt the quality of education offered (Papastathis, 2014). Unlike industrial sectors or other markets, results of miscalculated strategies in education are difficult to trace and evaluate, before a reasonable period of time.

The present research uses education in the light of educational organizations’ supervisory bodies. It is therefore understood that the public sector and the peculiarities that distinguish it must be taken into account in the implementation of audit as an optimization tool. For this type of organizations, competitiveness and profitability are not immediate goals (Sorros et al., 2017). Thus, the same swiftness and procedures used in the private sector should not be used as measures of comparison.

The importance of this research is decided in its research hypotheses. The absence of estimated correlations of factors from four hypotheses can be traced as part of the specificity of the public sector. At the same time, education’s specific features can differentiate



**Figure 2.** The validated model with the associated paths among variables. (a) Factors: "Optimal Process Utilization" (OPU), "Audit's Operational Assistance" (AOA), "External Audit Supportability" (EAS), "Audit Originated Redesign" (AOR). (b) Solid lines denote direct correlation; intermittent lines denote indirect correlation. (c) Paths: H1: OPU→AOA; H2: AOA→EAS; H3: AOA→AOR; H8: OPU→EAS.

normalcy, when applying audit mechanisms.

Initially, the fourth hypothesis ( $H_4$ ) concerned the processes and activities of an organization. It was expected that they should comply with external audits that eventually would lead to redesigns. On the contrary, redesign seems to be directly affected only by those procedures performed by the organization to support the subsequent audit. In fact, there is difficulty in distinguishing between external and internal audit in the answers of the respondents. The latter is explained as external audits of educational and monitoring organizations are executed by the public body to which they are subject. The state from time to time appears not as an external auditor but as a higher administrative stage of the same organization. At the same time, the audit does not seem to be cathartic or bring about significant redesigns.

The latter can be confirmed by the first hypothesis ( $H_1$ ), where "Optimal Process Utilization" (OPU) directly affects "Audit's Operational Assistance" (AOA), which proved to be true. Nevertheless, the effect was negative. So in public education support organizations, audit related procedures are abandoned when an organization's activities are optimal. Therefore, there is a high possibility audit is used as a provisional practice. At the same time, audit seems to propose redesigns only when the organization can support an audit.

The third hypothesis ( $H_3$ ) is where "Audit's Operational Assistance" (AOA) directly affects "Audit Originated Redesign" (AOR). Given that the education monitoring organizations belong to the public sector, it is the state that has to decide on reorganization. Practically, the

usefulness of audit can be found where the state allows it and when the quality of procedures has been significantly reduced. At the same time, the second hypothesis ( $H_2$ ) states that "Audit's Operational Assistance" (AOA) has a direct and opposing effect on "External Audit Supportability" (EAS). This confirms the above conclusions. External audit performed to educational and educational-monitoring institutions remains as a part of the general public sector's performance

Nevertheless, external audit seems to be positively affected by the optimization of operations and procedures. This is implied in  $H_8$  where, "Optimal Process Utilization" (OPU) directly and positively affects "External Audit Supportability" (EAS). So the increase in functionality of an organization increases its ability to support an external audit. This assumption is logical and expected. Nevertheless, questions arise as to the timing and criteria on the basis of which the external audit is decided. At the same time, more questions are raised as to whether the external audit works as a correction or mainly as a confirmatory tool for the already sufficient functionality of organizations. These questions intensify since the expected correlation of the proposed redesign of processes from audit and its assistance in process optimization has not been confirmed.

## Conclusions

From this research it is understood that audit in education is deemed important by both state and educational

institutions. Through the audit procedures, educational organizations strive to optimize their services. Nevertheless, data supports that audit be used partially, since it has little influence on the reorganization and optimization of operations. The first interesting finding of this research is that educational monitoring organizations consider the state as an external auditor. The factor measuring external auditing was found to be great. The second interesting finding concerns achieved process optimization and its effect on external audit. It is understood that public organizations that monitor education systems do not use audit proactively. Rather audits are performed after certain procedures have already been redesigned to a sufficient level. Namely, the reorganization of the departments and activities seems to originate from the support work the organizations have to do before and for the audit. It is possible that organizations and employees want to show good results in auditing. However, it seems that audit itself does not affect the procedures. It is an important tool for optimizing processes as a means of stimulation. This increases the likelihood that the healing properties of audit will not be fully utilized. This is despite the importance of audit given by both employees and organizations, as well as by the respective state.

### Implications

This paper shows a very interesting aspect of the public sector and its differences in approach to audit. The existence of pre-audit preparations to aid the procedure is normal and expected. However, it was not expected that the reorganization would occur to such an extent from pre-audit support processes performed by the organization. This raises important questions about the philosophy of audit in the public sector as well as the educational organizations it oversees.

### Limitations

Existing literature was scarce as far as audit in educational institutions and educational monitoring organizations are concerned. For this reason, the opinion of audit experts from both the public and private sectors was vital. The questionnaire as a tool is expected to contain some elements of subjectivity. While finally, on researching an area with many peculiarities and a wide range of responsibilities, such as education, it is expected to yield results that need further analysis.

### Future research

At a later time, from the questions raised in the conclusions about the time chosen and decisions of initiating an audit, new research is likely to emerge. In

case external private sector auditors were used, which would be the factors and issues raised, it is evident that such decisions should be made with assurance that private external auditors have taken into account the objectives of an educational institution. Finally, the audit-public sector's relationship found in education could be transferred to other similar organizations or different levels of public administration.

### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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*Full Length Research Paper*

# Greek tax reality and the VAT gap: Influential factors

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Received 24 November, 2020; Accepted 26 January 2021

The value added tax gap (VAT gap) is a notable indicator of tax evasion, tax avoidance and overall inefficiency within the tax system. As the VAT gap in Greece is one of the largest in the European Union (EU), an attempt to quantify and analyze it was made. In order to achieve that, social, economic, fiscal and tax factors were examined based on international literature, since there is very little relevant research in Greece. Particular emphasis was given to factors that revolve around tax administration, such as tax audits. Specifically, twelve factors were examined for a period of 21 years (between 1997 and 2018) using econometric models based on time series data. In addition, the VAT Gap was separated into two components; a gap arising from tax non-compliance ('compliance gap') and a gap arising from political decisions ('policy gap'), for the purpose of properly analyzing the effects of the influential factors on the Greek VAT gap. The VAT revenue ratio (VRR) was used as the dependent variable in order to measure the Greek VAT Gap. The analysis revealed that five out of the total twelve explanatory variables examined greatly influence the Greek VAT Gap. Specifically, two of them, that is, the ratio of VAT to total taxes and the number of tax audits, have a negative correlation with the Greek VAT gap. The other three variables, namely the final government consumption expenditure, the difference between the standard and reduced VAT rates and the gross value added/gross domestic product ratio have a positive correlation with the Greek VAT gap. These findings can be potentially utilized by the authorities to limit VAT non-compliance and battle evasion.

**Key words:** Value added tax (VAT), VAT gap, VAT revenue ratio (VRR), tax administration, tax audits.

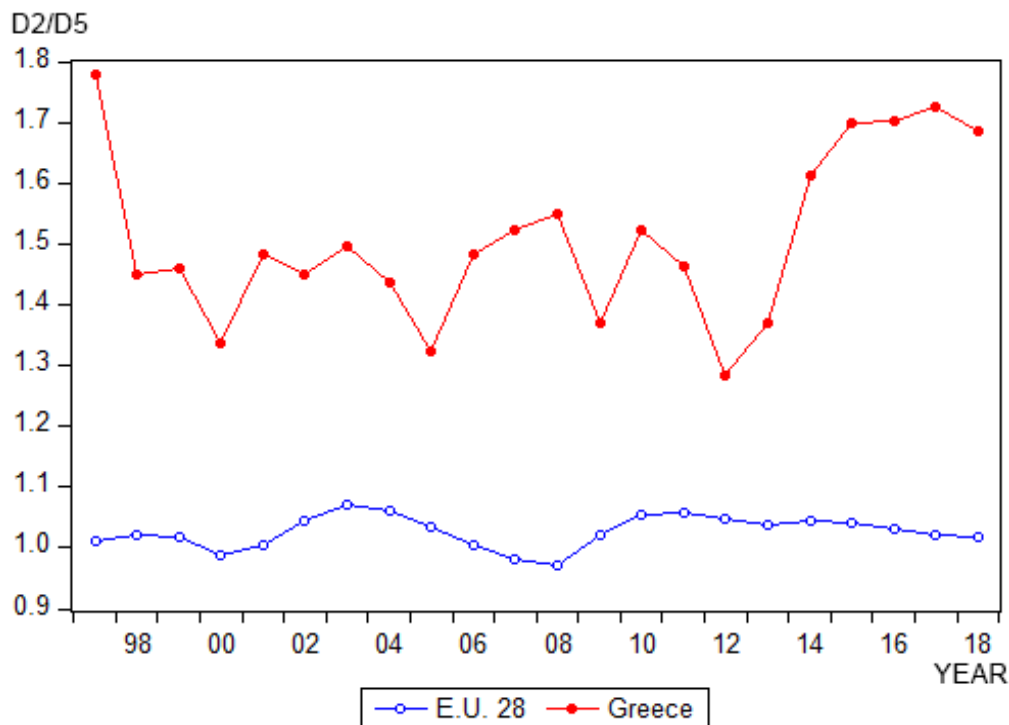
## INTRODUCTION

The Value Added Tax (VAT) was first introduced in Greece back in 1986 (Law 1642/1986) and since then has become the main indirect consumption tax applied in the Greek tax system. It was later codified by Law 2859/2000 (VAT Code) in order to incorporate all available rules and regulations up to that point. Today, there are four main types of VAT rates in Greece: the standard VAT rate at 24%, the reduced VAT rate at 13%,

the ultra-reduced VAT rate at 6% and the null VAT rate at 0%. The VAT is also a Community Tax that all European Union (EU) member countries are obliged to apply due to the implementation of EU Directive 2006/112/EC and the Council Implementing Regulation No. 282/15.03.2011.

For Greece in particular, indirect taxes represent the largest part of government revenues. On an annual basis, of the total tax revenues from indirect taxes, a percentage

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**Figure 1.** Ratio of indirect to direct taxes for Greece and EU countries' average, 1997-2018. Source: Author's own work, raw data taken from Eurostat database.

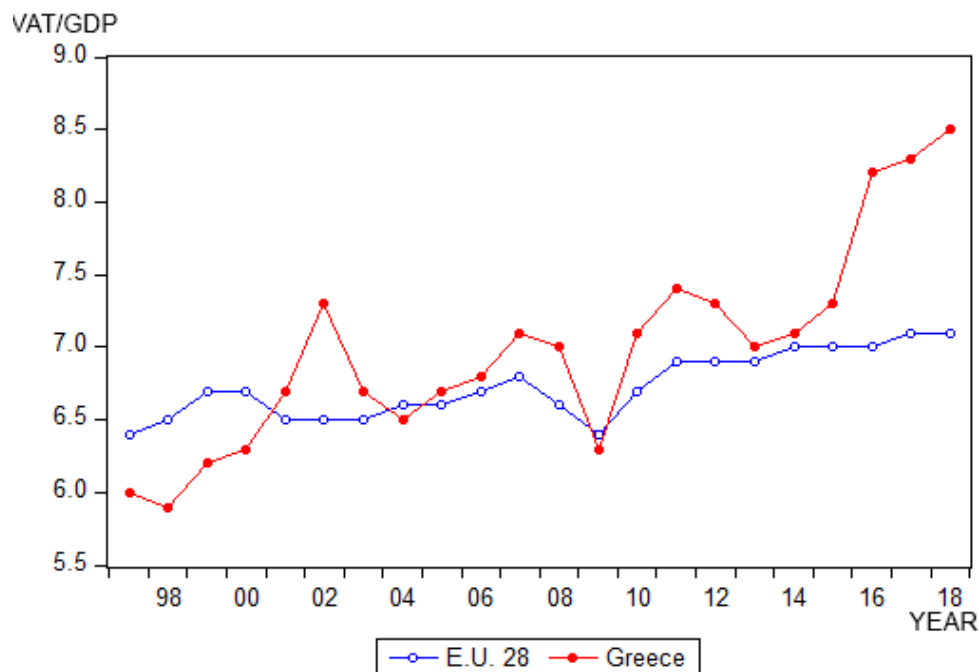
of more than 50% is VAT revenues (source: Eurostat database). Furthermore, when examining the ratio of revenues from indirect taxes to the Greek Gross Domestic Product (GDP), one can observe that consumer taxes are the main source of government revenue, contrary to other developed economies where direct taxes contribute more to the state budget. Figure 1 shows the ratio of indirect to direct taxes (denoted as D2/D5) for Greece (vertical axis) compared to the corresponding average ratio of the EU countries, for the 1997-2018 period (horizontal axis). The comparison of the two ratios confirmed the importance of indirect taxes for the Greek economy and its importance compared to the rest of the EU.

The ratio of VAT Revenues (VR) to the Greek GDP was examined for the whole period under investigation (1997-2018) and was found to be particularly high, while in some years it even exceeded 8% of the Greek GDP. The lowest price of VAT revenues in Greece was 7.58 billion Euros in 1997 (source: Eurostat database) and since then a rapid and continuous increase in revenues has been observed; in some years the VAT revenues doubled the 1997 revenues. In Figure 2, the vertical axis presents the percentage ratio of VAT Revenues to GDP (VR/GDP) for Greece compared to the corresponding average ratio of the EU countries for the 1997-2018 period (horizontal axis). These data show that from the year 2005 onwards (except the year 2009), the VR/GDP

percentage for Greece exceeded the corresponding EU average, with the difference constantly widening from 2013 to 2018.

Based on the above evidence, the significance of VAT revenues in the Greek economy becomes apparent. Any loss of VAT revenues may lead to public deficit in the short-run and greater public debt in the long-run. Also, low levels of VAT collection may cause less public and private investment, more unemployment and therefore lower economic growth. The loss of VAT revenues due to non-compliance, evasion, fraud and the ineffectiveness of policy-making choices- commonly referred to as a 'VAT Gap' - is a topic of great importance for all modern economies and a subject of research for many economists. Moreover, the VAT Gap can be divided into a 'compliance gap' which comes from tax non-compliance (this includes deliberate tax evasion, tax avoidance, errors in the calculation of taxes, low quality of tax administration services and the non-collection of taxes and fees) and a 'policy gap' which comes from policy choices (reduced VAT rates, exceptions).

Thus, the need to address the VAT Gap in Greece becomes obvious. To achieve this, an understanding of the structure of the Greek VAT Gap through a thorough analysis of factors that affect it is needed, including the analysis of the compliance and policy gaps. The objectives of this paper are to determine the VAT Gap in the Greek tax reality using a well-known analytical



**Figure 2.** Ratio of VAT Revenues to GDP (%) for Greece and EU countries' average, 1997-2018. Source: Author's own work, raw data taken from Eurostat database.

method for quantifying VAT gaps; the VAT Revenue Ratio (VRR), examine individual factors that affect it and provide relevant policy recommendations. In order to achieve more precise estimations a top-down approach and an econometric model that focuses on tax administration variables was used to address VAT compliance issues.

## LITERATURE REVIEW

International literature on the subject of VAT gaps is well documented in recent years. Efforts have been made to address VAT Gaps both at the level of national economies by the appropriate administrative bodies and individual scholars, as well as on a global level by internationally renowned organizations such as the Organization for Economic Co-operation and Development (OECD), the International Monetary Fund (IMF), the Center for Social and Economic Research (CASE) and the EU's Directorate-General department for Taxation and Customs Union (TAXUD). Contrary to this, Greek literature and research on VAT gaps are still insufficient, despite the fact that Greece has one of the largest VAT Gaps in the EU. For this reason, the investigation of factors that influence the Greek VAT gap and their relationship with the Greek tax reality may provide innovative 'data' in terms of the adoption of appropriate policies and procedures (best practices) for battling tax evasion. The case of Greece can be a 'benchmark' case study for other countries with a high

VAT gap and similar socio-economic characteristics and tax systems.

## The importance of tax administration in vat gap analysis

VAT Gap literature has so far being focused on economic and social factors which are directly or indirectly linked to government policy. However, there is little bibliography on the correlation between the actions/schemes of Tax Administration and the VAT Gap. Dealing with the VAT gap is a complex combination of public finance, tax law enforcement, tax authority's organizational design, ethics and tax morale (Andreoni et al., 1998).

In this paper we incorporate the role of Tax Administration, in order to (a) understand its importance in relation to the Greek VAT gap and (b) ascertain its uses for policy-making. An indicator of the importance of Tax Administration in the Greek economy can be seen in its establishment as an autonomous entity known as the Independent Public Revenue Authority (hereafter AADE) in 2017, while up until 2016 all actions regarding tax policy and administration were exercised by the Ministry of Finance. AADE's mission is to ensure public revenues, strengthen tax compliance, combat tax evasion and smuggling and at the same time provide high quality services to citizens and businesses (AADE Strategic Plan 2020-2024). Its activities, among others, consist of collecting established and due tax debts and leading the

suppressive - control mechanism (tax audits). These activities and their relationship with the VAT gap are examined in this paper.

### **Key factors that influence the VAT gap**

As seen above, there is little literature on VAT Gap analysis in Greece. For the purposes of this paper, prominent economic, fiscal and social factors were chosen from international literature, based on their strong influence over the VAT Gap. Furthermore, in order to address the Greek tax reality, several tax factors such as audits and fines were selected for investigation. A total of twelve influential factors were thus selected. In order to understand their significance and meaning a brief review of every factor is provided below.

### **Gross domestic product (GDP) growth**

GDP has been studied extensively as a determinant of the VAT Gap in various forms, such as GDP per capita, GDP (size of economy) and GDP growth. The growth of GDP, in particular, has been used in the CASE reports (CASE, 2019, 2020) for the EU VAT gap quantification where it was observed that an increase in economic growth leads to a reduction of the VAT gap. When addressing the issue from a single-country perspective (instead of CASE's panel data analysis of the EU 28 countries), as in Redo (2018), concerning the VAT gap in Poland, we observe that despite the increase in economic growth the VAT Gap continued to grow, for a specific number of years. For the purposes of our paper, we examine the year-by-year economic growth of the Greek economy in terms of percentage in order to determine its effect on the VAT gap.

### **Unemployment rate**

In the 2018, 2019 and 2020 CASE reports (CASE 2018, 2019, 2020), we observe that the unemployment rate has a positive impact on the VAT Gap (the higher the unemployment rate the higher the level of the VAT Gap). Madzharova (2014) argues that unemployment as an explanatory variable not only denotes the general state of the economy, but also directly affects private consumption since VAT's performance deteriorates as the number of the unemployed rises. In our case, we calculate the annual unemployment rate as the percentage of active population.

### **General government final consumption expenditure (as % of GDP)**

According to Reckon (2009), the government's final

consumption expenditure is one of the main categories of relevant expenditure that gives rise to irrecoverable VAT Revenues. Ueda (2017) also debates the importance of government final consumption and reasons that this variable greatly affects the policy gap of the VAT Gap. Considering the above and that there is no tax evasion in government expenditures, we focus on General Government Final Consumption Expenditure to determine the relationship of final consumption with the VAT Gap. It is also important to note that VRR, by nature, overestimates the contribution of Government Consumption in the calculation of VAT Gap (Keen, 2013). Therefore, we expect this variable to be significant and to balance the above overestimation.

### **Difference between standard and reduced VAT rates**

Another variable that has been used in previous literature to determine tax policy and the complexity of the VAT system is the difference between Standard and Reduced VAT Rates. Agha and Haughton (1996) highlight that the greater the number of VAT rates, the lower the degree of compliance as multiple-rate VAT systems offer more opportunities for evasion, as well as being harder to supervise. Their results point towards the necessity of a single moderate VAT rate on a broad tax base as multiple VAT rates lead to bigger compliance gaps due to increased costs in tax administration. Ebrill et al. (2001) also expected it to have a positive relationship with the VAT Gap. More recent studies such as the Institute for Fiscal Studies (2011) have yielded similar results. It is therefore understandable that in order to examine the relationship of this variable with the VAT Gap in Greece, we calculated the difference between the standard VAT rate and the weighted average of the reduced VAT rates, excluding the ultra-reduced rates in some Greek islands.

### **Tertiary education**

According to Zidkova (2016), a more educated society (thus measuring the share of tertiary education in a country) would be less inclined to commit tax evasion and more able to comply with difficult VAT rules, hence a high level of education is expected to decrease the VAT Gap. In Greece, tertiary education is increasingly high in recent years; therefore we consider it crucial for our paper and we specifically examined the percentage of higher education graduates between the ages of 25 and 64.

### **Gini Index**

Bird et al. (2004) reasons that unequal distributions of income and wealth are likely to enhance tax avoidance and tax evasion. Christie and Holzner (2006) also agree that income inequality, as measured by the Gini



coefficient, hints at the fact that tax evasion may be influenced by poverty. Kozuharov (2015) showed that the impact of the VAT on income inequality is relatively high, that is, there is a possible bond between the tax revenues derived from VAT and the income inequality measured with the Gini index in his country.

### **VAT as a percentage (%) of total taxes in an economy**

The significance of VAT in the tax structure of an economy can influence the size of the VAT Gap, since VAT revenues are a significant source of state budget (Zidkova, 2016). In Greece, VAT is the most important indirect consumption tax and is a major source of government revenues. By incorporating this variable into our model we intend to not only show its significance for reducing the Greek VAT gap but also reducing the Compliance gap and simultaneously increasing VAT Revenues.

### **Gross Value Added/ Gross Domestic Product (GVA/GDP)**

The variable of the added value of the Greek Economy in relation to its GDP is examined by the author as it reflects the “new wealth” created in an economy minus taxes (for instance VAT) and adding subsidies on products. For this reason, the value added of specific sectors in GDP such as catering, agriculture and construction has not been examined as has been the case in past research. There are a lot of influences that affect the evolution of VRR, or VAT gap, or any other phenomenon for that matter that no model can ever hope to cover conclusively. We usually examine some specific factors that theory, practice, common sense or even intuition dictate us and make models that help us understand a given question. GVA as a percentage of GDP plays that role in this case. If GVA/GDP increases, for example, it means that the proportion of taxes corresponding to the created value added decreased. This variable taken within the context of a model represents everything that we do not explicitly examine, so we expect it to prove significant and have a negative effect on VRR.

### **Established and collected fines**

AADE collects data for two categories of fines; established fines (the number of fines which have been charged and certified) and collected fines (the part of the established fines that have been collected). For each of the two categories of fines we examined the sums of three types of penalties: (a) the imposed fines and surcharges for VAT, (b) the fines imposed for violations of the Greek Code for Accounting Books and Records (later on replaced by the Greek tax code of tax transactions

(KFAS)) and (c) the fines imposed by the Customs for smuggling and simple customs violations. The last two penalties were considered by the author given their relevance with the VAT fines. Previous studies included the collection rate of fines and taxes associated with auditing activities and showed that the collection of fines stimulated tax compliance in general (Tagkalakis, 2014). In this paper the correlation between Established and Collected Fines with the VAT Gap was investigated, using top-down estimations.

### **Suppressive mechanism–Tax audits**

Previous research on tax audits as factors that may influence the VAT Gap only included bottom-up techniques (Lešnik, 2018), whereas in this paper a top-down approach was attempted. Regarding the suppressive mechanism of the Greek tax administration, it must be noted that tax audits are broken down into “from-the-office” audits, full-on-site audits and partial-on-site (pre-emptive) audits in accordance with article 23 of the Code of Tax Procedure (KFD) under Law 4174/2013. Of these, only the number of pre-emptive audits carried out on an annual basis was examined, given that they are a dominant form of audit in Greece. Data from “from-the-office” and “full-on-site” audits were not examined. The “from-the-office” form of audit was first established in 2013 and there are insufficient data for the entire range of the examined time series. As for the latter, we also lack available data for the full range of our time series in order to incorporate them into our model.

### **Number of violations**

In relation to the previous factor we also examined the number of violations found by the pre-emptive audits.

### **METHODOLOGY**

International literature -both theoretical and empirical- that addresses the issue of VAT Gaps is ever-growing in recent years. The methodologies used by different organizations and scholars to analyze VAT efficiency and quantify the VAT Gap are diverse and often fitted specifically to the country or countries under investigation, depending on the availability of data, particularities of the tax system, type of fraud or evasion, administrative capacity and main objectives of the research in question. Therefore, when attempting an analysis on VAT Gaps, there are two fundamental issues that must be taken into account by the researcher. The first issue concerns the different estimation approaches that must be employed for the collection of the necessary data. The second issue concerns the different ‘instruments’ for analyzing the data, depending on the desired objective (VAT compliance, VAT Gap measurement, VAT liability, VAT revenues, etc).

### **VAT gap estimation approaches**

There are three major approaches for the estimation of VAT Gaps

(Hutton, 2017). The first one is the top-down approach, aiming to provide a comprehensive assessment of all tax losses by measuring the gap as the difference between estimated potential revenue and actual revenues. The estimates for potential revenue are typically produced using statistical data. The second is the bottom-up approach where 'bottom-up techniques', such as random sampling of taxpayers for audit or compliance risk analysis, are used to estimate the impact of specific behaviors. The final estimation approach revolves around econometric techniques, such as frontier analysis and time series analysis which provide estimates of efficiency or revenue losses. In all cases, the preferred methodology and the quality of data used will affect the robustness of the results. The estimation approach that was most appropriate for the objectives of this paper, based on the available raw data for the Greek economy, was the top-down approach.

### VAT gap analytical instruments

Based on the different estimation approaches mentioned above, there are several analytical instruments used for quantifying VAT revenues, VAT non-compliance and VAT Gaps.

#### C-efficiency ratio

The C-Efficiency Ratio measures the ratio of the actual VAT revenue to the theoretical revenue derived from the product of aggregate final consumption and the VAT standard rate and is widely used by the IMF as a broad indicator of the overall efficiency and effectiveness of the VAT system. According to Keen (2013), this indicator shows the impact on government VAT revenues of both the policy gap (due to different VAT rates and exemptions) and the non-compliance gap (due to incomplete application of the tax).

#### VAT revenue ratio (VRR)

VAT Revenue Ratio (VRR) is an indicator developed by the OECD and measures (top down) the difference between the VAT revenue actually collected and what would theoretically be raised if VAT was applied at the standard rate to the entire potential tax base. Essentially, it is a successor of the C-Efficiency Index, which measures VAT effectiveness by dividing VAT collections with the standard rate of VAT as a percentage of GDP (Ebrill et al., 2001). The VRR offers three important advantages. First and foremost, it is simple to calculate from readily accessible data (from National Accounts and respective authorities). Secondly, it provides a uniform VAT imposed on all final consumption, which policy makers can use as a benchmark tax for decreasing the VAT Gap. Thirdly, the gap between 'actual' and 'potential' revenues measured by the VRR may be decomposed in a number of useful ways for assessing VAT compliance and administrative effort (Keen, 2013).

#### Revenue administration gap analysis program (RA-GAP)

According to RA-GAP methodology, as developed by the IMF, the tax gap (for any type of tax including VAT) is the difference between potential revenue of the underlying economic tax base and actual revenue. Again, the tax gap is decomposed into two main components: the impact of non-compliance, and the impact of policy choices (Hutton, 2017).

#### VAT tax liability according to the law (VTTL)

The Center for Social and Economic Research (CASE) has carried

out several studies on behalf of the European Union regarding VAT gaps. The key (top-down) method used in this report is the VAT tax liability according to the law (VTTL). The VTTL is an estimated amount of VAT that is theoretically collectible based on the VAT legislation and ancillary regulations. The VAT gap is defined as the difference between the amount of VAT actually collected and the VAT Total Tax Liability (VTTL), in absolute or percentage terms (CASE, 2013, 2014, 2015).

#### Her Majesty's Revenue and Customs (HMRC), United Kingdom (UK)

In the UK, the Tax Authority (HMRC) developed a practice of tax gap estimations for all main taxes. In the HMRC's definition (HMRC, 2020), the 'tax gap' is the difference between the amount of tax that should, in theory, be collected by HMRC, against what is actually collected. In the United Kingdom, the VAT gap is estimated by both a top-down methodology and a bottom-up methodology. The calculations are prepared in-house by the Tax Authority (HMRC). From the analytical tools mentioned above, the VRR was chosen as the most appropriate indicator for quantifying the Greek VAT Gap, based on the availability of statistical data and its functionality for the researcher's purposes.

#### Quantification of VRR

The VAT Revenue Ratio (VRR) provides an indicator that combines the effect of loss of revenues due to VAT exemptions and reduced rates, tax planning as well as VAT fraud and/or evasion. Its aim is to interpret a country's ability to effectively secure the whole of its potential tax base and support policymakers in assessing their VAT revenue performance (OECD, 2014, 2015, 2016). It measures the difference between the actually-collected-VAT-revenues and the revenues that would theoretically be collected if VAT were applied at the standard rate to the whole potential tax base, otherwise known as a "pure" VAT regime (OECD, 2018). According to the OECD (2018), the VRR is measured as follows:

$$VRR = \frac{VR}{(B * r)} \quad (1)$$

Where, VR = actual VAT revenues, B = potential tax base and r = standard VAT rate.

According to the above equation, the relationship between the VAT gap and the VRR is depicted as follows (OECD, 2018):

$$VATGap = \frac{(B * r) - VR}{(B * r)} \Leftrightarrow VATGap = \frac{(B * r)}{(B * r)} - \frac{VR}{(B * r)} = 1 - VRR \quad (2)$$

Here, the standard VAT rate refers to the default rate applicable to the potential tax base (without taking into account exemptions, reduced rates or other schemes advised by tax administrations). The closest statistic for potential tax base is final consumption expenditure as measured in the national accounts. In the Eurostat database, final consumption expenditure (denoted as item P3) is calculated according to the standard international norm known as the System of National Accounts (denoted as SNA-2008) and consists of the following components (European Commission et al., 2009):

- (i) P31-S14: Private final consumption expenditure of households.
- (ii) P31-s15: final consumption expenditure of Non-Profit Organizations Serving Households (NPSH).
- (iii) P3 -S13: Final consumption expenditure of general government, including: P31-S13: Individual consumption expenditure of general

government and P32-S13: Collective consumption expenditure of general government.

In the VRR calculation formula as presented in equation (1), the potential tax base (B) is measured by the final consumption expenditure under Item P3 in the national accounts. However, since the SNA measures consumption expenditures at market prices including VAT, revenues from VAT should be deducted from the amount under P3. The theoretical basis for taxation should not include the tax itself (OECD, 2018), so the potential tax base equals the Final Consumption Expenditure (FCE) minus the actual VAT revenues (VR). According to the OECD (2018) the VRR can then be rewritten as:

$$VRR = \frac{VR}{(FCE - VR) * r} \quad (3)$$

From Equation 3 above, it is easy to interpret the VRR depending on how close a country's VAT system is to a "pure" VAT regime. If the VRR is equal to 1 we would have a "pure" VAT regime, whereas if the VRR is below 1 ( $VRR < 1$ ) we can see the effect of reduced VAT rates, exemptions or/and a failure to collect all VAT due. On the other hand, a VRR that is above 1 ( $VRR > 1$ ) would mean a VAT system where almost all the tax base is covered by the standard VAT rate and any exemptions applied to the system would ultimately lead to additional revenue due to the cascading effect of the exemption (OECD, 2015).

#### Decomposition of the VRR - Policy gap and compliance gap

The VRR is affected both by policy-making choices and tax compliance. Furthermore, the VRR also depends on the interaction between them. For example, a high standard VAT rate may create an incentive for evasion while multiple lower rates may lead to revenue loss due to misclassifications. Also, exemption of certain sectors of activity may create distortions and incentives for avoidance, which require additional administrative capacities that cannot be used for the efficient collection of VAT.

Inefficient tax administration, burdensome administrative requirements and complex VAT mechanisms may reduce the degree of compliance of taxpayers. These factors can be divided in two main categories (Keen, 2013); those resulting from policy decisions, mainly affecting the tax base or the coverage of the standard rate and those related to the efficiency of the tax collection and compliance levels. Measuring only the impact of policy decisions on a country's VAT revenue, sometimes called the "Policy Efficiency Ratio", can be achieved by comparing the theoretical VAT revenue under the actual tax base and rates (assuming perfect compliance) with that under a uniform tax on all consumption:

Policy Efficiency Ratio = (VAT theoretical revenue from actual tax law)/(final consumption Standard VAT rate)

On the other hand, a measure of compliance, sometimes called the "Compliance Efficiency Ratio" compares actual revenue with the theoretical VAT revenue under the legislated tax base and rates:

Compliance Efficiency Ratio = (VAT revenue)/(theoretical VAT revenue from actual tax law).

The VRR is a combination of the "Policy Efficiency Ratio" and the "Compliance Efficiency Ratio". Different methods were developed to produce breakdowns of the composition of the VRR. Keen (2013) presented an estimate for the decomposition of the VRR based on a combination of the VAT gap estimates that were carried out for the EU Commission in 2006 and the VRR estimates from the

OECD. Following the methodology of Keen (2013), we decomposed the VRR for Greece by taking the VTTL from the TAXUD reports, which essentially measures the compliance gap ( $\Gamma$ ) and we then calculated the policy gap (P) as a residue ( $P = 1 - VRR - \Gamma$ ). VAT Revenues (VR) were found in the Eurostat database under 'Main National Accounts Tax Aggregates' (denoted as gov\_10a\_taxag) under Item D211: Value added type taxes (VAT). The standard VAT rates were taken from the European Commission's "VAT rates applied in the Member States of the European Union" (European Commission, 2020). In the years that included a rate change a weighted mean was taken. Table 1 presents the decomposition of the Greek VRR into the Policy and Compliance gaps from 2000 to 2018. No data regarding the VTTL exist before the year 2000, thus we were unable to present the decomposition of the VRR for the full period under investigation. Nevertheless, this fact does not affect the econometric model which was used in this paper, since data for the calculation of the VRR was available for the full period under investigation (1997-2018). Figure 3 gives a better visual understanding of the Greek VRR, the Greek compliance gap ( $\Gamma$ ) and the Greek policy gap (P) in the vertical axis over the period from 2000 to 2018 (horizontal axis).

#### Model specification

In the econometric model utilized in this paper the dependent variable that is used for the VAT Gap is expressed by the VRR. There are twelve 12 explanatory variables. These are presented in Table 2. A first algebraic approach to a model would be in the form of a multiple linear regression, given by Equation 4, where  $X_i$  is the explanatory variables seen in Table 2.

$$VRR_t = b_0 + \sum_{i=1}^k b_i * X_t \quad (4)$$

That model would be acceptable provided that the Gauss-Markov assumptions are met. The available data cover a time period of 22 years and so a Generalized Least Squares (GLS) regression will have no advantage over an Ordinary Least Squares (OLS) regression as a method of estimation (Baltagi, 2008). Table 3 presents the summary statistics of the explanatory variables of the model. The data-set is complete except for the Gini Index that has a missing value for the year 2002. It was interpolated using Catmull-Rom Spline.

#### Data availability

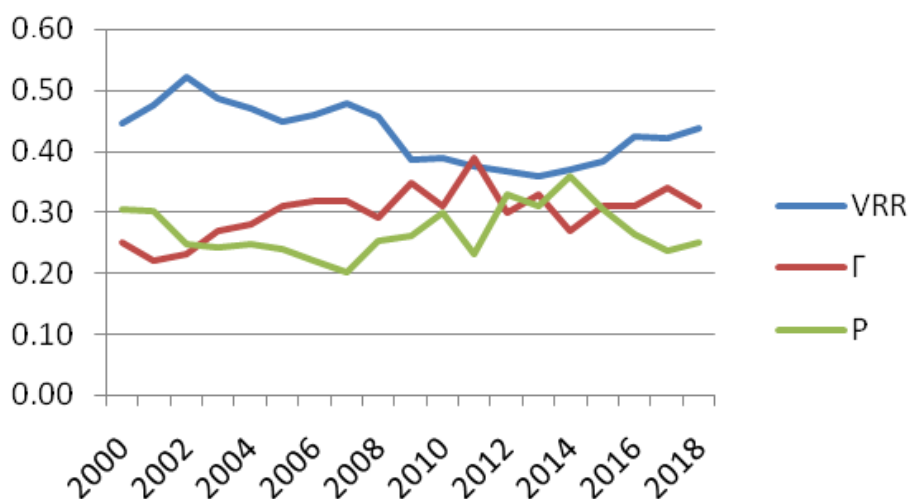
For the variables Growth of GDP, Unemployment, Final consumption expenditure of general government (% GDP), Difference of standard from reduced VAT rates, Gini-Coefficient, Value added type taxes (VAT) % of total taxes, and GVA/GDP the annual data from 1997 to 2018 were obtained from Eurostat's general government surveys (data accessed on August 04, 2020). Data regarding the level of tertiary education in Greece were collected from the OECD database due to the fact that the same category of data in the Eurostat database was not available for the full time period (data accessed on August 04, 2020).

Data concerning the pre-emptive audits as well as the number of VAT violations were obtained from the annual reports of the Greek Tax authorities, while data regarding the established and collected fines were obtained from the annual state accounts of the Greek Ministry of Finance. More specifically, they were acquired according to the Codes of Expenditures (KAE): 1700 - "Increases, fines and monetary penalties for indirect taxes", 3732 - "Fines imposed by the financial supervisors for violations of Greek Code for Accounting Books and Records" and 3733 - "Fines, multiple and additional fees

**Table 1.** VRR, compliance gap, policy gap for Greece from 2000 to 2018.

Year	VRR	$\Gamma$	P
2000	0.45	0.25	0.30
2001	0.48	0.22	0.30
2002	0.52	0.23	0.25
2003	0.49	0.27	0.24
2004	0.47	0.28	0.25
2005	0.45	0.31	0.24
2006	0.46	0.32	0.22
2007	0.48	0.32	0.20
2008	0.46	0.29	0.25
2009	0.39	0.35	0.26
2010	0.39	0.31	0.30
2011	0.38	0.39	0.23
2012	0.37	0.3	0.33
2013	0.36	0.33	0.31
2014	0.37	0.27	0.36
2015	0.38	0.31	0.31
2016	0.42	0.31	0.27
2017	0.42	0.34	0.24
2018	0.44	0.31	0.25

Source: Author's own work, raw data taken from Eurostat database and Keen (2013).



**Figure 3.** VRR, Compliance Gap, Policy Gap for Greece from 2000 to 2018. Source: Author's own work, raw data taken from Eurostat database and Keen (2013).

imposed by the Customs for simple customs offenses, smuggling and violations of Law 2637/53, as in force”.

## RESULTS AND DISCUSSION

Before the results of the model are presented, several

diagnostic tests were conducted. Table 4 shows a test for stationarity. The output of the unit root test in Table 4 indicates that the explanatory variables are not stationary and that could result in spurious regression. To solve this problem the differences of the logarithms of the variables were examined. This transformed the model from equation

**Table 2.** Explanatory variables.

Explanatory variable	Abbreviation model	in Measurement method	Type variable	of Previous literature / new
Growth of GDP	GROWTH	Change of gross domestic product at market prices	Economic	CASE (2019,2020),Redo (2018)
Unemployment rate	U	Unemployment % of active population	Economic	Madzharova (2014), CASE (2018, 2019,2020)
General government final consumption expenditure (as % of GDP)	CGOV	Final consumption expenditure of general government (% of GDP)	Economic	Reckon (2009), Keen (2013), Ueda (2017)
Difference between standard and reduced VAT rates	VATDIFF	Standard VAT rate minus the mean of Reduced VAT rates	Tax	Agha and Haughton (1996), Ebrill et al. (2001), Institute for Fiscal Studies (2011)
Tertiary education	TERT	Percentage of higher education graduates between the ages of 25 and 64	Social	Zidkova (2016)
GINI index	GINI	The Gini index	Social Economic	- Bird et al. (2004), Christie and Holzner (2006), Kozuharov (2015)
VAT as a Percentage (%) of total taxes in an economy	VATTAX	Value added type taxes (VAT) % of total taxes	Tax	Zidkova (2016)
GVA / GDP	VALUEADD	Value added, gross as GDP percentage	Tax - economic	New
Tax Audits	AUDITS	Number of pre-emptive audits	Tax	New
Number of violations	OFFENSES	Number of detected offense	Tax	New
Established fines	EST	Established Fines (the sum of KAE 3732, KAE 3733, KAE 1700)	Tax	New
Collected fines	COL	Collected Fines (the sum of KAE 3732, KAE 3733, KAE 1700)	Tax	New

(4) into the following:

$$d\log(var) = \log\left(\frac{var_t}{var_{t-1}}\right) = \log(var_t) - \log(var_{t-1}) \quad (5)$$

A stationarity test is conducted again for the

transformed (logarithmic) model. The following output (Table 5) shows that the stationarity problem has been addressed. Another advantage of the transformation of the variables to differences of logarithms, that are equivalent to percentage change, is the evening of the units of measure involved. All the variables are now

expressed as dimensionless numbers. The model that was actually estimated is described in equation (6).

$$\log\left(\frac{Y_t}{Y_{t-1}}\right) = b_0 + \sum_{i=1}^k b_i * \log\left(\frac{X_{i,t}}{X_{i,t-1}}\right) \quad (6)$$

**Table 3.** Summary Statistics of the Variables.

	VRR	AUDITS	CGOV	COL	EST	G	GINI
Mean	0.429074	111473.5	1.990.909	2.09E+08	1.34E+10	0.023324	3.380.909
Median	0.431307	111056.0	2.005.000	2.01E+08	1.10E+10	0.023303	3.400.000
Maximum	0.521327	175003.0	2.330.000	4.10E+08	3.37E+10	0.099606	3.500.000
Minimum	0.359776	37632.00	1.750.000	65667560	4.85E+08	-0.084070	3.230.000
Std. Dev.	0.044214	35751.59	1.480.961	79804226	1.22E+10	0.056528	0.756501
Skewness	0.092740	-0.181105	0.372735	0.652660	0.523625	-0.369199	-0.152857
Kurtosis	2.162.164	2.395.206	2.745.053	3.530.909	1.807.887	2.082.053	1.960.551
Jarque-Bera	0.675007	0.455558	0.568996	1.820.248	2.308.045	1.272.204	1.076.088
Probability	0.713549	0.796300	0.752392	0.402474	0.315366	0.529352	0.583889
Sum	9.439.630	2452417.	4.380.000	4.59E+09	2.94E+11	0.513132	7.438.000
Sum Sq. Dev.	0.041052	2.68E+10	4.605.818	1.34E+17	3.12E+21	0.067103	1.201.818
Observations	22	22	22	22	22	22	22
	<b>OFFENSES</b>	<b>TERT</b>	<b>U</b>	<b>VALUEADD</b>	<b>VATDIFF</b>	<b>VATTAX</b>	
Mean	24133.05	2.336.849	1.498.636	8.881.818	1.274.005	0.306859	
Median	25146.50	2.321.437	1.130.000	8.865.000	1.225.000	0.305555	
Maximum	37120.00	3.173.990	2.750.000	9.050.000	1.450.000	0.338736	
Minimum	8.162.000	1.562.228	7.800.000	8.700.000	1.200.000	0.272948	
Std. Dev.	7.953.479	4.944.496	6.742.777	0.970830	0.871289	0.022197	
Skewness	-0.387052	0.123421	0.723431	-0.058259	0.811140	-0.013716	
Kurtosis	2.280.452	1.824.737	1.877.554	2.187.975	2.268.430	1.585.905	
Jarque-Bera	1.023.906	1.321.994	3.073.857	0.616881	2.903.072	1.833.715	
Probability	0.599324	0.516336	0.215041	0.734592	0.234210	0.399773	
Sum	530927.0	5.141.067	3.297.000	1.954.000	2.802.811	6.750.889	
Sum Sq. Dev.	1.33E+09	5.134.089	9.547.659	1.979.273	1.594.203	0.010347	
Observations	22	22	22	22	22	22	22

This is a model of the change of VRR as a function of the change of some of the explanatory variables. The estimation can also be transformed to give a prediction formula for the VRR, as seen in Equation 7.

$$Y_t = Y_{t-1} * \left[ e^{b_0} * \prod_{i=1}^k \left( \frac{X_i}{X_{i-1}} \right) \right]^{b_i} \quad (7)$$

Tests for multicollinearity (Table 6) were taken using the Variance Inflation Factor (VIF). A VIF value that exceeds 10 would indicate a problematic amount of collinearity (Gareth et al., 2014). The results of Table 6 rule out high multicollinearity so the estimation method that was chosen was OLS. The results are given in Table 7. This is the first estimated Model denoted as VAT Gap Model 1

(VGM1). Before we proceed to the elimination of the less significant variables we should run some tests for autocorrelation to make sure that the requirements for the use of OLS are met. These are given in Table 8.

The output indicates that there is no autocorrelation in the residuals. The Breusch-Pagan-Godfrey test output shows no heteroskedasticity. The Jarque-Bera test is a test for normality of the residuals and it shows that they are normally distributed. The results are Jarque-Bera=1.397960 with Probability= 0.497092. Since the tests imply neither autocorrelation nor heteroskedasticity between normally distributed residuals we can continue using OLS estimation. We also take into consideration that the sample size is small and so OLS is preferred over GLS (Rao and Griliches, 1969).

Backward elimination of the less significant variables of

**Table 4.** Stationarity Test for the multiple linear regression model – equation 4.

---

Group unit root test: Summary  
 Series: VRR, AUDITS, CGOV, COL, EST, G, GINI, OFFENSES, TERT, U, VALUEADD, VAT DIFF, VATTAX  
 Sample: 1997 - 2018  
 Exogenous variables: Individual effects  
 Automatic selection of maximum lags  
 Automatic lag length selection based on SIC: 0 to 1  
 Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.47528	0.3173	13	280
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.34501	0.3650	13	280
ADF - Fisher chi-square	30.9385	0.2306	13	280
PP - Fisher chi-square	22.8372	0.6421	13	282

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

**Table 5.** Stationarity test for transformed logarithmic model – equation 5.

---

Group unit root test: Summary  
 Series: DLOG\_VRR, DLOG\_AUDITS, DLOG\_CGOV, DLOG\_COL, DLOG\_EST, DLOG\_G, DLOG\_GINI, DLOG\_OFFENSES, DLOG\_TERT, DLOG\_U, DLOG\_VALUEADD, DLOG\_VATDIFF, DLOG\_VATTAX  
 Sample: 1997 - 2018  
 Exogenous variables: Individual effects  
 Automatic selection of maximum lags  
 Automatic lag length selection based on SIC: 0 to 2  
 Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-10.5402	0.0000	12	236
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-10.7935	0.0000	12	236
ADF - Fisher chi-square	142.909	0.0000	12	236
PP - Fisher chi-square	146.177	0.0000	12	240

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

the previous OLS estimation (VGM1 model) was done. This is the result of a series of eliminations of the variables of the first estimation (VGM1) model. In each step the less significant variable is left out until the remaining are all significant. The following statistically significant variables are obtained (Table 9). This is now the new model denoted as VAT Gap Model 2 (VGM2). We repeat the tests for autocorrelation and heteroskedasticity to make sure that the residuals are still normally distributed (Table 10).

The results show that our model is reasonable (Jarque-Bera = 1.933667 with Probability = 0.380285). It could however, be argued that a constant term (denoted C) should be included to account for various factors that were not examined in the first place. In that case the other coefficients would not be affected much (Table 11). The constant term (C) is obviously very close to zero to make any difference and also the influences that were not specifically examined by the model are already represented in it by the variable VALUEADD that makes

**Table 6.** Multicollinearity test-Variance Inflation Factors (VIF).

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Sample: 1998 - 2018  
Included observations: 21

<b>Variable</b>	<b>Coefficient Variance</b>	<b>Uncentered VIF</b>
DLOG_AUDITS	0.002638	2.061148
DLOG_EST	0.004899	4.870104
DLOG_CGOV	0.095295	1.230200
DLOG_COL	0.000915	1.674107
DLOG_G	9.75E-05	2.837371
DLOG_GINI	0.375309	1.861473
DLOG_OFFENSES	0.002483	3.173834
DLOG_TERT	0.345926	5.530192
DLOG_U	0.014173	2.979897
DLOG_VALUEADD	5.825482	2.663431
DLOG_VATDIFF	0.234079	2.463922
DLOG_VATTAX	0.097343	2.942987

---

**Table 7.** OLS estimation results - VGM1.

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Dependent variable: DLOG\_VRR  
Method: Least squares  
Sample (adjusted): 1998 - 2018  
Included observations: 21 after adjustments

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
c	0.014603	0.029640	0.492666	0.6355
DLOG_AUDITS	0.060466	0.060347	1.001980	0.3457
DLOG_EST	-0.014177	0.073139	-0.193838	0.8511
DLOG_CGOV	-0.495004	0.391075	-1.265753	0.2412
DLOG_COL	0.013829	0.037349	0.370268	0.7208
DLOG_G	-0.001481	0.011374	-0.130224	0.8996
DLOG_GINI	0.221552	0.644322	0.343853	0.7398
DLOG_OFFENSES	-0.008945	0.053983	-0.165694	0.8725
DLOG_TERT	-0.225980	0.923943	-0.244582	0.8129
DLOG_U	0.013106	0.126896	0.103284	0.9203
DLOG_VALUEADD	-2.748684	2.923273	-0.940276	0.3746
DLOG_VATDIFF	-0.783992	0.515717	-1.520198	0.1669
DLOG_VATTAX	0.742280	0.329274	2.254295	0.0542
R-squared	0.742517	Mean dependent var		0.001309
Adjusted R-squared	0.356293	S.D. dependent var		0.059348
S.E. of regression	0.047616	Akaike info criterion		-2.978283
Sum squared resid	0.018138	Schwarz criterion		-2.331674
Log likelihood	44.27198	Hannan-Quinn criter.		-2.837953
F-statistic	1.922503	Durbin-Watson stat		2.125789
Prob(F-statistic)	0.179985			

---



**Table 8.** Autocorrelation tests, Breusch-Godfrey Serial Correlation LM Test & Breusch-Pagan-Godfrey Heteroskedasticity Test on the VGM1 model.

Sample: 1998 - 2018						
Included observations: 21						
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.   .	.   .	1	-0.034	-0.034	0.0276	0.868
. *   .	. *   .	2	-0.139	-0.140	0.5160	0.773
.   ** .	.   ** .	3	0.226	0.220	1.8855	0.597
.   .	.   .	4	0.051	0.045	1.9588	0.743
Breusch-Godfrey Serial Correlation LM Test:						
F-statistic	0.346898	Prob. F(2,7)			0.7184	
Obs*R-squared	1.824304	Prob. Chi-Square(2)			0.4017	
Heteroskedasticity Test: Breusch-Pagan-Godfrey						
F-statistic	0.693267	Prob. F(12,8)			0.7265	
Obs*R-squared	10.70538	Prob. Chi-Square(12)			0.5543	
Scaled explained SS	1.986574	Prob. Chi-Square(12)			0.9994	

**Table 9.** Statistically significant variables – VGM2 Model.

Dependent Variable: DLOG_VRR				
Method: Least Squares				
Sample (adjusted): 1998 - 2018				
Included observations: 21 after adjustments				
Variable	Coefficient	Std. error	t-Statistic	Prob.
DLOG_AUDITS	0.056128	0.028457	1.972400	0.0661
DLOG_CGOV	-0.423489	0.227911	-1.858134	0.0816
DLOG_VALUEADD	-3.087820	1.407589	-2.193694	0.0434
DLOG_VATDIFF	-0.672649	0.285572	-2.355442	0.0316
DLOG_VATTAX	0.658139	0.172683	3.811242	0.0015
R-squared	0.724259	Mean dependent var		0.001309
Adjusted R-squared	0.655323	S.D. dependent var		0.059348
S.E. of regression	0.034843	Akaike info criterion		-3.671678
Sum squared resid	0.019424	Schwarz criterion		-3.422982
Log likelihood	43.55262	Hannan-Quinn criter.		-3.617705
Durbin-Watson stat	2.016328			

the constant term redundant. We can repeat the procedure with Newey-West Heteroskedasticity and Autocorrelation Consistent (HAC) estimators, to address the possibility of heteroskedasticity and autocorrelation masking each other (Table 12). The tests results are similar to the previous ones. The standard errors are different, as expected, but the specification of the model is the same; so there is no advantage in using HAC estimators in our case (Newey and West, 1987). The

formulation of the VGM2 model according to equation (5) will be:

$$\begin{aligned}
 \text{DLOG\_VRR} = & 0.056127779855 * \text{DLOG\_AUDITS} & - \\
 & 0.423489000891 * \text{DLOG\_CGOV} & - \\
 & 3.0878203597 * \text{DLOG\_VALUEADD} & - \\
 & 0.672648668947 * \text{DLOG\_VATDIFF} & + \\
 & 0.658138564963 * \text{DLOG\_VATTAX} & 
 \end{aligned}$$

And if we transform it according to equation (7) we get:

**Table 10.** Autocorrelation and Heteroskedasticity tests - VGM2 model.

Breusch-Godfrey serial correlation LM Test:				
F-statistic	0.586740	Prob. F(2,14)		0.5692
Obs*R-squared	1.492615	Prob. Chi-		0.4741
Heteroskedasticity test: Breusch-Pagan-Godfrey				
F-statistic	0.411439	Prob. F(5,15)		0.8335
Obs*R-squared	2.532720	Prob. chi-square(5)		0.7716
Scaled explained SS	1.851363	Prob. chi-square(5)		0.8693

**Table 11.** Addition of constant term (C) to the VGM2 model.

Variable	Coefficient	Std. error	t-Statistic	Prob.
C	0.003052	0.008646	0.352978	0.7290
DLOG_AUDITS	0.057013	0.029376	1.940821	0.0713
DLOG_CGOV	-0.442185	0.240323	-1.839959	0.0856
DLOG_VALUEADD	-2.951140	1.498641	-1.969211	0.0677
DLOG_VATDIFF	-0.702962	0.306017	-2.297131	0.0364
DLOG_VATTAX	0.671750	0.181748	3.696043	0.0022
R-squared	0.726530	Mean dependent var		0.001309
Adjusted R-squared	0.635374	S.D. dependent var		0.059348
S.E. of regression	0.035837	Akaike info criterion		-3.584712
Sum squared resid	0.019264	Schwarz criterion		-3.286277
Log likelihood	43.63948	Hannan-Quinn criter.		-3.519944
F-statistic	7.970135	Durbin-Watson stat		2.065632
Prob(F-statistic)	0.000769			

**Table 12.** Possibility of heteroskedasticity and autocorrelation masking each other – VGM2 model.

Dependent variable: DLOG_VRR				
Method: Least squares				
Sample (adjusted): 1998 - 2018				
Included observations: 21 after adjustments				
HAC standard errors and covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG_AUDITS	0.056128	0.024841	2.259478	0.0382
DLOG_CGOV	-0.423489	0.158626	-2.669730	0.0168
DLOG_VALUEADD	-3.087820	1.287073	-2.399102	0.0290
DLOG_VATDIFF	-0.672649	0.322863	-2.083387	0.0536
DLOG_VATTAX	0.658139	0.191917	3.429284	0.0034
R-squared	0.724259	Mean dependent var		0.001309
Adjusted R-squared	0.655323	S.D. dependent var		0.059348
S.E. of regression	0.034843	Akaike info criterion		-3.671678
Sum squared resid	0.019424	Schwarz criterion		-3.422982
Log likelihood	43.55262	Hannan-Quinn criter.		-3.617705
Durbin-Watson stat	2.016328			

**Table 13.** Summary of predicted VRR changes in the VGM2 model.

Variable	Change of variable (%)	Resulting change of VRR (c.p.) (%)
AUDITS	+ 1	+0.056
CGOV	- 1	+ 0.427
VALUEADD	- 1	+ 3.152
VATTAX	+ 1	+ 0.657
VATDIFF	- 1	+ 0.678

$$VRR_t = VRR_{t-1} * \left[ \left( \frac{AUDITS_t}{AUDITS_{t-1}} \right)^{0.0561} * \left( \frac{CGOV_t}{CGOV_{t-1}} \right)^{-0.4235} * \left( \frac{VALUEADD_t}{VALUEADD_{t-1}} \right)^{-3.0878} * \left( \frac{VATTAX_t}{VATTAX} \right)^{0.6581} * \left( \frac{VATDIFF_t}{VATDIFF} \right)^{-0.6726} \right] \quad (8)$$

The final formulation of the VGM2 model can serve two purposes. It can inform us about which variables stand out and have a significant influence on VRR as well as the magnitude and direction of their influence. It can also serve as a predictive tool that can be used to make policy suggestions. For example, we see that an increase of 1% in the VAT to total taxes ratio will increase (ceteris paribus) the VRR by 0.657%. We can summarize these predicted results in Table 13.

Of course we can only expect these results from relatively small changes of the variables. If we double CGOV for example we cannot expect the model to hold because the structure of the economy will be different. We also cannot drastically change the VAT rates and expect to make an accurate prediction of the outcome without considering the effects that the final prices change will have on the consumption. But even with its limitations the model can give us some very useful insights.

## CONCLUSION AND RECOMMENDATIONS

Out of the twelve explanatory variables examined in our model, five were found to be statistically significant. Two of them, specifically the ratio of VAT to total taxes (VAT as a Percentage of total taxes in an economy) and the number of tax audits, have a positive correlation with the VRR and a negative correlation with the VAT gap. The other three variables, final government consumption expenditure, the difference between the standard and reduced VAT rates and the GVA/GDP ratio have a positive correlation with the Greek VAT gap.

Regarding the first of the two variables with a negative relationship with the VAT gap, the ratio of VAT to total taxes confirms the prominent position of the VAT in the Greek tax system and that its effective and robust collection contributes decisively to the increase of government revenues. The detection of unpaid VAT

through the control mechanism and the appropriate control procedures, as well as the collection of VAT confirmed through the implementation of the stipulated procedures should therefore be key priorities of the Greek Tax Administration.

In the same direction, the second variable with a negative relationship with the VAT gap is the number of tax audits. The need to strengthen tax audits is demonstrated not only by the statistical importance of this variable but is also tied to the aforementioned variable. Pre-emptive audits are characterized by particular features such as holistic and the element of surprise as they are unanticipated. As a consequence, the revelation of tax evasion takes place at the moment it is in progress and not after its completion; therefore there is a greater deterrent effect. The aforementioned characteristics give pre-emptive audits an important position in the field of tax audits, making them crucial in preventing tax evasion and reducing the VAT gap. When carrying out a pre-emptive audit, given that its scope covers the entire activity of a tax entity, comprehensive knowledge of taxable entities is required and therefore it is necessary for Tax Administration personnel to have adequate training and education regarding tax entities and their activities, as well as tax laws and regulations. This is a prerequisite for attaining the pursued results from tax audits. Of course this 'knowledge' must be combined with impartiality and objectivity as the tax control mechanism must remain corruption-free and independent from political interference. The responsibility of the Greek Tax Administration at this point is enormous as it must take the appropriate measures and ensure the smooth conduct of audits, seriously affecting tax evasion and reducing the VAT gap. In this context, the establishment and operation of AADE from 01.01.2017 can only be characterized as a positive step towards this direction.

In addition to the aforementioned variables, three others were found to be important, nonetheless, having a positive correlation with the VAT gap. First of all, the correlation between the VAT gap and the explanatory variable of the Gross Value Added of the Greek Economy (GVA) in relation to GDP is positive. Considering both subsidies and production/consumption as non-changing (ceteris paribus), then if the change in GVA is greater

than the change in GDP that means that the taxes collected have been reduced which confirms the existence of a positive relationship between the variable and the VAT gap. That means that the increase of the numerator (GVA) of the examined variable is accompanied by the collection of less taxes and therefore leads to a larger VAT gap whether this is due to tax evasion or non-performance of the relevant political decisions. In this case, if the policy gap has not increased then the increase is due to tax evasion, which is addressed by the tax administration. Conversely, if, by keeping subsidies and production / consumption constant, we have a reduction in the GVA. This means that the taxes collected have increased and therefore we have a reduction in the VAT gap.

Likewise, the relationship between the VAT gap and the difference between the standard VAT rate and the reduced rates is also positive. Reduced VAT rates as well as zero VAT rates are enforced based on government policy decisions to protect or promote certain goods and services, which are considered essential for basic survival (such as foodstuff) that corresponds to a large part of poor households. These goods are closer to the true social optimum and may be seen as having intrinsic social or cultural value (Institute for Fiscal Studies-IFS, TAXUD, 2011), as is the intention on the part of governments to achieve a fairer fiscal and social policy through income redistribution. However, the application of zero and reduced rates should be done with special care so that their effect on the VAT gap is not decisive. The promotion - protection of specific products of sectors or geographical areas should be considered in the context of the broader tax system taking into account not only VAT taxation but also other forms of taxation such as income taxation, without omitting the consideration of other alternative policies such as systems' benefits-subsidies for specific goods or geographical areas and social security.

Policy makers must take into account both the potential tax evasion and the loss of tax revenues due to the implementation of reduced or zero VAT rates. Following the findings of our analysis, we conclude that the use of a significantly-lower-than-the-standard reduced VAT rate is not recommended, since increasing the difference between the normal rate and reduced rates and the existence of zero rates would increase the VAT gap.

Finally, our model shows that final government consumption expenditure on GDP, although not related to tax evasion, has a positive correlation with the Greek VAT gap. The lack of VAT revenues from transactions regarding government expenditure (not due to evasion but due to reduced or zero rates) positively affects the policy gap, thus increasing the VAT gap. This paper comes to two primary conclusions. The first is that both the policy and compliance components of VAT gap are relatively high in the Greek economy. The second is that the Greek VAT gap is positively affected by final

government consumption expenditure, the difference between the standard and reduced VAT rates and the GVA/GDP ratio, and negatively affected by the ratio of VAT to total taxes (VAT as a Percentage (%) of total taxes in an economy) and the number of tax audits. Policymakers, in their effort to reduce the VAT gap, should take into account the findings of this study, not only for the Greek economy but also for other countries with similar socio-economic characteristics and tax systems. Finally, in the future, a more detailed, sectoral (on the primary, secondary and tertiary sectors of the Greek economy) study on the Greek VAT Gap would be more effective in addressing the factors that affect the vat gap and would yield even better results regarding policy making.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## ACKNOWLEDGMENT

The authors express their appreciation towards all the responders and all anonymous reviewers for their comments.

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*Review*

# Tax-free synthetic cash for individuals: A theoretical review of the Swiss case

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Received 29 May, 2020; Accepted 5 March, 2021

**Synthetic cash, which is a pure product of financial engineering, can be defined as a combination of financial instruments that provide (before tax) a performance equal to that of a traditional monetary deposit but without the use of a debt or interest payment instrument. This article discusses the taxation of synthetic cash in Switzerland and shows that synthetic cash can generate tax-free income when adequately structured. This also creates a tax incentive for sophisticated private investors to avoid taxes by holding synthetic cash rather than monetary deposits. In addition, the article explores the various defense mechanisms available to the Swiss tax authorities when fighting against synthetic cash. Finally, it examines virtual currencies, which have recently emerged and could constitute the next generation of synthetic cash.**

**Key words:** Taxation, cash management, financial engineering, tax avoidance.

## INTRODUCTION

Financial derivatives were initially created to facilitate risk transfers between market participants but may also be used to synthesize the returns of virtually any asset. Because most tax systems do not necessarily treat economically equivalent returns from different instruments in the same manner, synthetic assets often include a different tax treatment than the original asset that they replicate. Using synthetic assets also allows sophisticated investors to choose the timing, character, and/or source of otherwise economically equivalent cash flows. In addition, it opens the door to tax planning activities and creates substantial threats to tax revenues for all states.

In this article, we extensively discuss a specific example of synthetic assets, namely, cash in Switzerland. This choice is motivated by two arguments. First, cash is deemed to be the simplest and safest asset, and it normally generates only fully taxable ordinary income. Let us recall that, in finance, the term “cash” or “traditional cash” represents all types of debt instruments that pay fixed or variable interest on a given amount (nominal value) and have a residual lifetime of less than one year, such as treasury bills, bank deposits, short-term bonds, and loans. Second, Switzerland hosts a large banking industry that caters to wealthy individuals from around the

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world. Swiss banks are also known for their conservative investment approach, with cash as an important component in the portfolios of clients in search of a safe haven during periods of extreme market stress. The tax treatment of cash returns is therefore important.

This paper has three objectives. The first one is to illustrate the weakness of the current Swiss tax code in regard to synthetic cash. For this purpose, several simple synthetic cash products are described in detail and analyzed from a Swiss tax perspective; moreover, it is shown that these products generate legally tax-free income when adequately structured. The second objective is to assess the anti-avoidance mechanisms of the Swiss tax authorities when confronting such synthetic cash constructions. Although theoretically available and effective in other areas, these mechanisms are found to be extremely difficult to use in practice against synthetic cash. Finally, the third objective is to discuss how virtual currencies, which have recently emerged, could constitute the next generation of synthetic cash. Overall, by discussing the concepts and mechanics of synthetic cash, including virtual currencies, the paper provides useful and practical evidence for policymakers interested in stemming aggressive tax planning. It also contributes to the ongoing debate on fundamental tax reforms in Europe and elsewhere.

To the best of the author's knowledge, the present article is the first to focus on using derivatives for tax evasion by *individuals* in Switzerland. Derivative-based tax avoidance is not by any means a new phenomenon. Based on anecdotal evidence, several calls for research on the topic have been issued by both academics and regulators (Shevlin, 2007; Hanlon and Heitzman, 2010; Raskolnikov, 2011; United States Government Accountability Office, 2011; United States Congress Joint Committee on Taxation, 2011). Surprisingly, more than a decade later, such research remains relatively limited. Most investigations in the United States (US) have focused on the corporate side because more disclosures are available from this perspective. In particular, the Statement of Financial Accounting Standards No. 161 requires firms to distinguish between derivatives that are designated as "hedging instruments" from those designated as "non-hedging instruments."

Per the comprehensive research of Donohoe (2011, 2012, 2015a, b), corporations were found to use derivatives as a tool of tax avoidance. Gallemore et al. (2019) confirmed that some banks specialize in assisting corporate clients with tax planning, a role that goes far beyond their traditional one of being a financial intermediary. Similar conclusions were obtained by Sitinjak and Martani (2018) and Devi and Efendi (2018) in Indonesia, by Zeng (2014) in Canada, and by Oktavia et al. (2019) in four member states of the Association of Southeast Asian Nations. However, in regard to wealthy individuals, the literature remains scarce owing to limited

disclosures.

In the US, although Fabozzi (1998) and Keinan (2007) described various strategies using derivatives for tax planning, the corresponding loopholes have been closed by specific anti-abuse rules (Schizer, 2001; Brennan, 2013; Gorella, 2020). In Europe, various policy initiatives such as information exchange treaties, increased control of money flows, or tax amnesties have flourished, but little has been done regarding derivatives and tax planning. Persaud (2014) outlined the main challenges that European countries face when taxing derivatives and provided general recommendations for the way forward. Guter-Sandu et al. (2018) focused on the aggressive tax planning practices of individuals who used financial engineering and, in particular, the deployment of derivatives. Their main conclusion was that various initiatives, such as the Organization for Economic Co-operation and Development's (OECD's) Base Erosion and Profit Shifting initiative and the European Union's Aggressive Tax Planning Indicators, do not focus enough on the opportunities that are created by financial engineering from a tax avoidance perspective. More recently, derivative-based tax avoidance discussions seem to have migrated toward the use of total return swaps by wealthy individuals to avoid paying withholding taxes on dividends (Reinarz and Carelli, 2016; Reinarz, 2017; Buettner et al., 2020) and toward offshore-based tax evasion (European Commission, 2019).

The remainder of this paper is structured as follows. First is an explanation of the tax treatment of traditional cash in Switzerland for different types of taxes (e.g., stamp duty, wealth tax, withholding tax, and income tax), followed by illustration of various approaches for creating synthetic cash using derivatives. Furthermore, a discussion is presented on the tax treatment of synthetic cash in Switzerland leading to the conclusion that synthetic cash is essentially tax free. Additionally, the various defense mechanisms that are available to the Swiss tax authorities when combating synthetic cash constructions are explored, the findings summarized, and the case of Switzerland is briefly compared to that of the US, where a small set of rules explicitly and generically prevent such constructions. Finally, virtual currencies are introduced as the next possible loophole in Switzerland for creating tax-free synthetic cash.

## TRADITIONAL CASH FROM A SWISS TAX PERSPECTIVE

In Switzerland, traditional cash instruments are either bonds or monetary securities, as stated in Art. 4, Al. 4 of the Federal Law on Stamp Duty (LSD) dated June 27, 1973. Specifically, the notion of bonds is defined in Art. 4, Al. 3 of the LSD and Art. 15, Al. 1 of the Ordinance on Withholding Tax (OWT) dated December 19, 1966. This

definition, which is wider than those found in the Swiss Law on Securities, is used for federal, cantonal, and communal taxes. It also contains an essential element, to which we will return later, in that a bond can exist only if there is a principal debt in capital. From a tax perspective, monetary securities are defined as bonds of a duration that does not exceed 12 months (Art. 4, Al. 4 of the LSD). Initially, this definition seems similar to that used in finance, which can be misleading. The financial definition of monetary securities considers the current residual duration of the instrument, whereas the tax definition refers to the duration measured from when the debt relationship was initiated. Consequently, some traditional cash instruments are considered to be bonds for tax purposes even though their residual life falls under 12 months. This is, for instance, what occurs in the case of an old long-term bond that is less than one year from reaching maturity.

For certain types of taxes, the borrower's domicile must be considered. A borrower will qualify as "Swiss" if the borrower has residency in Switzerland or in the Principality of Liechtenstein, has registered an office (or legal headquarters) there, or is registered as a company with the Commercial Register (Art. 4, Al. 1 of the LSD). It should be noted that a legal entity whose registered office is in a foreign country but is effectively managed from Switzerland will also qualify as "Swiss" (Art. 9, Al. 1 of the Federal Law on Withholding Tax (LWT) dated October 13, 1965). Moreover, a bond issued by a Swiss borrower will qualify as "Swiss," but a borrower or a bond will qualify as "foreign" if the aforementioned criteria are not met.

### Stamp duty

The issue, sale, or purchase of traditional cash is generally not subject to stamp duty. Indeed, the stamp duty on new issues has been abolished since March 1, 2012, for bonds and monetary securities. In addition, the stamp duty on the transfer of securities applies neither to monetary securities (Art. 14, Al. 1, Let. G of the LSD) nor to bonds issued by foreign debtors and denominated in a foreign currency (Art. 14, Al. 1, Let. F of the LSD). However, attention must be given to the aforementioned case of a Swiss bond, or a foreign bond that is denominated in Swiss francs, whose residual life is less than 12 months. From a financial perspective, such a bond is viewed as a monetary security; however, for tax purposes, it is handled like a bond. It is therefore subject to stamp duty when transferred if one of the contracting parties or one of the intermediaries is a securities trader (Art. 13, Al. 3 of the LSD). For securities that are issued by an entity domiciled in Switzerland, the tax rate is 1.5% (0.75% for each contracting party); for securities that are issued by an entity domiciled outside of Switzerland, the

tax rate is 3%. Finally, at maturity, the act of delivering securities to obtain the reimbursement of the principal is not subject to stamp duty (Art. 14 of the LSD).

### Wealth tax

Traditional cash instruments must be included in the taxpayer's net taxable assets (Art. 13 of the Federal Law on the Standardization of Direct Cantonal and Communal Taxes (DCT) dated December 14, 1990). When these instruments are listed on an exchange, their current value corresponds to the market price that prevailed at the end of the tax period under consideration (Art. 66, Al. 1 of the DCT). However, when such instruments are not listed, their book value must be estimated. In practice, cantons follow the guidelines contained in Circular 28 of the Swiss Tax Conference, which is entitled "Instructions concerning the estimation of non-listed securities for the purpose of wealth tax" and dated August 28, 2008.

### Withholding tax

If they stem from Swiss bonds or from assets with Swiss banks (or Swiss savings banks), interest and returns provided by a traditional cash position are subject to a withholding tax on investment income of 35% (Art. 4, Al. 1, Let. A and D as well as Art. 13, Al. 1, Let. A of the LWT). The notion of banks, as per the LWT, encompasses companies that are not subject to banking regulations but constantly accept funds against some interest. In practice, for tax purposes, any company that includes more than 100 creditors for an outstanding total of more than CHF 5 million is considered a "bank." The notion of returns encompasses all and any remuneration paid by the debtor to the creditor for having made capital available except for amounts that correspond to the repayment of the principal (Art. 14, Al. 1 of the OWT). In the case of Swiss bonds, possible issue discounts or repayment premiums are thus also subject to a withholding tax.

However, there is no withholding tax due in the following cases: (i) fiduciary deposits made (through a Swiss institution) with a foreign bank; (ii) client assets with a bank or savings bank, if the interest amount does not exceed CHF 200 per year (Art. 5, Al. 1, Let. C of the LWT); and (iii) foreign bonds and assets with foreign banks (or foreign savings banks).

Individuals domiciled in Switzerland can also request a reimbursement of the withholding tax in the form of a tax credit against their cantonal and communal taxes (Art. 22 of the LWT; Art. 51, Al. 1 of the OWT). However, the following conditions must be met: (i) such persons must have the right to use the securities that have produced the related taxable returns (Art. 21, Al. 1, Let. A of the



LWT), and (ii) such persons must declare not only the returns that have been subjected to withholding tax but also the principal amounts that have generated these returns in an accurate and spontaneous manner for the purpose of cantonal and communal taxes (Art. 23 of the LWT). Moreover, partial reimbursement for individuals domiciled outside of Switzerland may be available based on a double taxation treaty.

### Income tax

For both direct federal taxes (Art. 20, Al. 1, Let. A of the Federal Law on the Direct Federal Tax (LIFD) and cantonal and communal taxes (Art. 7, Al. 1 of the DCT), interest and returns arising from traditional cash generally qualify as income and are taxed accordingly. Here, the notion of returns encompasses any remuneration paid by the debtor to the creditor except for amounts that correspond to the repayment of the principal (Art. 14, Al. 1 of the OWT). In particular, this notion applies to interest from assets held with banks and savings banks and to interest arising from Swiss or foreign bonds.

In the case of a bond that only pays its holders a periodic interest (e.g., coupons or similar payments) and no other form of remuneration, the interest received at maturity is taxed as income to the beneficiary of said interest. Should the instrument be disposed of prior to maturity, the portion of the price that relates to the accrued interest constitutes a capital gain that is tax free for the seller because the accrued interest is not paid out by the bond debtor but by a third party (Art. 16, Al. 3 of the LIFD). However, the accrued interest will be fully taxed to the bond holder at the time when it is paid out by the debtor.

In the case of a bond that only gives its holders a one-time remuneration at maturity, including the form of a spread between the issue price and the repayment price (issue premium, repayment discount), all the realized gains are considered to be revenue from movable property. This includes the cases involving disposal before reaching maturity or repayment.

In the case of mixed bonds that offer both a periodic interest and a one-time remuneration, one must perform an actuarial calculation—at the time and under the conditions of issue—to estimate both components. The larger component will definitively point to the category in which to classify the bond. Even in the case of a bond in which the one-time interest is greater, the periodic interest that is paid out remains taxable according to the ordinary regime.

### CREATING SYNTHETIC CASH: ILLUSTRATIVE TRANSACTIONS

The simplest way of obtaining synthetic cash is to create

a portfolio that combines a risky asset (e.g., a stock) with derivative products that are linked to said asset to eliminate risk. To avoid any type of financial arbitrage, this portfolio should provide investors with a return that matches the so-called risk-free rate, namely, the interest rate paid by traditional cash. Although basic constructive sales strategies based on short selling (e.g., shorting against the box) are one of the most obvious approaches to creating synthetic cash, they may easily be requalified from a tax perspective. Thus, subsequently, without aiming to be comprehensive, we present three examples of synthetic cash realized via derivatives by increasing order of financial complexity. For readers unfamiliar with the various financial instruments employed herein, a detailed description of the instruments can be found in Hull (2009). The key element to remember is that while the three forms seem considerably different, they result in the same economic return.

#### Synthetic cash with a forward contract (portfolio P1)

A forward contract is a bilateral contract through which two parties commit to buy and/or respectively sell a given quantity of a specific product at a price agreed in advance and on a preset date (maturity). By combining the purchase of a financial asset with the simultaneous sale of a forward contract on the same asset, an investor creates a pretax position that is financially equivalent to a monetary placement, the maturity of which would be the same as that of the forward contract (Hull, 2009).

**Example 1:** *Suppose we take an interest rate of 3% p.a. and a risky asset as a listed stock trading at CHF 100 while not paying any dividends. The cost-of-carry model (Hull, 2009) indicates that a one-year forward contract on this stock should be traded at CHF 103. Any other price would create financial arbitrage opportunities. Combining the purchase of this stock with the simultaneous sale of a one-year forward contract requires an initial investment of CHF 100, which will definitely be worth CHF 103 one year later regardless of the stock price evolution. Before tax, the return profile is identical to that of a one-year monetary placement.*

In the case of an underlying asset that pays a dividend or an interest that is known in advance, the financial reasoning before tax remains the same. The price of the forward contract will take the distribution into account and will be adjusted accordingly.

**Example 2:** *Suppose we take an interest rate of 3% p.a. and a risky asset as a listed stock trading at CHF 100 while paying a known dividend of CHF 5 in six months. The cost-of-carry model indicates that a one-year forward contract on this stock should be traded at CHF 97.92.*

*Any other price would create arbitrage opportunities. Combining the purchase of this stock with the simultaneous sale of a one-year forward contract requires an initial investment of CHF 100, which will definitely be worth CHF 103 one year later (CHF 97.92 + the dividend of CHF 5 + CHF 0.08 of interest on the dividend during six months) regardless of the stock price evolution. Before tax, the return profile is identical to that of a one-year monetary placement.*

Once the forward contract reaches maturity, several scenarios are possible depending on the terms of the contract. There may be a physical delivery of the underlying asset against the payment of the agreed price; in this case, the investor has *de facto* liquidated their entire position in synthetic cash at a price that was known beforehand. Alternatively, there may be a cash settlement of the difference between the agreed price and the value of the underlying asset; here, the investor retains the underlying asset. If the asset has dropped below the agreed price, the investor receives the difference in cash. If the asset has risen above the agreed price, the investor must pay the difference in cash, which may force the investor to sell a portion of the underlying asset if they do not otherwise hold freely available cash.

It is possible to exit from a synthetic cash position at any time before the forward contract reaches maturity. In this case, the investor sells the underlying asset, and the original forward contract is neutralized by the purchase of another forward contract based on the same asset and with the same maturity date.

### **Synthetic cash through a swap contract (portfolio P2)**

A total return swap (TRS) is a bilateral contract whereby one party undertakes to pay the other the increase in value realized by a financial asset over a given period and, where applicable, dividends or interest paid by this asset over the same period. In exchange, the other party agrees to pay the first party a fixed or variable amount, usually expressed as an interest rate applied to a notional amount that is set in the contract, as well as any possible asset value depreciation over the same period. As a rule, payments are made at regular intervals and are usually compensated, with only the net flow actually paid out. Furthermore, because the asset itself does not change hands, there is no physical delivery of the underlying asset.

By holding an underlying asset and entering into a TRS on the same asset, the investor obtains a pretax position that is financially equivalent to a monetary placement, the maturity of which corresponds to that of the swap (Hull, 2009).

**Example 3:** *Suppose we take an interest rate of 3% p.a.*

*and an underlying asset as a listed stock trading at CHF 100 while not paying any dividends. Let us consider a one-year TRS on this stock with a notional amount of CHF 100 and an interest rate of 3% p.a. Combining the purchase of this stock with this TRS requires an initial investment of CHF 100, which will definitely be worth CHF 103 one year later regardless of the stock price evolution. Thus, if the stock price has risen to CHF 110 in one year, the investor must pay a net flow of CHF 7 for the swap. If the share has dropped to CHF 90 in one year, the investor will receive a net flow of CHF 13 for the swap. In all cases, the net value of the swap will be CHF 103. Before tax, the return profile is identical to that of a one-year monetary placement.*

The previous comments made on the case of an underlying asset paying a dividend or coupon remains valid. Moreover, it can be observed that a TRS with a single payment date at maturity is financially identical to a forward contract. Here, we come across a well-known notion in finance, according to which a swap is generally nothing more than a portfolio of forward contracts, namely, one forward contract for each payment date. Thus, financially speaking, portfolios P1 and P2 are equivalent. However, an important operational difference exists: a TRS involves interest calculations on notional amounts, whereas a forward contract is treated at a fixed price that is directly expressed in cash.

### **Synthetic cash with options (portfolio P3)**

Options also allow synthetic cash to be created. According to a financial relationship called “put-call parity” (Stoll, 1969), a zero-coupon bond can be replicated by purchasing a financial asset and a put option on said asset while simultaneously selling a call option on the asset. In general, maturities should be identical for the put, the call, and the zero coupon. The put and the call should also include the same exercise price, which is equal to the zero coupon’s final price.

**Example 4:** *Suppose we take an interest rate of 3% p.a. and an underlying asset as a listed stock trading at CHF 100 while not paying any dividends and bearing a volatility of 20% p.a. According to Black and Scholes’s (1973) model, a call option and a put option on this stock, with a one-year maturity and an exercise price of CHF 100, are worth CHF 9.39 and CHF 6.48, respectively. A one-year zero-coupon bond is worth CHF 97.09. Any other prices would create arbitrage opportunities. Together, the purchase of the stock and put and the sale of the call create a position that requires an initial investment of CHF 97.09 and definitely pays CHF 100 in one year. Before tax, the return profile is identical to that of a one-year monetary placement.*

The earlier comments made on the case of an underlying asset paying a dividend or coupon remain valid. Options can be used with physical delivery or cash settlement. The pretax total economic output is the same, but the cash-flow consequences differ and must be analyzed. Similarly, one may opt to liquidate their position in full before maturity. Note that the aforementioned example only represents the simplest combination of options for creating synthetic cash. Many other optional combinations, also based on put-call parity, exist in practice and would deliver the same economic results.

### SYNTHETIC CASH FROM A SWISS TAX PERSPECTIVE

Let us consider the case of an investor who creates synthetic cash by combining various financial products. This implicitly assumes that the investor possesses sufficient capital and financial knowledge to execute the required transactions.

#### Choosing the underlying asset and the tax consequences thereof

As shown in the previous section, the creation of synthetic cash implies holding an asset and covering related risks by one or more derivatives. To achieve a risk-free return, capturing all of the underlying asset's gross performance, whether positive or negative, is essential. To do so, choosing an underlying asset that meets the following characteristics is preferable: (i) an asset that is liquid and of a financial nature to avoid storage, transportation, insurance costs, etc.; (ii) an asset whose possible increase in value during the course of the holding period will not be treated as revenue from taxable movable property but as non-taxable capital gain (Art. 16, Al. 3 of the LIFD; Art. 7, Al. 4, Let B of the DCT); and (iii) an asset without distribution (e.g., dividend, coupon, and interest) during the holding period, as it might be subject to withholding tax and/or income tax. In particular, these characteristics exclude all commodity-type assets, including precious metals (e.g., gold and platinum) as well as all bond-type assets and currencies with an interest rate greater than zero. One asset that features all the desired characteristics is a Swiss share (or a basket of Swiss shares) that pays no dividend. For the sake of simplicity, in the remainder of this article, unless otherwise stated, we will assume that a Swiss share without dividend has been selected as the underlying asset. Nevertheless, we will briefly discuss the case of other underlying assets.

Using an underlying asset that makes distributions would render the creation of synthetic cash considerably, and unnecessarily, more complicated. For example,

using a share of a Swiss company that pays a dividend creates three problems:

- i) The *anticipated* dividend, on which the pricing of the derivatives is based, may differ from the actual dividend received; thus, the final return on synthetic cash can no longer be guaranteed.
- ii) For a Swiss investor, the actual dividend will normally be subject to (non-recoverable) income tax, thereby lowering the return delivered by synthetic cash.
- iii) The actual dividend may be subject to a Swiss withholding tax, which the investor may seek to recover; however, this is not always possible.

The last problem—recovering the withholding tax on a dividend—raises the issue of beneficial ownership. For a Swiss company's share, the actual beneficial owner of the dividend is the only one who is entitled to file a withholding tax refund (Art. 21, Al. 1, Let. A of the LWT). For a foreign company's share, the withholding tax refund, in part or in full, is only possible if a double taxation agreement (DTC) is in place between Switzerland and the foreign country. Some DTCs explicitly include a clause on actual beneficial ownership, whereas others do not. However, many authors (Mäusli-Allenspach, 1993; Matteotti, 2005; Danon, 2007) have stated that it is implicit.

Since the synthetic cash holder has economically transferred the performance of the underlying asset (including dividends) to their counterparty through derivatives, is the holder still the actual beneficial owner thereof? In the case of Swiss equities, both scholars (Baumgartner, 2010) and recent decisions of the Swiss Federal Administrative Court have answered in the affirmative, pointing to the absence of contractual or *de facto* interdependence between the receipt of dividends and the obligation to make a payment of an equivalent amount. The acquisition of the underlying security depends solely on the investor's willingness to hedge against the risks inherent in their derivatives' position. In all cases, the investor is obliged to honor their commitment to the derivatives even if they have not received the dividends or if those are unavailable (e.g., in the case of seizure, legal restrictions, or *force majeure*). Hence, the investor should not be regarded as a mere agent or delegate but as the actual beneficial owner of the dividend; consequently, they should be entitled to file a withholding tax refund. In the case of non-Swiss equities, the situation is less clear and depends on the meaning given by the country sourcing the dividends to the term "beneficial owner." This remains a greatly debated international tax issue (Du Toit, 2010; Verdoner et al., 2010a, b; Desax and Busenhardt, 2012; De Broe and Von Frenckell, 2013; Danon et al., 2014; Reinartz and Carelli, 2016; Reinartz, 2017; Buettner et al., 2020). Thus, by default, one should conservatively assume that the

refund of the foreign withholding tax is not guaranteed.

Note that because the performance of the underlying share does not matter (since it is fully hedged), manufacturing a Swiss share with no dividend is theoretically possible. Given an initial share, this would require selling it just before it pays its dividend for the year, replacing it by a share that has already paid it, and adjusting the derivatives position to reflect the change in the underlying asset. This would *a priori* involve higher transaction costs as well as possible tax consequences, in particular, stamp duty. However, such consequences should be studied thoroughly. Finally, a more complex underlying asset, also bearing all the desired characteristics, is a derivative product. One example is a forward oil contract, which by definition does not pay out any distributions and includes no storage costs. In addition, further derivatives can be built upon a derivative product, with the latter acting, in turn, as the underlying asset (for example, the options on forward oil contracts). Let us now review how synthetic cash is treated from a Swiss tax perspective.

### Stamp duty

When creating synthetic cash, one must buy an underlying stock and handle the various derivatives according to the selected portfolio. A stock purchase is subject to stamp duty (a securities trading tax) if the counterparty is a Swiss security trader trading on the Swiss stock exchange. However, this can be avoided by dealing exclusively with foreign members of the Swiss stock exchange (that is, remote members). Since July 1, 2010, remote members are no longer considered security traders (further to the deletion of Art. 13, Al. 3, Let. E of the LSD) and are therefore no longer subject to stamp duty on the trading of securities. Additionally, the issuing and trading of derivatives are exempt from stamp duty (neither securities issuing tax nor securities trading tax are applied).

If a synthetic cash position is held up to maturity, it may lead to executing a forward contract (portfolio P1), having a swap reach maturity (portfolio P2), or exercising an option (portfolio P3). Thus, distinguishing the derivatives with a cash settlement from the derivatives with a physical delivery of the underlying asset becomes necessary. In the case of a cash settlement, stamp duty does not apply because there is no costly transfer of a taxable document (Art. 13, Al. 1 of the LSD *a contrario*). However, the investor may be forced to sell a portion of their underlying asset for cash flow reasons; in this case, the tax treatment on the sale is identical to that of the purchase (see above). Moreover, the investor always retains ownership of all or part of the underlying asset. If they wish to renew their synthetic cash position, no stamp duty will apply, which is an advantage. If they do not wish

to renew their position, they must sell the underlying asset and eventually pay the stamp duty. In the case of a physical delivery, the stamp duty must be paid when the transaction leads to acquiring a taxable document, which occurs if the underlying asset is a Swiss stock. The stamp duty is then calculated on the equivalent countervalue that was agreed to during the transaction's completion (Art. 16 (1) of the LSD).

If a synthetic cash position is liquidated before its derivatives reach maturity, the considerations for the creation of the position apply *mutatis mutandis*. The investor may liquidate only the derivative products, if they wish, and then reinstate a new derivatives position with a longer maturity, which is financially equivalent to extending the maturity of their synthetic cash.

### Wealth tax

Both the underlying security and the derivatives used must be included in the taxpayer's taxable net wealth (Art. 13 of the DCT). The valuation criteria are the same as those mentioned for traditional cash.

### Withholding tax

Withholding tax is charged on some types of capital returns and benefits, as detailed by law. Moreover, the gains from a synthetic cash position with an underlying asset making no distributions are not subject to withholding tax (Art. 4 (1) of the LWT *a contrario*).

### Income tax

Here, we discuss the key advantages of synthetic cash. If synthetic cash is well structured, an increase in its value is potentially considered—not as an interest payment but as a capital gain. In the case of dividend-free shares, realized private capital gains are exempt from income tax (Art. 16, Al. 3 of the LIFD; Art. 7, Al. 4, Let. B of the DCT).

How do certain aspects work for derivatives? In the Swiss Tax Law, the notion of interest only applies if there is a capital debt. However, none of the P1, P2 or P3 portfolios contain an instrument that is linked to a capital debt. In regard to an underlying stock, there is a transfer of capital, but it does not qualify as a debt. In the case of a forward or options contract, there is no underlying debt. In the case of a TRS, even if an interest rate is applied to a hypothetical (notional) amount to determine the amount due, the cash payments do not correspond in any way to remuneration for the capital loaned (Oberson, 1993). Consequently, the Swiss doctrine agrees that returns on forward contracts, options, and swaps qualify as capital gains. However, the activity generating the gain must

occur on an occasional basis rather than as part of self-employment pursuits.

One exception to this rule is that of derivatives or swaps financed in advance wherein there would be a one-time, upfront capital payment that would then be somehow reimbursed in the future. In such a case, Swiss practice varies depending on the duration of the derivative. If its duration is under 12 months, a product is referred to as a “typical derivative,” and its interest component is ignored. If it has a longer term, it may be requalified as a “hybrid product” (that is, a bond with interest plus derivatives). Given that our definition of cash is limited to a one-year time horizon, this situation does not concern us. In view of the above, it therefore appears that an increase in value of synthetic cash constitutes a private capital gain that is exempt from income tax for individuals.

## DEFENSE MECHANISMS AVAILABLE TO THE TAX AUTHORITIES

To collect taxes on synthetic cash, the Swiss tax authorities essentially have three weapons at their disposal: using traditional approaches for taxing hybrid products, invoking the notion of quasi-professional securities trading, and claiming a tax evasion

### Traditional methods for hybrid products

In Switzerland, hybrid products regroup financial instruments issued by banks that combine a bond with some derivative positions. Examples include capital guaranteed notes and reverse convertibles. The Swiss tax authorities have historically used a pragmatic approach to handle them, as described in the Circular number 15 (“AFC15”) of the Swiss Federal Tax Authorities (2018). If the components behind a hybrid product have been explicitly disclosed by the issuer or analytically identified ex-post by the tax authorities, the product is said to be “transparent,” and each component must be taxed separately. This is the case, for example, of a reverse convertible, the yield of which can easily be broken down into a bond-sourced component (that is, a coupon, which is taxed as an income) and an option-sourced component (that is, a put option sale, which is a tax-free capital gain). In all other cases, the hybrid product is said to be “non-transparent” and is essentially taxed as a bond. In particular, all its coupons, as well as the price difference between the purchase price and the final reimbursement price, are treated as taxable income.

This approach has been effective against tax evasion related to hybrid products, particularly attempts to convert taxable coupons into tax-free capital gains. Unfortunately for the Swiss tax authorities, this principle does not apply

to synthetic cash for two reasons. First, synthetic cash is generally not issued as a hybrid product but simply as a series of financial assets (see, for instance, portfolios P1, P2, or P3). Synthetic cash is therefore *de facto* transparent, and the tax authorities have no legal basis to arbitrarily select certain financial assets in an investor portfolio, package them, and then unbundle the package to end up with an economically equivalent set of other assets. Second, even if synthetic cash is offered as a hybrid product, the issuer can easily disclose the underlying components (see, for instance, portfolios P1, P2, or P3), with each of them only generating non-taxable private capital gains. Therefore, the Swiss tax authorities can only requalify the financial construction as generating taxable income in the presence of non-transparent synthetic cash.

### Quasi-professional securities trading

The principle of exemption for private capital gains is clearly anchored in Swiss tax laws (e.g., Art. 16, Al. 3 of the LIFD; Art. 7, Al. 4, Let. B of the DCT). However, per the Federal Court’s jurisprudence, the only gains to be considered private capital gains are those obtained by an individual in a fortuitous manner or in the simple administration of their private wealth. In addition, as soon as one leaves this framework and the activity of the taxpayer is geared toward income generation, the existence of an independent profit-making activity, known as “quasi-professional securities trading,” cannot be excluded. Capital gains from such an activity represent taxable income at both the federal and cantonal levels (Art. 18 of the LIFD; Art. 8, Al. 1 of the DCT) and are subject to social contributions. In the presence of synthetic cash, tax authorities may therefore attempt to demonstrate that the taxpayer is a quasi-professional securities trader.

The distinction between simple private asset management and quasi-professional securities trading has been the subject of considerable jurisprudence, which essentially recommends a case-by-case analysis. To guarantee legal certainty to taxpayers, the Swiss Federal Tax Authorities (2012) outlined the criteria and indications that can be applied in this regard in the Circular no 36 (“AFC36”). The first five elements are the preliminary criteria that, if met cumulatively, make it possible to admit that it is a case of the simple administration of private wealth and that, therefore, the capital gains exemption applies. These criteria are as follows: (i) that positions are held for at least six months; (ii) that the total volume of trades does not exceed, over any calendar year, five times the amount of securities and assets held at the beginning of the tax period; (iii) that capital gains arising from securities transactions are not required to replace missing or discontinued income

and maintain the taxpayer's living standards—in practice, this is the case if the realized capital gains represent less than 50% of the net revenue for the tax period under consideration; (iv) that investments are not financed by borrowed funds; and (v) that purchases and sales of derivatives are limited to hedging the taxpayer's security positions.

In our case, two criteria may prove problematic. First, criterion (iii) may not be met in the case of a wealthy taxpayer who nevertheless has a low level of income. Capital gains related to synthetic cash and, more generally, capital gains related to their wealth, could therefore be required to maintain their living standards. For such a taxpayer, there remains the option to invoke the argument of the prohibition of confiscatory taxation (Article 26 of the Federal Constitution) and have recourse to the tax shield, if applicable, for their cantonal and communal taxes. Further, criterion (v) is perfectly fulfilled in the case of our examples of synthetic cash using a forward contract (P1) or a TRS (P2) since the related derivative is used for the sole purpose of hedging the taxpayer's positions. Conversely, in the case of synthetic cash using put-call parity (P3), the sale of a call, if considered in isolation, is not truly a hedging operation.

If the aforementioned criteria are not cumulatively met, the existence of professional securities trading cannot be ruled out. It is then necessary to move on to an examination *in concreto*. Based on the 2C\_868 / 2008 ruling of October 23, 2009, the AFC36 restates the priority order to be applied among the criteria laid down by the jurisprudence. Three primary criteria (that is, a high transaction frequency/short holding duration, the use of foreign funds, and the use of derivatives) can lead to characterizing an activity as "professional securities trading." Secondary criteria, such as a close relationship with the taxpayer's professional occupation, the use of specific knowledge, and a systematic and planned manner of conducting certain activities, add to the above but cannot alone lead to a professional securities trading characterization. These aspects merely corroborate such characterization when a main criterion is met.

The mention of derivatives in the primary criteria may pose a problem for synthetic cash holders. Note that this criterion is *not* included in the 2C\_868 / 2008 ruling of October 23, 2009 upon which the AFC36 is based. Nevertheless, the jurisprudence seems to confirm that the use of derivatives, insofar as it is limited to hedging a taxpayer's securities positions, is acceptable. Again, portfolios P1 and P2 appear to be safe, while portfolio P3 is more debatable because it is linked to the sale of a call.

Despite the apparent legal certainty, the synthetic cash holder must keep in mind that the AFC36 is only an administrative directive that does not have the force of law. Under the principle of good faith, this circular binds the tax administration but not the courts. In a ruling that

was issued post-AFC36, the Federal Court made it clear that the circular was not aimed at dealing with the most complex cases but was primarily intended to quickly resolve clear cases as part of an effort to "mass administer" these matters. More importantly, the Federal Court has deviated substantially from the AFC36 by placing the primary and secondary criteria on the same level and by adding new criteria such as "the systematic and/or planned nature of operations," "the taxpayer's training and/or main occupation," "the use of expert knowledge," or "the reinvestment of earnings." The Federal Court's jurisprudence also stated that the notion of "independent lucrative activity" is to be interpreted in a broad sense and that such a characterization may be justified, depending on the case, even in the absence of a recognizable activity in the eyes of a third party and even if the activity is only carried out on an occasional basis. In any event, for the Federal Court, the concrete circumstances of the case must be decisive. Therefore, the security of synthetic cash and that of its holder remain relative. However, there is some risk that the apparent protection offered by the AFC36 may be shattered before the courts. As a reminder, this was the case with the previous circular of 2005 on the same topic.

### Possible recharacterization as tax evasion

In Switzerland, tax evasion refers to a situation wherein a taxpayer uses civil law institutions to avoid a tax burden while attaining their ultimate economic objective (Glauser, 2007). The Federal Court has characterized tax evasion as the use of a legal form that is "unusual, inappropriate or strange, in any case unsuitable for the economic goal pursued," which is chosen "solely for the purpose of saving taxes that would be owed if the legal relationships were adapted in an appropriate manner," and that effectively results in "substantial tax savings, in as far as the tax authorities would accept it." When these three conditions are met, the Federal Court's jurisprudence has admitted that taxation must not be based on the form chosen by the taxpayer but on "the situation that should have appropriately expressed the economic goal pursued by those concerned."

Does the holding of synthetic cash constitute a form of tax evasion? It is difficult to answer this question in general terms. On one hand, all the criteria retained by the Federal Court seem to be well tested. Although the economic nature of the performance of synthetic cash corresponds closely to that of an interest payment, the sole purpose of synthetic cash is to have it fiscally passed off as tax-free private capital gains. To respect the principle of equal treatment of taxpayers, we must correct the situation and discourage other taxpayers from taking this route. Literally, "slyness must not triumph over law" (*Die Schlaueit darf nicht über das Recht*

*triumphieren*) (Vetsch, 1917). On the other hand, at which point does the decision of a taxpayer to hedge a position that they hold, which *de facto* creates synthetic cash, become tax evasion? Is it necessary to systematically requalify any hedged position as tax evasion? Should it only be done if such a position is held longer than a certain period of time, if a large amount is involved, or if it has been renewed several times? In this regard, we are not far from arbitrariness.

To make matters worse, the transactions carried out are *a priori* economically justified and not simulated by the counterparties of the synthetic cash holder. It is therefore impossible to requalify these transactions from a tax perspective but possible to leave their combination in the hands of the taxpayer. This can lead to an undesirable legal situation in which bilateral transactions between two taxpayers can be fiscally accepted for the first party but fiscally requalified for the second party depending on the composition of the remainder of their portfolios.

## DISCUSSION

The Swiss tax system proceeds by determining the legal form of a transaction before taxing this legal form rather than by seeking the economic substance of a transaction and taxing by referencing this substance. Together with the absence of taxes on capital gains for individuals, this provides an ideal framework for the creation of tax-free synthetic cash. In addition, by combining no income-distributing risky assets with the appropriate derivative hedges, one can create a package that delivers cash-like returns but is not legally subject to any income tax.

In my opinion, the Swiss tax authorities are underequipped to fight this problem. There is a clear mismatch, in terms of expertise and in numbers, between the advisors of wealthy taxpayers and the employees of the tax authorities. This adds to the first mover advantage of the taxpayer, who can choose the combination of derivatives to be used and can to a considerable extent elect the tax treatment. The ability to recharacterize a synthetic cash construction as tax evasion is powerful, but it requires full disclosure of the underlying positions and, more importantly, the technical financial ability to rebuild the hidden economic substance. Again, this requires time, resources, and financial expertise.

By comparison, many other countries are not as welcoming to synthetic cash. For instance, the tax system in the US relies on familiar cubbyholes, such as debt and equity, ownership, and non-ownership, which can easily be gamed using derivatives. However, the complex straddle rules of the Internal Revenue Code (IRC § 1092) focus on preventing tax avoidance by combining offsetting positions that consist of a publicly traded stock vs. a derivative or one equity derivative vs. another equity

derivative. The Treasury Regulation Secs. 1.1092(d)-2(a) and 1.246-5(c) also contain complex rules for applying these principles to baskets of stocks that are offset, for example, by equity index futures or option contracts. These rules are directly applicable to fight synthetic cash. Thus, Swiss lawmakers are encouraged to cease confronting yesterday's battles and become more proactive in this area.

## OTHER FORMS OF SYNTHETIC CASH

More recently, the emergence of virtual currencies has opened new possibilities in terms of creating synthetic cash. In this section, the European Borrowing Unit (EBU), which is a virtual currency based on a long/short basket of currencies, and Bitcoin, which is a new dematerialized currency that is decentralized from the banking system, are discussed.

### Synthetic cash through a synthetic currency: The EBU

The EBU was the first synthetic currency in the world. Introduced by Barclays on September 27, 2007, the EBU is a long/short basket of G10 currency forward contracts. It is rebalanced monthly and optimized to obtain a 0% borrowing interest rate and a minimal exchange rate volatility against the euro. In addition, the EBU is a non-deliverable currency that can only be converted into euros for amounts exceeding 20 million euros. Initially, the EBU specifically targeted European borrowers who had historically been financing themselves in yen to minimize their borrowing rates. Owing to the EBU, these borrowers could reduce their borrowing costs to zero while controlling their exchange rate risks.

Can the EBU be considered by an investor as a possible form of synthetic cash? In my opinion, the answer is no. Admittedly, by construction, an investor holding EBUs receives no interest payments in the end, and the only possible yield would result from a variation in the exchange rate of the EBU, which should be considered a "tax-free capital gain." However, several problems arise.

The exchange rate variation against the EBU is not known in advance. The EBU is certainly optimized by accounting for the historical volatility and correlations between its component currencies, but this is no guarantee of future results. Before its launch, on a simulated basis, the EBU had depreciated against the euro (while it was worth 100 euros in January 2000, it traded at 112.3 at official inception). If this tendency had continued, European borrowers of the EBU would have combined a 0% borrowing interest rate and a foreign exchange gain. Meanwhile, investors in the EBU would

have combined a 0% borrowing interest rate and a foreign exchange loss. Moreover, the optimization is made only in relation to the euro, not in relation to the Swiss franc. In other words, the Swiss investor in the EBU cannot exclude a foreign exchange loss.

An EBU investor always has a traditional cash problem. The creation of a long/short basket of forward contracts only requires collateral and no investment. The amount invested in the EBU must therefore be placed in traditional cash, where it will earn interest. In theory, before tax, the interest received should be equal to the expected foreign exchange loss on the long/short portfolio of forward contracts. However, in practice, the tax treatment of these two amounts differs. Specifically, the former is taxable as income, while the latter is nondeductible for a private investor. The net flow is therefore negative, which means an expected loss for the Swiss private investor.

After an initial phase during which it attracted strong interest, the EBU was gradually abandoned and practically disappeared in the aftermath of the financial crisis of 2007–2008.

### **Synthetic cash through a virtual currency: The Bitcoin example**

Introduced in 2009, Bitcoin (*bit* for binary information unit and *coin*) is a virtual accounting unit stored on an electronic medium that can be used as a means of payment on a peer-to-peer Internet network. Bitcoin allows for money to be exchanged without going through the conventional banking system. In simple terms, Bitcoin can be described as a type of digital token, which can either be acquired for free in return for one's participation in the operational functioning of the Bitcoin management system, or bought or sold against "traditional" money. The latter case is the one that interests us here. Specifically, can a private investor use Bitcoin as synthetic cash; if so, how would the resulting gains be dealt with from a tax perspective?

Until now, Bitcoin deposits were distinct in that they offered no remuneration. Therefore, the value expressed in Bitcoins has remained constant over time. However, their value expressed in a traditional currency (e.g., the US dollar and the Swiss franc) has varied upwards and downwards and has historically displayed an extremely high volatility and large drawdowns. Thus, we are far from the steady and stable growth offered by synthetic cash. Consequently, Bitcoin deposits cannot replace the synthetic cash position unless the cash amount used by the taxpayer to value their fortune is in Bitcoins, which is a situation that the tax authorities are unlikely to recognize. This would imply that (i) Bitcoins be taxed and recognized as a foreign currency; (ii) the notion of functional currency, as introduced in Art. 958d, Al. 3 in the Swiss Code of Obligations, be applicable to a private

taxpayer; and (iii) the taxpayer be authorized to prepare their tax return in Bitcoins.

However, a taxpayer with a positive outlook for the future value of Bitcoins expressed in Swiss francs could decide to temporarily convert their Swiss francs into Bitcoins and resell them later, hopefully at a profit. It is thus no longer a deposit whose future value in Swiss francs would be guaranteed but a risky investment owing to exchange rate movements.

The first Bitcoin deposits to pay interest (in Bitcoins) have been recently launched, coinciding with the first financial analysis of what should be the equilibrium level of the Bitcoin interest rate (Wesner, 2014). Therefore, we can logically expect the broadening of Bitcoin deposit remuneration, meaning that a gain in Bitcoins be in addition to the potential foreign exchange gain discussed above. However, the tax treatment of these two potential gains will mainly depend on the legal nature given to Bitcoin, which, in turn, will determine the tax plan to which they should be connected. More specifically, should Bitcoin be considered a currency, an asset, an accounting unit, or a payment service?

Before turning to the case of Switzerland, let us quickly examine the international situation. Although Bitcoin can be used to purchase goods and services or stored as an investment, it is not a *fiat* currency and has no legal value in most countries. Currently, its use is prohibited in Russia, Bolivia, Iceland, and Thailand. In China, individuals may use Bitcoins at their own risk, but financial institutions are prohibited from offering any Bitcoin-related services. In Europe, Bitcoin does not match the definition of electronic money provided in Directive 2009/11/EC73 (that is, Bitcoin is not issued as a receivable on the issuer), while the European Banking Authority has issued a considerably negative opinion regarding its use (European Banking Authority, 2014).

Some countries have nevertheless adopted a more pragmatic approach toward Bitcoin, with regulatory and tax developments first observed in 2014. The following are some examples:

i) In Canada, Bitcoin has been recognized as a currency since June 19, 2014. Any gain in Bitcoins is therefore taxed as if it were a foreign currency gain. Any company dealing with Bitcoin-related transactions must be registered with the Financial Transactions and Reports Analysis Centre of Canada, keep records of transactions, report suspicious activities, implement an anti-money-laundering program, etc.

ii) In the US, Bitcoin has been recognized by the Internal Revenue Service (IRS) as an asset ("property"), rather than as a currency, since March 25, 2014. Thus, a taxpayer who makes a profit by selling Bitcoins (or by trading them for another asset) will be taxed on realized profits as measured by the difference between the dollar value on the acquisition date and the dollar value on the



date of sale. If the taxpayer has held their Bitcoins for more than a year, the reduced rate on long-term capital income will apply.

iii) Since August 2013, Germany has considered Bitcoin an accounting unit (*Rechnungseinheiten*), namely, a private currency (*privates Geld*). Consequently, capital gains resulting from a sale in Bitcoins will be subject to a tax of 25% but will be exempt from tax if the holding period exceeds one year, which is a similar tax treatment to that for real estate gains. This also opens the door to applying value-added tax (VAT) on the commercial sale of Bitcoins.

iv) On July 11, 2014, France expressed its position in an administrative commentary wherein it defined Bitcoin as an accounting unit rather than a currency. Bitcoin-related earnings are subject to income tax in the non-commercial-profits category if they are occasional and in the industrial-and-commercial-profits category if they are customary. They are also subject to social levies on property income. Moreover, Bitcoin holdings are included in the solidarity tax base (*impôt de solidarité*), as defined in Article 885 E of the French Tax Code (*code général des impôts*), and are subject to duties on the free transfer of assets (*droits de mutation à titre gratuit*).

v) Great Britain originally announced that it recognized Bitcoin as an exchange currency (voucher) subject to VAT. However, after the bankruptcy of the MtGox Bitcoin exchange platform, Great Britain revised its position in a preliminary notice issued in March 2014. It now taxes Bitcoin-based capital gains and losses in the same way as foreign exchange gains and losses but without giving Bitcoin currency status.

Clearly, the international regulatory and tax situation is evolving. Many countries are in a waiting mode, particularly in Europe, where a certain harmonization should occur. However, what is happening in Switzerland? On June 25, 2014, the Federal Council published a report on virtual currencies. In a relatively moderate stance, the report noted that “the economic importance of virtual currencies as a means of payment is currently insignificant” and “is not expected to increase in the near future.” Consequently, it suggested “not to legislate in the immediate future.” However, the report described the main principles governing the legal treatment of virtual currencies from the perspective of private law, criminal law, and financial market law. In particular, it stated that Bitcoin is not a security paper, warrant, financial contract, or a derivative but that it should be considered a “means of payment.” It also mentioned that Bitcoin deposits are allowed; however, these deposits should be treated as deposits within the meaning of the banking legislation and should therefore be regulated accordingly. In a factsheet published on

June 25, 2014, the Swiss Financial Market Supervisory Authority (FINMA) confirmed Bitcoin as a means of payment and that Bitcoin deposits should be treated as bank deposits, with everything such deposits imply in terms of prior authorizations. Concurrently, the FINMA authorized the Swiss Bitcoin Exchange to become the first Bitcoin trader in Switzerland.

Furthermore, the report of the Federal Council has no force of law, but it can be considered an indication of governmental will. To date, only metal coins issued by the Confederation, banknotes of the Swiss National Bank (SNB), and demand deposits in Swiss francs at the SNB constitute legal means of payment in Switzerland (Federal Law on Currency and Payment Instruments). In this regard, electronic currencies, such as Bitcoin, are not a legal means of payment. Moreover, such currencies are not included in the SNB’s currency monopoly. Nevertheless, if Bitcoin was officially recognized in Switzerland as a legal means of payment, this would help clarify its tax situation, particularly with respect to the following.

- Bitcoin would be excluded from the scope of VAT (Art. 21, Al. 19, Let. D of the Federal Act on Value Added Tax).
- Entities providing payment services or taking Bitcoin deposits would need to be licensed and regulated.
- Gains arising from the sale of Bitcoins should be exempt from tax, both at the federal and cantonal levels, unless such gains are part of the taxpayer’s commercial wealth.
- Bitcoin-related revenues (e.g., interest on Bitcoin deposits) could then be considered revenue from movable property and taxed accordingly.

Like its European neighbors, Switzerland faces the need for uniform regulations for Bitcoin and, more generally, for virtual currencies. Bitcoin contracts for difference (equivalent to Bitcoin forward contracts) are already traded on several virtual exchanges, and Bitcoin futures and options are traded on the Chicago Mercantile Exchange. The strategies described to create synthetic cash could therefore use Bitcoins as underlying assets. Here, again, the US has moved quickly regarding this aspect (Brito et al., 2014). The IRS applies general tax principles to transactions in virtual currencies (Notice 2014-21, Q&A-1) including the tax straddle rules to offsetting positions. Therefore, leaving these instruments in a gray area, from both a regulatory and a tax perspective, is undesirable for Switzerland because it would likely create another loophole.

## CONCLUSION

The synthetic replication of the economic characteristics

of a given asset by a portfolio comprised of derivatives is a basic activity of financial engineering. It has engendered many regulatory and tax inconsistencies, particularly when the legal form used differs considerably from the economic substance obtained. The examples of synthetic cash discussed herein illustrate this issue well. Indeed, under certain conditions, it is possible for a Swiss investor to create a bond-type economic substance that adopts the fiscal form of a tax-exempt capital gain and is thus exempt from income tax. The Swiss tax authorities may threaten to requalify such doing as “quasi-professional securities trading” or as “tax evasion.” However, this would open the door to considerable legal uncertainty since practically any hedging transaction can suffer a similar fate. The approach taken by the US to prevent the abuse of such synthetic cash constructions seems more robust, with specific rules targeting a broad range of transactions that substantially eliminate the risk of loss and the opportunity for gain for a taxpayer. In particular, consider the straddles (IRC Section 1092) and constructive sales (IRC Section 1259) rules, as discussed by Schizer (2001), Brennan (2013), and Gorella (2020).

Given that interest rates are currently at record-low levels, synthetic cash is not particularly attractive at present. It also requires establishing a technically complicated solution to ultimately achieve a substantially low, albeit tax-free, remuneration. However, should interest rates rise, synthetic cash could rapidly develop as a trade, which in turn could become a serious concern for tax authorities. Therefore, the latter should urgently examine the taxation of synthetic cash, and more generally review the taxation of portfolios containing new financial instruments such as derivatives, synthetic products, and virtual currencies. The increasing use of such instruments has directly invalidated a series of major historical distinctions (equity vs. bond, interest vs. dividend, owner vs. beneficiary, own funds vs. foreign funds, etc.), which a large part of several tax systems still rely on today.

## ACKNOWLEDGEMENTS

The author appreciates the insightful comments and constructive suggestions of two anonymous referees as well as the editorial assistance of Sophie Maire.

## CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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