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Is there any evidence of VAT related buoyancy effects in Greece?

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Abstract

This paper investigates the presence of buoyancy effects in VAT revenue. The projected improvement in economic conditions from 2014 onwards could result in cumulative gains in VAT revenue up to 0.70% of GDP in the period from 2014 to 2016. There is evidence that the intensification of VAT related audits and a likely shift in consumption patterns away from necessity goods (that are taxed at lower VAT rate) will further increase tax efficiency. The abovementioned factors can boost VAT revenue beyond what is currently expected, facilitating the achievement of future primary balance targets.

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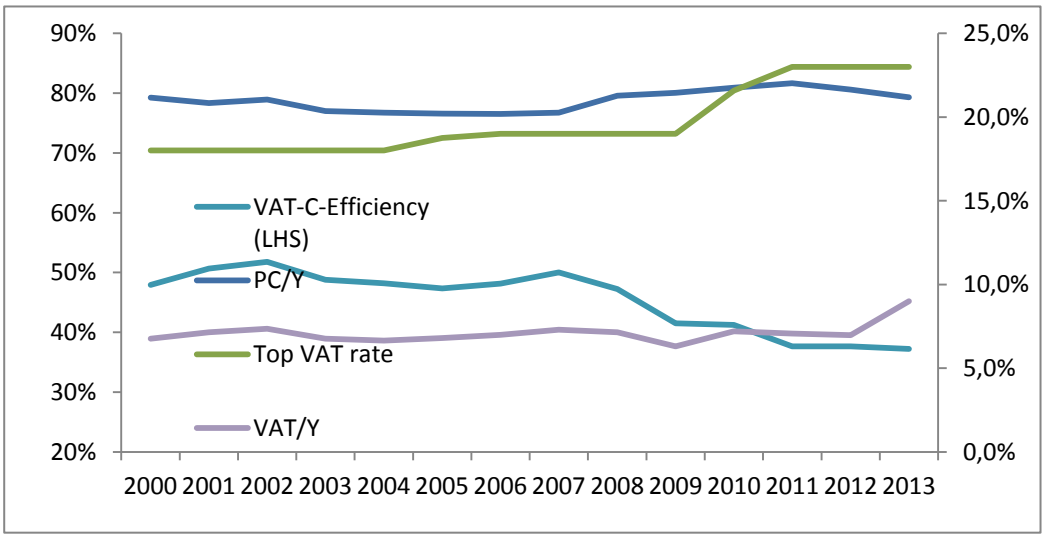
1. Introduction

The on-going fiscal consolidation has substantially improved fiscal balances. Indirect tax, and in particular, VAT rate hikes have played a prominent role at the beginning of this effort in 2010-2011.[1] Nevertheless, the successive increases in VAT rates since March 2010 did not bring about a higher VAT to GDP ratio (IMF, 2013a). Meanwhile, the collection efficiency of VAT deteriorated dramatically in recent years, i.e. from about 50% in 2007 it declined to about 41% in 2009-2010 and moved further down at about below 38% in 2011 (see Figure 1), compared to the unweighted OECD average (excluding Greece) of 0.67 in 2011.[2] The dramatic drop observed in 2009-2011 has moderated substantially in 2012-2013; however, it hasn't been reversed raising concerns about the future VAT revenue performance.

Several studies (see e.g. Sancak et al. 2010 and Bank of Greece, 2013) have pointed out that VAT collection efficiency varies across the business cycle (see Figures 2 and 3). This could be related to behavioral changes by consumers (increased consumption of (necessity) goods that carry a lower VAT rate), as well as a worsening in tax evasion (IMF, 2013a) in particular during recessions (see e.g. Poghosyan 2011; Brondolo 2009; Sancak et al. 2010). This could be driven by changes in confidence, liquidity pressures, as well as by a weak tax administration system.

Figure 1: VAT-C-efficiency, top VAT rate, and VAT revenue



Notes: Top VAT rate stands for the standard VAT rate; VAT/Y is VAT collections as a % of GDP.We define VAT C- efficiency as the share of VAT revenue in private consumption, normalized by the standard VAT rate. PC/Y stands for private consumption over GDP.

[1] There have been a series of VAT rate changes in particular in 2010-2011. For example, in 2010 Q1 VAT rates were raised to 21%, 10%, 5% from 19%, 9% and 4.5% in effect since 2005. In 2010 Q2 the rates were further increased to 21%, 11% and 5.5%. In 2010 Q3 the higher rate was further increased to 23%. In 2011 Q1 the middle and lower rates were increased to 13% and 6.5%, and from 2011 Q3 the higher rate of 23% was applied to a wider base of products, i.e. catering and restaurant services (food and drinks that were previously taxed at 13%). However, since 1st August 2013 the catering and restaurant services where transferred back to the middle VAT rate of 13%; see Bank of Greece (2010-2014).

[2] We define VAT C- efficiency as the share of VAT revenue in the tax base (private consumption), normalized by the standard VAT tax rate: VAT C-efficiency = [(VAT revenue/private consumption)/standard tax rate], rearranging it becomes VAT C-efficiency = (VAT revenue/(private consumption*standard tax rate). If VAT C-efficiency = 1, that is because VAT revenue equals the product of the standard rate and private consumption, a situation that can only occur if 100% of private consumption is taxable (see Ebrill, L. et al. 2001). Data on VAT rates were taken from Bank of Greece (2010-2014). Changes in the middle and lower VAT rates and exemptions are not fully reflected here. If there were no exemptions from the standard VAT rate the theoretical value of the VAT C-efficiency ratio would have been 100%.

Figure 2: VAT-C-efficiency and output growth

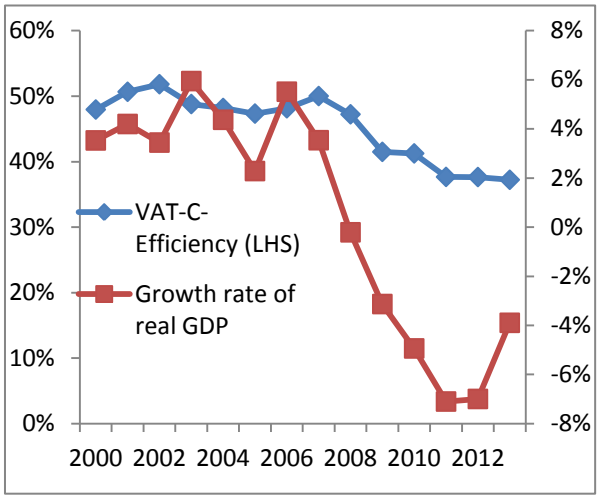
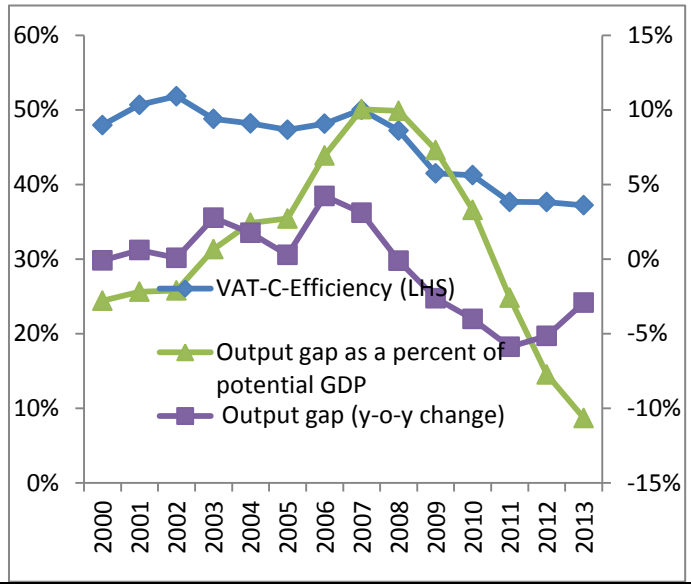


Figure 3: VAT-C-efficiency and output gap



Building on the aforementioned studies we examine the VAT revenue efficiency performance as a way of understanding the recent revenue shortfalls and the prospects for buoyancy effects in VAT revenue in view of the projected economic recovery. We examine the relationship between VAT revenue efficiency and various economic activity indicators. We focus on tax efficiency and its behaviour over the business cycle as a way of understanding whether there are buoyancy effects in tax revenue. In case of positive buoyancy tax efficiency will increase, i.e., revenues will be a bigger part of the tax base in booms and smaller in recessions. [3] In addition, we control for other policy changes since 2010 and we take into account the VAT related tax audits that have been conducted since January 2012.

Our findings provide empirical evidence in favor of buoyancy effects in VAT revenue, i.e., VAT revenue efficiency is positively associated with various proxies of economic activity. In particular, a 1% increase in real GDP growth rate increases VAT efficiency by about 0.438% to 0.942% (or by about 0.20 percentage points (p.p.) and 0.43 p.p., respectively). The findings are more sizeable when considering proxies of the output gap, i.e., a 1 p.p. increase in the output gap increases VAT efficiency by about 0.641% to 1.212% (or by about 0.29 pp to 0.55 pp, respectively). Based on the current projections for a pickup in output growth, in private consumption, and the prospective narrowing of the output gap in 2014-2016 (European Commission 2014; IMF, 2013), we find that the cumulative gains from buoyancy over these three year period could reach up to 1.3 billion euro (or 0.70% of 2013 GDP).

Moreover, there is evidence that a shift in consumption patterns towards necessity goods depresses VAT collection efficiency given that necessity goods are usually taxed at the lower VAT rate. A likely shift in consumption patterns away from necessity goods (to return to pre-crisis levels) could generate additional revenue gains , with the cumulative effect over the 2014-2016 period increasing up to about 0.86% of 2013 GDP (or 1.6 billion euro). Last but not least, we find evidence that an intensification of VAT related audits has a positive effect

[3] Of course this is not the only way of capturing buoyancy effects (see for example Belinga et al. 2014) and it might not reflect all factors inducing changes in buoyancy.

on VAT collection efficiency. These findings imply that the projected improvement in economic conditions from 2014 onwards, including a shift in the consumption patterns towards non-necessity or durable goods, and an increased emphasis on tax audits can increase VAT revenue beyond what is currently expected, facilitating the achievement of future fiscal targets.

In the remainder we consider the following: Section 2 discusses data issues and methodology. Section 3 presents the main findings. Section 4 presents a simple back of the envelope exercise of the likely gains from buoyancy in 2014-2016. Finally, Section 5 summarizes and concludes.

2. Data and methodology

We use quarterly data on VAT revenue, private consumption and GDP over the period 2000:Q1-2013:Q4. Following earlier IMF studies like Sancak et al. (2010) and Bank of Greece (2013) we investigate the effect of cyclical economic activity (buoyancy effects) on VAT C-efficiency by estimating with OLS (with robust standard errors) equation (1)[4]:

$$\Delta log(VAT\ C\text{-}efficiency)_t = \alpha + \beta * \Delta(economic\ activity)_t + \varepsilon_t \quad (1)$$

The key issue in estimating equation (1) is finding the appropriate economic activity indicator that reflects the gap of current economic conditions from potential output. For annual data the natural candidate is the output gap, which is the difference between of real GDP from the potential output of the economy calculated by means of the production function (PF) approach. Unfortunately, in case of quarterly data there is no estimate of the potential output calculated by the PF approach making difficult to have a reliable quarterly estimate of output gap.

Hence, we shall consider two alternative indicators of the output gap at quarterly frequency ($\Delta ygap1_t$, $\Delta ygap2_t$) that use proxies of the potential GDP, as well as real GDP growth rate $\Delta log(Real\ GDP)_t$. First we convert the annual potential output calculated with the PF approach into quarterly frequency by considering the quadratic match sum approach. The quarterly output gap is calculated as: $ygap1_t$= *[(real GDP-potential real GDP)/potential real GDP]* and the year-on-year difference is: $\Delta ygap1_t = gap1_t - gap1_{t-4}$.

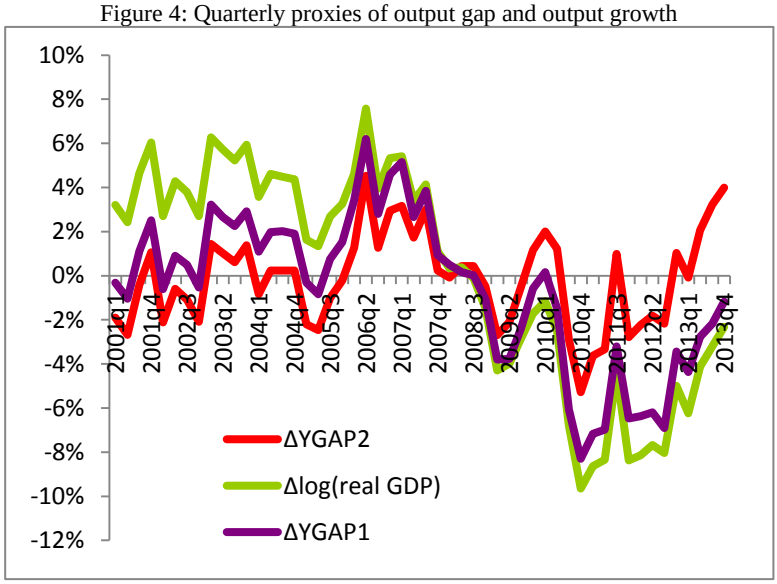
Second, we proxy the quarterly potential GDP with the trend real GDP that has been extracted by means of an HP filter. In this case the quarterly output gap is calculated as: $ygap2_t$ *=[(real GDP-trend real GDP)/trend real GDP]]* and the year-on-year difference is: $\Delta ygap2_t = ygap2_t - ygap2_{t-4}$. Last but not least, we consider also real GDP growth (as in Sancak et al 2010) as our cyclical economic activity variable, i.e.: $\Delta log(Real\ GDP)_t = log\ Real\ GDP_t - log\ Real\ GDP_{t-4}$.

Visual inspection of Figure 4 shows that the two output gap proxies ($\Delta ygap1_t$ and $\Delta ygap2_t$) move closely together from the start of the sample till mid 2008, but from that period onwards it is $\Delta ygap1_t$ and $\Delta log(Real\ GDP)_t$ that move closely together. The three indicators of quarterly economic activity (Figure 4) are more volatile than their respective annual

[4] We have also considered OLS with Newey-West standard errors, i.e., the error structure is assumed to be heteroskedastic and autocorrelated up to lag one. Moreover, we have also considered a generalized least-squares method to estimate the parameters in a linear regression model in which the errors are assumed to follow a first-order autoregressive process.

counterparts (shown in Figures 2 and 3). However, qualitatively they look alike; we' ll use all of them in the subsequent analysis for robustness reasons.

Figure 4: Quarterly proxies of output gap and output growth



We examine several variants of specification (1) considering other control variables. First, we add the "EAP" dummy variable (equal to 1 from 2010 Q2 onwards, 0 otherwise), which captures the period that Greece is under joint EU-IMF surveillance. During that period Greece had to take several measures to improve revenue administration and to fight tax evasion. Moreover, tough consolidation measures were implemented in this period.

Second, we add three dummy variables: (1) d2010 equal to 1 from 2010Q2 on, 0 otherwise; (2) d2011 equal to 1 from 2011Q1 on, 0 otherwise; (3) d2012 equal to 1 from 2012Q1 on, 0 otherwise; and (4) d2013 equal to 1 from 2013Q1 on and 0 otherwise. These four dummy variables control for permanent policy measures initiated in 2010, 2011, 2012, and 2013, respectively (i.e., each of the policy changes in 2010, 2011 and 2012 have a carry-over effect in subsequent years).

Building on earlier studies we also investigate the effect of possible shifts in consumption patterns, as well as the effect of the ability to fight tax evasion. As pointed out by Sancac et al (2010) "*during a downturn (upswing), it is reasonable for rational consumers to increase (decrease) the share of necessity goods and services in total consumption*….". Hence "…*shifts in consumption patterns can have a significant impact on revenue collections, as necessity items are either zero-rated or taxed at a lower than standard rate in many countries*." We take into account possible shifts in consumption patterns by including the (year-on-year difference of the) share of necessity goods in total household consumption. Necessity goods are considered to be the following: food and non-alcoholic beverages and housing, water, electricity, gas and other fuels.[5]

We account for the fight against tax evasion by incorporating in the analysis the (log of the) number of VAT related audits that have been concluded in recent years. These targeted tax

[5] These are the annual HICP weights of each respective category in the HICP. Annual data have been converted to quarterly by using the quadratic match average approach.

audits have been initiated in the context of the EU-IMF programme in an effort to improve tax administration and can be considered as indicator of the on-going fight against tax evasion. These data are available at the General Secretariat of Information Systems' (GSIS) website and cover the period from January 2012 to December 2013. Unfortunately, in quarterly terms this translates into only 8 data points.[6]

3. Findings

The findings are reported in Tables 1-3. A 1 percentage point (p.p.) increase in Δygap1 increases VAT C-Efficiency by about 0.70% (Table 1, column 1). After controlling for the EAP and the d2010-d2013 dummy variables the coefficient estimate of the quarterly output gap proxy increases above 1, i.e., to about 1.17% in columns 2 and 3. Taking into account the effect of the shift in consumption patterns towards necessity goods (columns 4-6) the output gap coefficient estimate shows slight variability compared to columns 1-3 but overall the effect is not particularly changed. When we take into account both VAT related audits and shift in consumption pattern the output gap coefficient estimate is about 1.019% (column 7) and increases to 1.212% (column 8) when we include the EAP dummy. Overall, if the output gap closes by 1 p.p. the VAT-C-efficiency ratio will increase by about 0.29 pp to 0.55 pp (corresponding, respectively, to the 0.641% and 1.212% estimates in columns 4 and 8).[7]

It is worth highlighting that an increase in the share of necessity goods, which are usually taxed at the lower VAT rate, reduces VAT collection efficiency. More specifically a 1 p.p. increase in the share of necessity goods to total household consumption lowers VAT efficiency by about 0.27-0.60% (columns 4-8). At the same time the tax audits variable is associated positively with VAT-C-efficiency implying that concerted effort by the tax administration can improve VAT collection efficiency. In more detail a 1% increase in tax audits increases VAT C-efficiency by 0.01-0.12% (columns 7-8).

In Table 2 we present the findings for the second output gap proxy (Δygap2) which is based on the HP filter. In this case there is a more pronounced positive association between VAT-C-efficiency and the output gap proxy, with the coefficient estimates being around 0.94% to 1.39%. Both the shift in consumption patterns towards necessity goods and the tax audits variable have a statistically significant effect on VAT C-efficiency.

[6] Due to the limited data availability and in order to make use of the tax audit data in our estimation we resort to the following assumption, i.e., prior to 2012 there were no targeted VAT related tax audits. This allows us to set equal to 0 all pre-2012 data points for the (log of the) tax audits variable.

[7] The calculations are based on the sample average VAT-C-efficiency ratio of 45.4%. Using the 2011-2013average of VAT C-efficiency of 37.5% the incremental change is, respectively, 0.24 and 0.45 p.p.

Table 1: VAT-C-efficiency and output gap (Δygap1)

	1	2	3	4	5	6	7	8
Dependent variable:	VAT-C-efficiency							
Δygap1	***0.701 (2.321)****	***1.174 (1.84)****	1.168 (1.62)	***0 .641 (2.09)****	***1.311 (2.00)****	1.123 (1.64)	***1.019 (3.23)*****	***1.212 (1.87)****
EAP		0.047 (0.99)			0.069 (1.30)			0.0247 (0.46)
D2010			0.046 (0.78)			0.039 (0.72)		
D2011			-0.045 (-1.43)			-0.036 (-1.12)		
D2012			0.095 (1.95)*			0.094 (2.06)**		
D2013			-0.050 (-0.96)			0.018 (0.41)		
Δ(consumption share of necessity goods)				***-0.267 (-2.03)****	***-0.404 (-2.25)****	***-0.601 (-3.22)*****	***-0.5199 (-3.34)*****	***-0.538 (-2.96)*****
log(VAT audits)							***0.0115 (2.61)****	***0.0101 (2.61)****
constant	-0.015 (-1.52)	-.0256 (-1.43)	-0.025 (-1.34)	-0.0164 (-1.64)	-0.032 (-1.71)*	-0.033 (-1.69)*	-0.0294 (-2.41)**	-0.034 (-1.74)
R^2	0.0966	0.1259	0.1820	0.12354	0.1810	0.2613	0.2476	0.2530
N	52	52	52	52	52	52	52	52
F-test (p-value)	F(1, 50) = 5.38 (0.0245)	F(2, 49) = 2.81 (0.070)	F(5, 46) = 3.32 (0.0122)	F(2, 49)= 4.94(0.011)	F(3, 48) = 4.21 (0.0101)	F(6, 45) = 4.83 (0.0007)	F(3, 48) = 5.57 (0.0023)	F(4, 47) = 6.62 (0.0003)

Notes: OLS estimation, robust standard errors in parenthesis; ***, **, *statistically significant at 1%, 5% and 10%, respectively.

Turning to the specification with real GDP growth rate we find strong evidence that VAT C-efficiency improves along with economic conditions (Table 3). A 1% increase in real GDP improves VAT collection efficiency by about 0.497% (column 1), while the coefficient estimate reaches 0.995-1.007% when we take into account the EAP and d2010-d2013 dummy variables (columns 2-3). The magnitude of the output growth coefficient estimates remains almost unchanged when controlling for the shift in consumption patterns (columns 4-6). Controlling both for the tax audits conducted in the period 2012-2013 and the shift in consumption patterns we find that the effect of economic activity on VAT C-efficiency ends up to 0.741% in column 7. Taking also into account the EAP dummy the output growth coefficient estimate reaches 0.942% (column 8). Therefore, a 1 percent increase in real GDP

raises VAT-C-efficiency by about 0.20 pp to 0.43 pp (corresponding, respectively, to the 0.438% and 0.942% estimates in columns 4 and 8).[8]

There is a positive and statistically significant effect from tax audits on VAT C-efficiency with the coefficient estimate being 0.01-0.012% (columns 7-8). Last but not least, the shift in consumption patterns towards necessity goods depresses VAT-C-efficiency (by about 0.3-0.5% see columns 5-8).

Table 2: VAT-C-efficiency and output gap (Δygap2)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Dependent variable:	VAT-C-efficiency							
Δygap2	***1.003 (1.91)****	***0.941 (1.71)****	0.902 (1.30)	***1.32 (2.35)*****	***1.387 (2.08)*****	1.060 (1.52)	***1.3491 (2.45)*****	***1.161 (1.73)****
EAP		-0.0143 (-0.63)			0.0081 (0.30)			-0.029 (-0.96)
D2010			-0.006 (-0.19)			-0.006 (-0.19)		
D2011			-0.054 (-1.79)*			-0.044 (-1.42)		
D2012			0.089 (1.85)*			0.087 (1.91)*		
D2013			-0.047 (-0.88)			0.024 (0.55)		
Δ(consumption share of necessity goods)				***-0.497 (-3.32)*****	***-0.532 (-2.33)*****	***-0.685 (-2.91)*****	***-0.659 (-3.32)*****	***-0.620 (-2.72)*****
log(VAT audits)							0.006 (1.60)	***0.009 (2.27)*****
constant	-0.018 (-1.74)*	-0.0140 (-1.01)	-0.014 (-0.96)	-0.019 (-1.92)*	-0.022 (-1.41)	-0.023 (-1.46)	-0.027 (-2.25)**	-0.023 (-1.46)
R^2	0.0711	0.0777	0.1283	0.1597	0.1617	0.2301	0.2033	0.2165
N	52	52	52	52	52	52	52	52
F-test (p-value)	F(1, 50) = 3.64 (0.0620)	F(2, 49) = 2.32 (0.1092)	F(5, 46) = 2.81 (0.0269)	F(2, 49) = 5.52 (0.0069)	F(3, 48) = 4.51 (0.0072)	F(6, 45) = 5.02 (0.0005)	F(3, 48) = 4.3 (0.0090)	0(0.0002)

Notes: OLS estimation, robust standard errors in parenthesis; ***, **, *statistically significant at 1%, 5% and 10%, respectively.

4. A back of the envelope calculation of the gains from buoyancy

Next we'll use some of the abovementioned estimates to better understand the impact of buoyancy effects on VAT revenue in the period 2014-2016. Specifically, we'll use the VAT C-efficiency elasticities 0.438% (low value) and 0.942% (high value) estimated when the variable of interest is output growth and the VAT C-efficiency semi-elasticities 0.641% (low value) and 1.212% (high value) when the variable of interest is output gap (Δygap1).

[8]The calculations are based on the sample average VAT-C-efficiency ratio of 45.4%. Using the 2011-2013average of VAT C-efficiency of 37.5% the incremental change is, respectively, 0.16 and 0.35 p.p.

According to IMF estimates (IMF 2013b) the output gap in percent of potential GDP is expected to change from -10.65% in 2013, to -9.49% in 2014, to -6.88% in 2015, and to -4.43% in 2016, i.e., it will to close by about 1.16 p.p. in 2014, 2.61pp in 2015, and 2.45 p.p. in 2016. Based on the European Commission (2014) and the IMF (2013b) real GDP is expected to be 0.6% in 2014, 2.9% in 2015, and 3.7% in 2016. Nominal private consumption is expected to decline by 2.1% in 2014 and to increase by 1.8% in 2015 and 2.8% in 2016 (European Commission, 2014).

Table 3: VAT-C-efficiency and output growth (Δlog(real GDP))

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Dependent variable:	VAT-C-efficiency							
Δlog(real GDP)	***0 .497 (2.26)*****	***1.007 (1.76)****	***0.995 (1.59)***	***0.438 (1.89)****	***1.018 (1.81)****	0.870 (1.44)	***0.741 (3.08)******	***0.942 (1.68)****
EAP		0.066 (1.12)			0.079 (1.28)			0.033 (0.53)
D2010			0.061 (0.90)			0.047 (0.72)		
D2011			-0.042 (-1.34)			-0.035 (-1.11)		
D2012			0.095 (1.94)*			0.095 (2.05)**		
D2013			-.0468 (-0.91)			0.016 (0.33)		
Δ(consumption share of necessity goods)				-0.225 (-1.59)	***-0.315 (-2.07)****	***-0.519 (-2.93)*****	***-0.450 (-2.96)*****	***-0.456 (-2.88)*****
log(VAT audits)							***0.012 (2.65)****	***0.010 (2.59)****
constant	-0.020 (-1.87)*	-0.039 (-1.59)	-0.039 (-1.47)	-0.020 (-1.93)*	-0.044 (-1.74)*	-0.043 (-1.63)	-0.036 (-2.75)***	-0.044 (-1.73)*
R^2	0.0956	0.1429	0.1998	0.1139	0.1772	0.2573	0.2417	0.2504
N	52	52	52	52	52	52	52	52
F-test (p-value)	F(1, 50) = 5.10 (0.0283)	F(2, 49) = 2.71 (0.0764)	F(5, 46) = 3.21 (0.0143)	F(2, 49) = 4.81 (0.0124)	F(3, 48) = 4.41 (0.0081)	F(6, 45) = 4.41 (0.0014)	F(3, 48) = 5.63 (0.0022)	F(4, 47) = 6.36 (0.00044)

Notes: OLS estimation, robust standard errors in parenthesis; ***, **, *statistically significant at 1%, 5% and 10%, respectively.

On the basis of the above outlook assumptions, we shall examine the impact of the projected improvement in economic activity (increase in output growth/narrowing of the output gap) on VAT revenue performance.[9]

Multiplying the estimated semi-elasticities (elasticities) with the projected narrowing of the output gap (change in output growth) in 2014 we obtain the following: a 1.16 pp narrowing of the output gap in 2014 improves VAT-C-efficiency by about 1.16*0.641% (or 1.212%)

[9] We'll use also the 2013 values of VAT C- efficiency of 37.22% and effective VAT rate (VAT revenue/private consumption: 8.56%, as well as the average values for 2011-2013 for VAT-C-efficiency (37.51%), the effective VAT rate (VAT revenue/private consumption: 8.63%) and the standard VAT rate of 23%.

i.e., by 0.74% (1.41%). This is then multiplied with the VAT-C-efficiency average in 2013 to get the incremental change in 2014. Thus, VAT C-efficiency increases by about 0.28-0.52 p.p. reaching 37.50%-37.74% in 2014 (or on average 37.62% - see Table 4). Assuming that the standard VAT rate of 23% will not change in the period under examination, the effective VAT rate (VAT/private consumption) increases to 8.62%-8.68% in 2014 (or about 8.65% on average – see Table 4). Next, multiplying the calculated effective VAT rates for 2014 with the projected private consumption in 2014 (based on the projection for a decline of 2.1% vis-à-vis 2013) we obtain the estimated VAT revenue for 2014.

Turning to 2015, the 2.61% projected narrowing of the output gap will improve VAT C-efficiency by about 2.61*0.641% (or 1.212%) i.e., by 1.67% (3.16%). This is then multiplied with the VAT C-efficiency in 2014 to get the incremental change in 2015. We find that VAT C- efficiency increases by 0.63 p.p. to 1.19 p.p. reaching 38.12%-38.94% in 2015 (or on average 38.53%; see Table 4), which implies that the effective VAT rate increases on average to 8.86% in 2015 (see Table 4). Multiplying the calculated effective VAT rates for 2015 with the projected private consumption for 2015 (based on the projection for an increase of 1.8% vis-à-vis 2014) we obtain the value of VAT revenue in 2015.

In 2016 output gap is projected to narrow by 2.45pp, this implies that VAT C-efficiency improves by about 2.45*0.641% (or 1.212%) i.e., by 1.57% (2.97%). This is multiplied with the VAT-C-efficiency in 2015 to obtain the incremental change of tax efficiency in 2016. VAT C- efficiency increases by 0.60 p.p. to 1.16 p.p. reaching 38.72%-40.09% in 2016 (or 39.41% on average; see Table 4); while the effective VAT rate increases on average to 9.06% in 2016 (see Table 4). Finally, multiplying the calculated effective VAT rates for 2016 with the projected private consumption for 2016 (based on the projection for an increase of 2.8% vis-à-vis 2015) we obtain the value of VAT revenue in 2016. A similar exercise was performed when examining the projected increase in output growth (see Table 4).

Table 4: VAT-C-efficiency and VAT effective rate (yearly averages calculated based on high and low GDP (YGAP1) elasticities (semi-elasticities))

Period	Effective VAT rate (YGAP1)	Effective VAT rate (GDP)	VAT-C-Efficiency (YGAP1)	VAT-C-Efficiency (GDP)
2013	8,56%	8,56%	37,22%	37,22%
2014	8,65%	8,60%	37,62%	37,37%
2015	8,86%	8,77%	38,53%	38,12%
2016	9,06%	8,99%	39,41%	39,10%

Based on the abovementioned back of the envelope exercise, we find that in 2014-2016 the cumulative gains from buoyancy are estimated to be, on average, around 942.1 –1,047.4 million euro or 0.52-0.58% of 2013 GDP (see Table 5). Using the high values of the estimated elasticities the gains from buoyancy could even reach about 1.3 billion euro (0.70% of 2013 GDP). While based on the low values the gains amount to about than 0.7 billion euro or 0.39% of 2013 GDP.[10]

[10] On account of the shrinking tax base (private consumption) in 2014 these gains materialize in 2015-2016. Based on this back of the envelope exercise VAT revenue increase more than 1-1 vis-à-vis private consumption in 2015-16

Table 5: Tax buoyancy in 2014-2016 : VAT revenue

GDP or YGAP1 Estimate	Based on GDP (Eur mil.)	Based on GDP (in % of 2013 GDP)	Based on Output gap (YGAP1; Eur mil)	Based on Output gap (YGAP1; in % of 2013 GDP)
Average	942.1	0.52%	1047.4	0.58%
Low	705.9	0.39%	814.2	0.45%
High	1178.3	0.65%	1280.5	0.70%

The projected increase in VAT revenue in 2014-2016 takes into account the estimated impact of the narrowing of the output gap (on the output growth increase) on VAT C-efficiency, but assumes that the VAT rates will remain unchanged. Moreover, the likely gains from the improvement in tax administration and the fight against tax evasion (which raises VAT C-efficiency) are not reflected here. The same applies for a likely reversal in consumption patterns away from necessity goods. These two factors which could yield additional gains in terms of VAT revenue are examined in the next subsection.

4.1 The effects of a likely shift in consumption patterns and an intensification of tax audits

On the basis of the coefficient estimates presented in Tables 1-3 we can extent this back of the envelope exercise to account for the likely change in consumption patterns as well as the gains from the intensification of VAT related tax-audits.

The share of necessity goods in total household consumption has reached 29.0% in 2013 vis-à-vis a pre crisis level of 26.0% in 2007. On account of improving economic conditions we consider two scenarios: first a gradual return to pre-crisis levels i.e., by about 1p.p. per year in 2014-2016 (scenario 1). Second a more optimistic scenario with a more rapid convergence to pre-crisis levels, i.e., by 2p.p. in 2014 and 0.5 p.p. in 2015 and 2016 (scenario 2). This more optimistic scenario implies that the eventual resolution of the sovereign debt crisis and Greece's the return to positive growth in 2014 will induce them to consume more durable goods (that are taxed at higher rate) vis-à-vis necessity goods already in 2014 (e.g., the purchase of durable goods might have been postponed during the crisis years on account of both income cuts and high uncertainty that induced people to save rather than consume). We shall consider both the GDP and output gap estimates presented above, but for the sake of brevity we'll present projections for 2014-2016 only for the output gap estimates.

According to scenario 1 an annual 1 p.p. decrease in the share of necessity goods to total consumption increases VAT-C-efficiency by about 0.19 p.p. per year in 2014-2016 (relative to the previous year). Whereas, in scenario 2 a 2 p.p. increase in the share of necessity goods in 2014 increases VAT C-efficiency by about 0.37-0.38 p.p. in 2014 vis-à-vis 2013. The annual increases in 2015-2016 amount to 0.09-0.10 pp.

In scenario 1 the average gains from buoyancy including the shift in consumption patterns away from consumption goods could reach up to 0.60%-0.86% of GDP in 2014-2016 (see

Table 6). The average gains from buoyancy in Scenario 2 (Table 7) are quite close to those in Scenario 1, the only difference being that tax revenue gains in 2014 are slightly more sizable on account of the assumption for pronounced shift away from necessity goods in 2014.

Table 6: Scenario 1- Gains from buoyancy and shifts in consumption patterns 2014-2016 (in % of 2013 GDP) : based on output gap

Output gap estimate	2014	2015	2016	2014-2016
average	0.01%	0.32%	0.40%	0.73%
low	-0.01%	0.27%	0.34%	0.60%
high	0.04%	0.37%	0.45%	0.86%

*total gains from buoyancy refer to the narrowing of the output gap by 1.16 pp in 2014, 2.61 pp in 2015 and 2.45 pp in 2016 as well as an annual 1 pp decrease in the share of necessity goods in 2014-2016.

Turning next to the effect of tax audits we find that an annual 10% increase in the number of concluded tax audits increases VAT-C-efficiency by about 0.05 p.p. per year in 2014-2016 (relative to the previous year). Based on this we find that there is an additional cumulative revenue increase of about 0.02% of 2013 GDP over the period 2014-2016 (compared to the projections in Tables 9-12).[11]

Table 7: Scenario 2- Gains from buoyancy and shifts in consumption patterns 2014-2016 (in % of 2013 GDP) : based on output gap

Output gap estimate	2014	2015	2016	2014-2016
average	0.05%	0.30%	0.38%	0.73%
low	0.02%	0.25%	0.32%	0.60%
high	0.07%	0.36%	0.43%	0.86%

*total gains from buoyancy refer to the narrowing of the output gap by 1.16 pp in 2014, 2.61 pp in 2015 and 2.45 pp in 2016 as well as a 2 pp decrease in the share of necessity goods in 2014 and an annual 0.5 pp decline in 2015-2016.

5. Summary and conclusions

This paper provides shows that there are buoyancy effects in VAT revenue. According to the estimates presented above VAT revenue efficiency is positively associated with various proxies of economic activity. A 1% increase in real GDP growth rate increases VAT C-efficiency by about 0.438% to 0.942% (or by about 0.20 p.p. and 0.43 p.p., respectively). The findings are more sizeable when considering proxies of the output gap, i.e., a 1 p.p. increase in the output gap increases VAT efficiency by about 0.641% to 1.212% (or by about 0.29 p.p. to 0.55 p.p., respectively).

Based on the current projections for a pickup in output growth, in private consumption, and the narrowing of the output gap in 2014-2016 (European Commission 2014; IMF, 2013b), we find that the cumulative gains from buoyancy over these three year period could reach up to 1.3 billion euro (or 0.70% of 2013 GDP).

The quantitative estimates are robust to the inclusion of various dummy variables capturing policy changes in 2010-2013. There is evidence that a shift in consumption patterns towards

[11] The overall cumulative gains from the narrowing of the output gap, the shift in consumption patterns and the intensification of tax audits could reach up to 0.88% of in 2014-2016. The revenue gains from tax audits are probably substantially underestimated in view of the limited data information available at the moment.

necessity goods depresses VAT collection efficiency given that necessity goods are usually taxed at the lower VAT rate. A likely sift in consumption patterns away from necessity goods (to return to pre-crisis levels) could generate additional revenue gains , with the cumulative effect over the 2014-2016 period increasing up to about 0.86% of 2013 GDP (or 1.6 billion euro). Furthermore, we find evidence that an intensification of VAT related tax audits has a positive effect on VAT collection efficiency, without depressing the coefficient estimate of the economic activity variable. This implies that doing more to address tax evasion can further boost revenue performance through the tax compliance channel. Of course it should be mentioned here the low VAT-C-efficiency in Greece vis-à-vis its OECD peers is also affected by numerous exemption (reduced rates etc) from the standard VAT rate. A rationalization of the VAT system is therefore required (see IMF, 2014) in order to improve its collection efficiency.

Concluding, the current analysis suggests that the projected improvement in economic conditions from 2014 onwards, including a likely shift in the consumption patterns towards non-necessity goods, and an increased emphasis on tax audits could increase VAT revenue beyond what is currently expected. This positive development will contribute to the over-achievement of future fiscal policy targets.

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