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Tax arrears and VAT revenue performance: Recent evidence from Greece

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Abstract

Using regional data on VAT revenue collection over the period 2006-2011, we find that an increase in VAT-related tax arrears and uncollected (VAT related) fines reduce tax compliance and consequently result in lower VAT revenue. These findings are very important at the current juncture for Greece because they show that improvements in tax revenue administration and tax enforcement mechanisms can deter tax evasion, increase tax revenues and contribute to the on-going fiscal consolidation effort.

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1. Introduction

One of the goals of the on-going fiscal adjustment effort in Greece is to improve tax administration efficiency in order to fight tax evasion and raise revenue collection (IMF, 2013).[1] Several international organizations have reported that Greece lags behind in the efficiency of tax collection vis-à-vis its EU partners. For example, if Greece brings the VAT collection efficiency to the EU average it could increase revenues by about 1½-3% of GDP per year (IMF, 2012). While according to OECD (2013) if Greece could collect VAT and social security contributions with the same efficiency as its main OECD partners do it, then Greek tax revenues in 2011 would have been 6 percentage points higher, covering the projected fiscal gap over the period 2014-2016.[2]

To this end, in the context of the EU-IMF financed fiscal consolidation programme, Greek authorities have to meet certain quarterly or biannual structural benchmarks/targets regarding tax revenue administration, i.e., number of tax audits performed, collection of tax arrears and fines etc. Despite the recent improvements, tax arrears continue to increase undermining tax compliance. Recent data unveiled by the Hellenic Ministry of Finance (Ministry of Finance (henceforth MoF), 2014) revealed that tax arrears increased from 44.9 billion euro at the end of 2011 to 55.1 billion euro at the end of 2012, and have further increased to about 62,1 billion euro or 34.0% of GDP at the end of 2013 and stand at 65,5 billion euro (or 36,2% of 2013 GDP) at the end of March 2014.

Since the start of the implementation of the EU-IMF Economic Adjustment Programme (EAP) Greek authorities have been advised against resorting to tax amnesties as this undermines tax compliance. In the course of 2013 important steps have been taken towards improving the efficiency of the tax service and to strengthen tax collection. In more detail, in order to improve the collection of taxes and social security contributions (SSC), newly designed tax and SSC instalment schemes have been launched (see European Commission, 2013). A "basic scheme" with a 12-month duration was designed to become the normal way of repaying tax or social security debt. In light of the difficult economic conditions, liquidity pressures and tax obligations a special last-chance scheme ("fresh start") was put in place so as to allow debtors to repay old (2012 and before) debt in instalments until 2017. In addition, a new legislation was put in place allowing for the simplification of the procedure to classify debt as uncollectable, and suspend collection activities on uncollectable debt. Moreover, risk assessment techniques are put in place for audit, debt collection and tax refunds, while at the same time improving IT tools available for tax auditing purposes. [3]

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[1] Sancak et al. (2010) have shown that an increase in the ability to control tax evasion increases VAT collection efficiency. However, low tax efficiency could be attributed to other reasons as well, such as the extensive use of low VAT rates, the shift of consumption patterns towards goods and services with low VAT rates and bad economic conditions (Sancak et al., 2010).

[2] A recent study by Artavanis et al. (2012) based on 2009 data estimates that the undeclared income reached 28 billion euro, with the biggest tax offenders being self-employed professionals. The authors estimate that the tax revenue loss was 31% of Greece's 2009 general government deficit (which was 15.6% of GDP). Keen and Smith (2007) discuss the issue of VAT fraud and evasion, according to studies cited therein VAT tax evasion is estimated at 20.2% (of hypothetical revenue) in Greece (with the reference period being 1994-1996).

[3] On top of the on-going structural fiscal reforms, Greek authorities have undertaken a number of tax revenue changes in order to boost revenue performance: increases in personal and corporate income taxes, tax base broadening, introduction of extraordinary tax levies, increases in property income taxes, and increases in excise and VAT tax rates.

The recent improvements in tax administration are expected to yield additional revenues supporting the fiscal consolidation effort in the period 2014-2016. According to the European Commission (2013) the cumulative expected yield from changes in the tax administration in the period 2014-2016 is estimated at 1.5% of GDP.

Building on the very important role attributed (by the EAP) to the improvements in revenue administration as a method of fighting tax evasion and increasing tax revenue, this paper aims at investigating the effects of various tax administration performance indicators (associated with tax arrears and uncollected fines and penalties) on VAT revenue collection. To this end, we use information unveiled by the Greek authorities on VAT revenue collection, VAT-related tax arrears (due to tax amnesties) and uncollected (VAT-related) fines over the period 2006-2011 at the regional level (MoF 2007-2012).[4] On top of that we control for cyclical economic developments at regional level, as well as for changes in standard VAT rates.

Our findings show that an increase in the stock of uncollected (VAT-related) tax fines and in the stock of (VAT-related) tax arrears due to tax amnesties exert negative effects on tax compliance and reduce VAT revenue. Lower economic activity as reflected in higher regional unemployment rates impacts negatively on VAT revenue performance. Increases in the standard VAT rate are associated with higher VAT revenue. Controlling for other relevant factors, time (or year) effects show that the VAT revenue performance has been affected negatively in 2011. This could be associated with the fact that the higher VAT rate of 23% was in effect for the whole year in 2011 (and was applied to a much broader tax base since September 2011).[5]

These finding show that improvements in tax revenue administration and tax enforcement mechanisms and can deter tax evasion, leading to higher tax revenue and facilitating the on-going fiscal consolidation effort. This is of utmost importance for Greece, because it will ensure a fair burden sharing of the fiscal adjustment effort. Moreover, improvements in tax administration and tax collection are a matter of urgency given the recently legislated automatic correction mechanism in the Greek fiscal system (see IMF, 2013). According to this mechanism shortfalls from targets will automatically lead to spending cuts. Hence, from a fair burden sharing point of view it would be problematic if the tax revenue administration is unable to collect taxes and fines and to fight tax evasion leading to new spending cuts on wages, pensions and social expenditure in order to abide by the EAP goals. A situation of this kind could risk undermining public support for the Economic Adjustment Programme objectives.

The remainder of the paper proceeds as follows. Section 2 provides data information and discusses the empirical model and main findings. Section 3 concludes.

[4] Unfortunately, the relevant MoF data for 2012-2013 have not been released yet.

[5] The VAT rates were increased from 19% (9% and 4.5%) in the period 2006-2009 to 21% (and 10% and 5%) on 15 March 2010 and then to 23% (and 11% and 5.5%) on 1 July 2010. While from 1st January 2011 the mid and the reduced rates were increased to 13% (from 11%) and to 6.5% (from 5.5%), with medicines and hotel services being transferred to the new reduced rate of 6.5% from the previous mid rate of 11%. Moreover, from 1st September 2011 food served at restaurants, hotels and cafes and non-alcoholic beverages were all transferred to the high VAT rate of 23% from the new mid rate of 13% in effect since January 1st. Hence the new VAT rate of 23% was in effect for a whole year only in 2011 and was applied to a much broader base of products. Since August 2013 food served at restaurants, hotels and cafes and non-alcoholic beverages were all transferred back to the mid VAT rate of 13%.

2. Data information, methodology and main findings

Based on the information from the MoF (MoF, 2007-2012) we classify the available data on VAT revenue, (VAT-related) tax arrears due to tax amnesties, uncollected (VAT-related) tax fines, and the collection rate of total (VAT-related) tax arrears and fines in the 13 regions of Greece according to NUTS-II[6]. In addition we use regional unemployment rates from Eurostat to proxy regional economic activity, and the standard VAT rates to take into account VAT rate changes (in line with earlier work by Brondolo (2009) and Sancak et al. (2010)).

As can been seen in Figures 1-4, in the period 2006-2011 VAT-related tax arrears and (VAT related) uncollected fines kept increasing, while VAT revenue performance started declining in particular since 2008. In addition, while the average standard VAT rate increased in 2010 and 2011, the collection rates of VAT-related tax arrears and fines followed a declining path. Declining collection rates and increasing stocks of (VAT-related) tax arrears and uncollected fines indicate a laxity in tax enforcement mechanisms and a weak tax administration. These developments erode tax morale and reduce tax compliance. [7]

Using data for the 13 regions of Greece over the period 2006-2011 we estimate equation (1), where i (i=1…13) stands for region and index t (t=1…6) stands for year:

$$\Delta log(\text{real VAT revenue per tax unit})_{it} = \alpha_{1*}\,\Delta log(\text{real VAT revenue per tax unit})_{it-1} + \alpha_{2*}unemployment\ rate_{it} + \alpha_{3*}X_{it-1} + a_4*VAT(2010) + a_5*VAT(2011) + time\ trend + \lambda_i + \varepsilon_{it} \quad (1)$$

It should be stressed that the dependent variable (real VAT revenue per tax unit) reflects within the year VAT revenue collection, i.e., VAT revenue from VAT statements in local tax offices. VAT revenue collected within the year reflecting past years' tax obligations (due to tax amnesties or due to fines) is recorded separately in the State Budget and is not included in the dependent variable. We focus only on the effects of past years' tax arrears and uncollected fines on current years VAT revenue collection (through VAT statements in local tax offices), because these components can act as a signal of the effectiveness of tax administration. Large stocks of tax arrears due to tax amnesties and uncollected fines imply weak tax collection structures and provide incentives for non-compliance. [8]

The vector X_{it-1} includes the log of uncollected (VAT-related) tax arrears and/or the collection rate of fines and total VAT-related arrears and/or the log of uncollected VAT-related fines. λ_i stand for unobserved regional effects; ε_{it} is the random component satisfying the usual properties.

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[6] NUTS-II stands for Nomenclature of Territorial Units for Statistics by regional level. The 13 regions are: Attica, Central Macedonia, Crete, East Macedonia and Thrace, Epirus, Western Greece, Western Macedonia, Sterea Ellada, Ionian Islands, North Aegean, Peloponnese, South Aegean and Thessaly.
See http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction.

[7] See Alm (1999) and Slemrod and Yitzhaki (2002) for a discussion on the importance of audits and penalties as part of tax enforcement policy.

[8] All regional tax revenue variables, VAT revenue, tax arrears and uncollected fines are transformed in real terms by dividing them with the nationwide GDP deflator. In addition, the VAT revenue variable is divided by the number of legal entities and self-employed professionals (tax units) that have filled VAT revenue statements in local tax offices. There is no available information on the number of tax units that are associated with the accumulated VAT tax arrears and uncollected fines. Hence, these two variables have not been transformed into per tax unit terms. Nevertheless, the stock of VAT-related tax arrears and uncollected VAT-related fines contains valuable information on the tax compliance incentives.

The unemployment rate controls for cyclical economic activity developments at regional level; we expect that high unemployment leads to lower VAT revenues. [9] An increase in the stock of uncollected fines and/or tax arrears possibly due to weak tax administration and the repeated use of tax amnesties undermines incentives for tax compliance, impacting negatively on VAT tax revenue collection (see Andreoni et al. 1998). Similarly, a low collection rate of tax arrears and fines implies that tax enforcement is weak, eroding the tax moral. This, in turn, increases tax evasion and reduces VAT revenue (see e.g., Alm, 1999; Andreoni et al. 1998).[10]

We include *VAT* rate dummy variables for 2010 and 2011, as well as a *time trend*.[11] This way we intend to control for two things. First, the impact of the double VAT tax hike in 2010 (from 19% to 21% and then to 23%), which brought the average standard VAT rate at 21.6% in 2010 and at 23% in 2011.[12] Second, by including the time trend we control for trend changes in VAT revenue, i.e., the overall fiscal consolidation effort and the overall progress in fiscal account in the latter years of the sample. It should be taken into account that economic activity has been declining in the years covered by out sample. However, this is already controlled for with the inclusion of the regional unemployment rate variable. Therefore, the time trend variable and the VAT rate dummies do not reflect economic activity developments.

An increase in the VAT rate is expected to be associated with higher VAT revenues (Sancak et al., 2010). However, as discussed in Alm (1999) there is also evidence for the opposite effect (in line with the Laffer curve argument).

In order to control for the likely autoregressive nature of the VAT revenue series we add a lagged dependent variable in specification (1). Due to the presence of the lagged dependent variable and the fact that N=13>T=6 we estimate the model with the two step system GMM

[9] It should be taken into account that changes in consumption patterns could also influence VAT revenue collection because not all goods are taxed at the same rate.

[10] In times of economic crisis business where firms face liquidity pressures they might become more prone to tax evasion as a way of avoiding bankruptcy.

[11] We abstract from examining the mid and reduced VAT rates because they include no additional information compared to the standard VAT rate. This is due to the fact that both for the standard and the mid and reduced VAT rates we have solely time series information (i.e., incorporating the mid and reduced VAT rates would not add cross sectional variability).

[12] The standard VAT rate was 19% in the period 2006-2009 and in 2010 till 14 March. From 15 March till 30 June the standard VAT rate was 21% and from 1 July 2010 till now it is 23%. Consequently, the standard VAT rate in 2010 is calculated as a weighted average i.e., 19% for the first 2.5 months, 21% for the rest 3.5 months and 23% for the last six months of 2010, i.e., 21.6% for 2010 and 23% for 2011. In 2011 the standard VAT rate of 23% was applied to broader tax base. This is not directly reflected in our specification. However, the step increase in VAT rate from 2010 to 2011 is reflected in our estimation by the fact that in 2010 we have included the weighted average of the three standard VAT rates that were applied at the time i.e., 21.6%, while in 2011 we have included 23%. Hence, the step change from one rate to the other is reflected in the VAT rate variable.

estimator (Arellano and Bond, 1995; Blundell and Bond, 1998). [13] Results are shown in columns 1-5 of Tables 1-2.[14]

The regional unemployment rate is instrumented with its second and third lagged value and the second and third lagged value of the growth rate (Δlog) of the real net households' disposable income at regional level. The net households' disposable income is extracted from personal income tax statements and is computed as total households' reported income minus total households' taxes (see MoF, 2007-2012). It is transformed in real terms by dividing the net households' disposable income at regional level with the nationwide GDP deflator. We use the GDP deflator at nationwide level on two grounds. First, there is not regional GDP data running till 2011, so we cannot compute the GDP deflator. Second, even if we could do that, in principle, we should not be expecting substantial differences in the GDP deflator at regional level.[15]

2.1 Findings

An increase in regional unemployment impacts negatively VAT revenue collection. A 1 percentage point (p.p.) increase in unemployment rate reduces VAT revenue by about 1.1-2.6% (see columns 1-5, Tables 1-2). The higher the stock of (VAT-related) tax arrears the lower VAT revenue collection is (column 3 in Table 1 and columns 1 and 3 in Table 2). The same applies for the stock of imposed but uncollected VAT-related fines (column 4 in Tables 1-2). In particular, a 1% increase in VAT-related tax arrears reduces real VAT revenue by about 0.02-0.03%; while, a 1% increase in uncollected tax fines lowers real VAT revenue by about 0.012-0.013%. The collection rates of taxes and fines have no particular effect on VAT revenue.

After controlling for the effect of tax arrears and fines, cyclical economic developments, and the positive time trend effect on VAT revenue (possibly reflecting the overall improvements in tax administration and fiscal consolidation), we find that the increase in the average (standard) VAT rate in 2010 has a significant positive effect on VAT revenue collection. However, the higher average (standard) VAT rate in 2011 (which was the outcome of the 2010 tax policy changes) is associated negatively with VAT revenue performance (see columns 1-5, Tables 1-2).

These finding imply that raising VAT rates improves revenue performance, after controlling for the declining economic activity (in particular since 2008) and the effect of the rising stock of tax arrears and uncollected fines. However, after taking into account the effect of the 2010 VAT rate hike, we find significant evidence of threshold effects, i.e., an additional increase in VAT rate is associated with declining VAT revenue. Therefore, taking into account cyclical economic conditions, the continuation of the fiscal consolidation effort and tax compliance

[13] Nickell (1981) has shown that in the context of fixed effects dynamic panel data models there is a serious bias in the estimate of the coefficient of the lagged dependent variable when the number of panels N is large and the number of time periods T is small (usual fixed effects estimator is inconsistent when the time span is small). In such cases, the instrumental variable (IV) estimator (Anderson and Hsiao, 1981) and the generalized method of moments (difference and system GMM) estimator (see Arellano and Bond (1991) and Blundell and Bond (1998)) have been proposed. The use of difference and system GMM techniques are considered in cases where N is large and T is small.

[14] We consider both first differencing (Table 1) and forward orthogonal deviations (fod) transformations (Table 2). Fod performs better in unbalanced panels.

[15] A collapsed subset of the available instrument matrix was used: namely the second and third lags of the dependent variable, the unemployment rate and the growth rate of real net disposable income.

effects due to uncollected tax arrears and fines, an increase in the VAT rate above a certain threshold could have negative effects on revenue collection both in terms of tax compliance and because it reduces demand for goods and services.[16]

Unfortunately, the VAT rate variable is characterized solely by time series variability. This does not allow us to investigate further the impact of an increase in VAT rate on revenue performance. In principle, the next step should have been interacting the VAT rate variable with time dummies (for 2006-2011) to examine whether the higher average VAT rate in 2011 dampened revenue growth in 2011. Given that both time dummies and VAT rates vary only across time and not across regions, we cannot pursue this further. In addition we cannot simultaneously include in the analysis time dummies (to control for individual year effects) and the VAT rate variable, because the latter drops off due to lack of cross section variability. Hence, we cannot fully disentangle the individual year effects (capturing e.g., political developments) from changes in the average standard VAT rate applicable in each year.

Nevertheless, we can pursue the analysis further by estimating a variant of specification (1) incorporating time dummy variables (but without the VAT rate variable –which in any case would drop off the estimation). This way we examine the role and importance of individual time effects in affecting VAT revenue performance after controlling for region effects.

The findings from this specification are presented in Tables 3-4.[17] An increase in the unemployment rate exerts a negative effect on VAT revenue as reported before. A repeated resort to tax amnesties that leads to accumulation of tax arrears has negative effects on tax compliance lowering VAT tax revenue. In more detail, a 1% increase in VAT arrears due to tax amnesties reduces real VAT revenue by about 0.016-0.025% (the estimates are significant in columns 1 and 4, in Tables 3-4). Similarly, a weak tax enforcement mechanism that imposes fines but fails to collect them, leading to the piling up of uncollected stock of fines and penalties erodes tax morale and reduces VAT revenue. In particular, a 1% increase in stock of uncollected VAT-related fines reduces the real VAT revenue by about 0.011-0.016% (see columns 3 and 5 in Tables 3-4). The coefficient of the collection rate of total tax arrears and fines is not statistically significant.

The year dummy variables produce some very interesting results. Year dummies for 2008, 2009 and 2010 (the year of the double VAT increase) are all associated positively with the collection of VAT revenues.[18] However, the year dummy for 2011 has a negative coefficient estimate, which is statistically significant in 7 out of 10 specifications (see columns 1, 3, 5 in Table 3 and columns 1-3 and 5 in Table 4). 2011 was the second year of implementation of

[16] At the same it should be taken into account that the Greek economy registered the biggest contraction in economic activity in 2011, i.e., 7.1% from 4.9% in 2010 and the biggest increase in unemployment (from 12.6% in 2010 it increased to 17.7% in 2011) in the period under examination (European Commission, 2013). The interaction of higher VAT rates in a continuously contracting domestic economic activity could explain our finding. Nevertheless, our specification already controls for cyclical economic conditions, hence some part could be explained by reduction in tax compliance due to higher rates. Moreover, given that credit conditions have become tighter (European Commission, 2013), firms and self employed professional could have problems complying with tax laws and increased VAT rates. Unfortunately, at the moment credit data are only available at a nationwide level; the lack of cross section information disallows us to examine this conjuncture which is left for future research.

[17] The specifications presented in Tables 3-4 have been estimated with a 2 step system GMM estimator. In Table 3 we have applied first differencing, while in Table 4 forward orthogonal transformation.

[18] The interaction term for 2007 drops out of the estimation, while that for 2006 in not included given the fact that we lose the first time series information due to data transformation and model specification.

the Economic Adjustment Programme for Greece. Moreover, the highest VAT rate of 23% was in effect for the whole year, and it was also applied to a much broader base of products from September 2011 onwards. Nevertheless, the negative coefficient estimate for 2011 cannot be linked with certainty with the application of higher average VAT rate in 2011. Other nationwide factors might have played important role undermining confidence and tax compliance, e.g., political uncertainty and the credit squeeze since early 2011 (European Commission, 2013) that might have led to cash-related constraints preventing firms and self employed professionals from meeting their tax obligations.[19] However, even in that case the application of an even higher average VAT rate might have amplified cash related constraints.

In any case, in Tables 1-2 we do present evidence that, after controlling for the time trend, the unemployment rate and tax arrear developments, there might be a negative association between the higher average VAT rate of 23% applied in 2011 and the VAT revenue collection.

3. Conclusions

Using regional data on VAT revenue collection, VAT-related tax arrears and uncollected tax fines over the period 2006-2011, we investigate the effect of tax administration performance on VAT revenue collection. In addition, we control for the standard VAT rate and unemployment rate at regional level.

Our findings show that a 1% increase in VAT-related tax arrears (due to tax amnesties) reduces real VAT revenue by about 0.016-0.028%; while a 1% increase in the stock of uncollected (VAT-related) fines reduces real VAT revenue by about 0.011-0.016%. Furthermore, an increase in regional unemployment is associated with a decline in VAT revenue collection, i.e., a 1 percentage point increase in unemployment reduces real VAT revenue by about 1.1-2.6%. Increases in the standard VAT rate raise VAT revenue collection. After controlling for other relevant factors, year effects reveal that the VAT revenue performance was affected negatively in 2011. Our analysis indicates that this might be linked with the fact that in 2011 the higher standard VAT rate of 23% was in effect for the whole year, while it was also applied to much broader tax base since September 2011.

The findings of this study indicate that tax enforcement and tax compliance can be enhanced if there is less resort in repeated tax amnesties that contribute to the pilling up of tax arrears.[20] As earlier studies on Greece have shown (e.g., Tagkalakis, 2013) the intensification of tax audits can deter tax related offences. However, the current study shows that revenue performance is at risk if increased audits lead to higher tax fines, which however remain uncollected. Therefore, the improvement in the ability of the tax revenue administration to collect fines and tax arrears is a prerequisite for the success of fiscal consolidation. If this is not achieved, then the intensification of audits will not succeed in fighting tax evasion.

Concluding, improvements in tax administration that involve the collection of past debts, the strict enforcement of penalties and fines and the intensification of audits can induce tax compliance and raise revenue collection. Last but not least, raising tax rates in an

[19] We already control for economic activity development via the regional unemployment rates.

[20] According to European Commission (2014) participation in the new installment schemes for tax and social security debt (basic and fresh start schemes) falls short of initial expectations. There are calls to review the current schemes to make them more attractive, though this would undermine the credibility of the whole effort.

environment of declining economic activity coupled with weak tax enforcement mechanisms can prove counterproductive.

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Figure 1: VAT revenues (based on VAT statements) and tax arrears (in million euro)

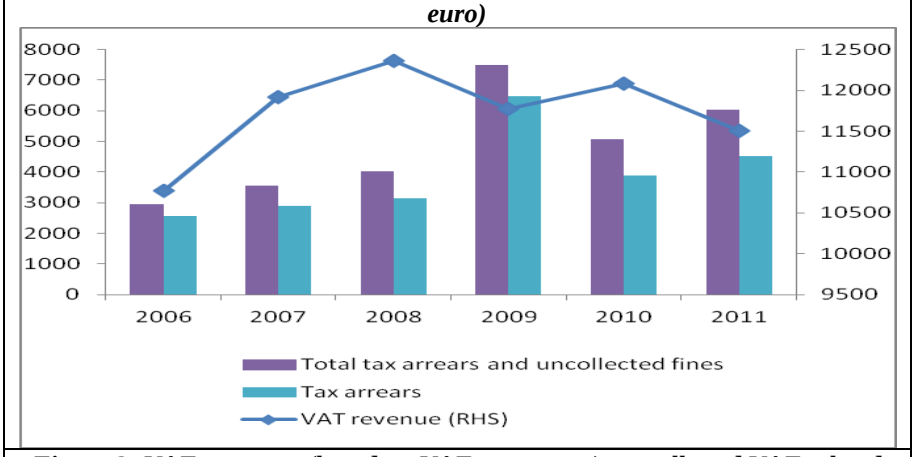

Figure 2: VAT revenues (based on VAT statements), uncollected VAT related fines and VAT tax arrears due to tax amnesties (all in million euro)

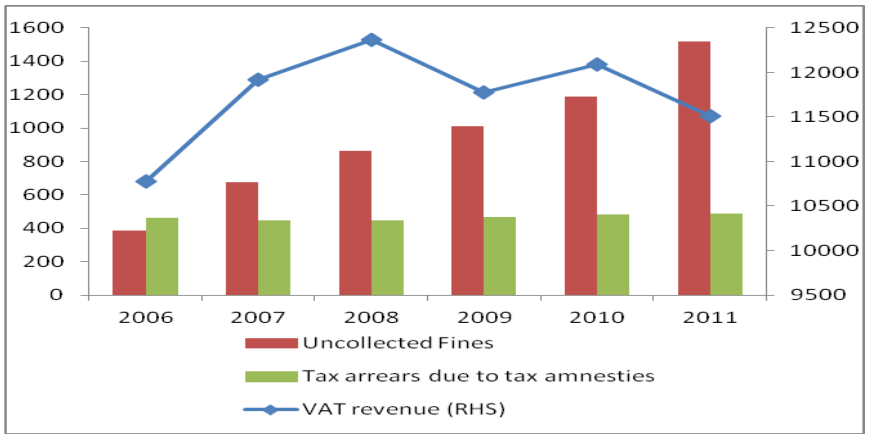

Figure 3: Collection rates of VAT tax arrears and imposed tax fines (in %)

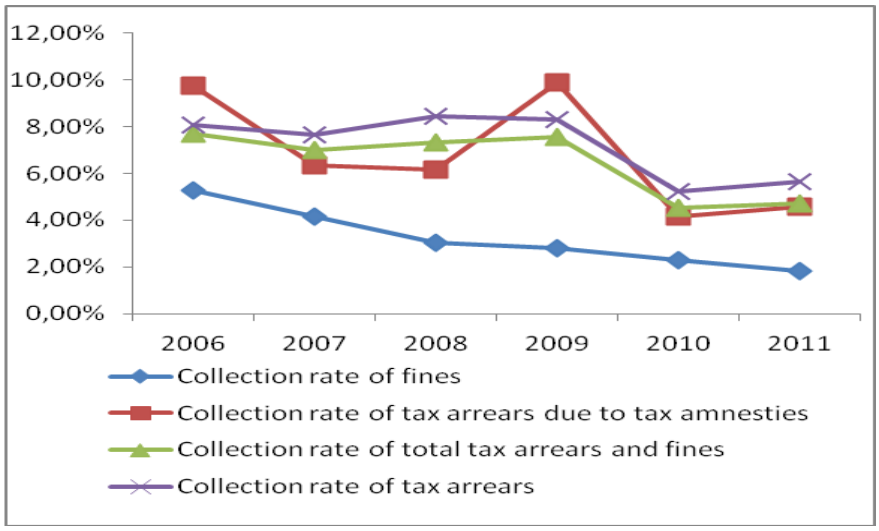

Figure 4: Collection rates of VAT tax arrears and imposed tax fines and the evolution of the average standard VAT rate (in %)

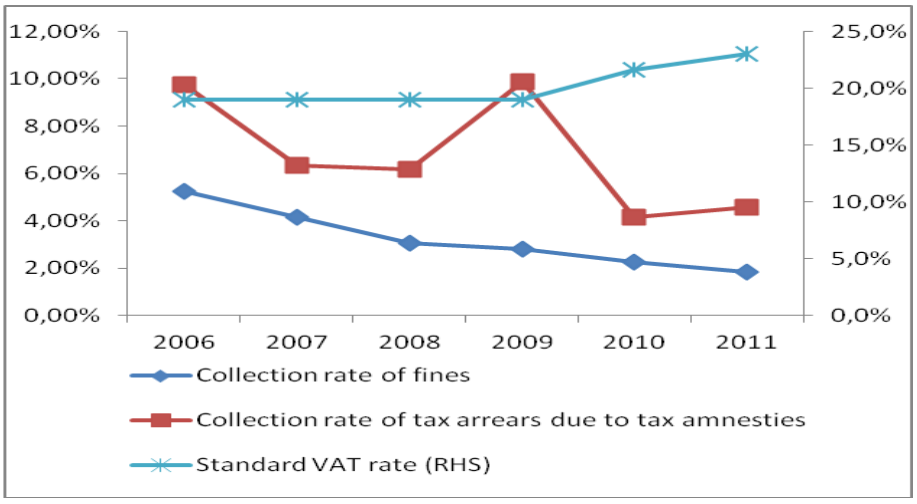

Table 1: Regression results – 2-step system GMM specifications with VAT rate dummies

		Dependent variable: Growth rate (Δlog) of real per tax unit VAT revenue			
	1	**2**	**3**	**4**	**5**
Estimation:	2-step system GMM (first difference transformation	2-step system GMM (first difference transformation	2-step system GMM (first difference transformation)	2-step system GMM (first difference transformation)	2-step system GMM (first difference transformation)
Dependent variable (t-1)	***-0.4588 (-6.31)******	***-0.508 (-4.25)******	***-0.474 (-4.83)***	***-0.385 (-3.71)******	***-0.361 (-5.08)******
Unemployment rate (t)	***-0.023 (-5.26)******	***-0.024 (-4.41)******	***-0.026 (-3.13)******	***-0.011 (-1.93)****	***-0.011 (-2.18)****
Log(uncollected VAT tax amnesties' arrears) (t-1)	-0.004 (-0.58)	-	***-0.028 (-3.32)******	-	0.003 (0.26)
Collection rate of fines and total VAT arrears (t-1)	-	-0.0006 (-0.27)	-0.006 (-1.70)*	-	-
Log(uncollected VAT fines)(t-1)	-		-	***-0.012 (-3.14)******	-0.0143 (-1.49)
VAT rates 2010	***0.168 (5.40)******	***0.176 (6.31)******	***0.172 (4.38)******	***0.127 (3.72)******	***0.123 (3.61)******
VAT rates 2011	***-0.551 (-12.48)******	***-0.534 (-10.45)******	***-0.539 (-7.24)******	***-0.647 (-9.79)******	***-0.654 (-10.69)******
Time trend	***0.0001 (2.62)******	***0.0001 (-2.69)******	***0.0003 (2.89)******	***0.00009 (2.45)****	***0.00008 (4.51)******
No. obs	52	52	52	52	52
Wald chi2(df) (p-value)	Wald chi2(6) : 25093.04 (0.0000)	Wald chi2(6) : 9410.65 (0.0000)	Wald chi2(7) : 14731.59 (0.0000)	Wald chi2(6) :17973.56 (0.0000)	Wald chi2(7) : 23022.14 (0.0000)
No of Instruments	13	13	14	13	14
AR(2) (p-values)	0.211	0.197	0.181	0.318	0.318
Sargan/Hansen test of over. Restrictions (p-values)	0.492/0.898	0.635/0.859	0.546/0.911	0.470/0.504	0.465/0.723

Notes: ***,**, * statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. A collapsed subset of the available instrument matrix was used: namely the second and third lags of the dependent variable, the unemployment rate and the growth rate of real net disposable income.

Table 2: Regression results – 2-step system GMM specifications with VAT rate dummies

		Dependent variable: Growth rate (Δlog) of real per tax unit VAT revenue			
	1	**2**	**3**	**4**	**5**
Estimation:	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation
Dependent variable (t-1)	***-0.498 (-4.67)******	***-0.511 (-5.13)****.	***-0.488 (-5.99)******	***-0.453 (-4.57)******	***-0.463 (-4.25)******
Unemployment rate (t)	***-0.021 (-6.10)******	***-0.023 (-7.82)******	***-0.23 (-5.80)******	***-0.016 (-5.57)******	***-0.017 (-3.07)******
Log(uncollected VAT tax amnesties' arrears) (t-1)	***-0.018 (-3.37)******	-	***-0.027 (-5.42)******	-	0.003 (0.34)
Collection rate of fines and total VAT arrears (t-1)	-	0.0005 (0.20)	-0.003(-1.38)	-	-
Log(uncollected VAT fines)(t-1)	-	-	-	***-0.013 (-2.88)******	-0.016 (-1.64)
VAT rates 2010	***0.161 (5.15)******	***0.176 (7.44)******	***0.164 (6.16)******	***0.144 (5.26)******	***0.148 (4.43)******
VAT rates 2011	***-0.564 (-15.71)******	***-0.543 (-19.92)******	***-0.563 (-15.21)******	***-0.596 (-15.89)******	***-0.588 (-9.53)******
Time trend	***0.0002 (4.08)******	***0.00008 (3.50)******	***0.0002 (5.61)******	***0.0001 (3.91)******	***0.0001 (4.40)******
No. obs	52	52	52	52	52
Wald chi2(df) (p-value)	Wald chi2(6) : 11683.99 (0.0000)	Wald chi2(6) : 10028.19 (0.0000)	Wald chi2(7) : 57661.87 (0.0000)	Wald chi2(6) : 12558.65 (0.0000)	Wald chi2(7) : 13407.37 (0.0000)
No of Instruments	13	13	14	13	14
AR(2) (p-values)	0.221	0.213	0.229	0.274	0.268
Sargan/Hansen test of over. Restrictions (p-values)	0.619/0.879	0.625/0.964	0.689/0.970	0.555/0.788	0.552/0.804

Notes: ***,**, * statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. A collapsed subset of the available instrument matrix was used: namely the second and third lags of the dependent variable, the unemployment rate and the growth rate of real net disposable income.

Table 3: Regression results – 2-step system GMM specifications with year dummies

		Dependent variable: Growth rate (Δlog) of real per tax unit VAT revenue			
	1	**2**	**3**	**4**	**5**
Estimation:	2-step system GMM (first difference transformation	2-step system GMM (first difference transformation	2-step system GMM (first difference transformation)	2-step system GMM (first difference transformation)	2-step system GMM (first difference transformation)
Dependent variable (t-1)	***-0.403 (-3.87)******	***-0.429 (-3.86)******	***-0.367 (-5.33)******	***-0.418 (-3.94)******	***-0.364 (-5.61)******
Unemployment rate (t)	***-0.012 (-2.07)****	***-0.020 (-1.50)***	***-0.010 (-1.75)****	-0.015 (-1.59)	***-0.011 (-2.23)****
Log(uncollected VAT tax amnesties' arrears) (t-1)	***-0.016 (-2.24)****	-	-	***-0.022 (-2.01)****	0.003 (0.42)
Collection rate of fines and total VAT arrears (t-1)	-	0.0004 (0.10)	-	-0.002 (-0.43)	-
Log (uncollected VAT fines) (t-1)	-	-	***-0.011 (-2.72)******	-	***-0.014 (-1.81)****
2008	***0.234 (2.66)******	***0.141 (0.90)***	***0.154 (2.59)******	***0.336 (1.57)***	***0.161 (4.31)******
2009	***0.227 (2.48)****	0.143 (0.81)	***0.148 (2.24)******	0.331 (1.48)	***0.152 (3.37)******
2010	***0.361 (3.27)******	0.298 (1.50)	***0.276 (3.34)******	***0.468 (1.98)****	***0.286 (4.90)******
2011	***-0.412 (-3.16)******	-0.427 (-1.53)	***-0.507 (-4.38)******	-0.291 (-1.02)	***-0.492 (-5.77)******
No. obs	52	52	52	52	52
Wald chi2(df) (p-value)	Wald chi2(6) : 13385.72 (0.0000)	Wald chi2(6): 82.94 (0.0000)	Wald chi2(6) : 98.02(0.000)	Wald chi2(7) : 14528.42 (0.000)	Wald chi2(7) 127.69 (0.000)
No of Instruments	14	14	14	15	15
AR(2) (p-values)	0.281	0.259	0.315	0.285	0.309
Sargan/Hansen test of over. Restrictions (p-values)	0.505/0.507	0.641/0.559	0.473/0.535	0.532/0.558	0.466/0.822

Notes: ***,**,* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. A collapsed subset of the available instrument matrix was used: namely the second and third lags of the dependent variable, the unemployment rate and the growth rate of real net disposable income.

Table 4: Regression results – 2-step system GMM specifications with year dummies

		Dependent variable: Growth rate (Δlog) of real per tax unit VAT revenue			
	1	**2**	**3**	**4**	**5**
Estimation:	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation	2-step system GMM (forward orthogonal transformation
Dependent variable (t-1)	***-0.468 (-4.31)******	***-0.492 (-4.69)******	***-0.458 (-4.66)******	***-0.483 (-5.24)******	***-0.446 (-5.22)******
Unemployment rate (t)	***-0.017 (-2.65)******	***-0.022 (-2.61)****	***-0.013 (-3.25)******	***-0.020 (-2.37)******	***-0.013 (-3.20)******
Log(uncollected VAT tax amnesties' arrears) (t-1)	***-0.017 (-2.91)******	-	-	***-0.025 (-2.93)******	0.003 (0.46)
Collection rate of fines and total VAT arrears (t-1)	-	0.0007 (0.27)	-	-0.003 (-0.80)	-
Log (uncollected VAT fines) (t-1)	-		***-0.013 (-3.00)******		***-0.016 (-1.97)****
2008	***0.281 (2.64)******	***0.155 (1.70)****	***0.205 (3.23)******	***0.427 (2.25)****	***0.201 (3.35)******
2009	***0.273 (2.32)****	0.157 (1.44)	***0.194 (2.69)******	***0.420 (2.07)****	***0.190 (2.73)******
2010	***0.425 (3.12)******	***0.328 (2.67)******	***0.343 (4.26)******	***0.585 (2.70)******	***0.342 (4.27)******
2011	***-0.321 (-1.93)****	***-0.397 (-2.36)****	***-0.422 (-4.07)******	-0.155 (-0.59)	***-0.423 (-4.03)******
No. obs	52	52	52	52	52
Wald chi2(df) (p-value)	Wald chi2(7): 13451.09 (0.000)	Wald chi2(7) 9003.06 (0.000)	Wald chi2(7) : 12616.07 (0.000)	Wald chi2(8): 26041.27 (0.000)	Wald chi2(8) : 16602.01 (0.0000)
No of Instruments	14	14	14	15	15
AR(2) (p-values)	0.237	0.205	0.264	0.230	0.271
Sargan/Hansen test of over. Restrictions (p-values)	0.629/0.917	0.702/0.964	0.570/0.935	0.705/0.988	0.571/0.969

Notes: ***,**, * statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. A collapsed subset of the available instrument matrix was used: namely the second and third lags of the dependent variable, the unemployment rate and the growth rate of real net disposable income.