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Audits and tax offenders:  
recent evidence from Greece

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# AUDITS AND TAX OFFENDERS: RECENT EVIDENCE FROM GREECE

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## Abstract

Using a novel dataset on summer 2012 tax inspections by the Hellenic Ministry of Finance in tourist and high economic activity areas in 13 regions in Greece we found that the intensification of tax audits can induce tax compliance. This finding is very important at the current juncture for Greece as it shows that improvement in tax administration and tax enforcement mechanisms can deter tax evasion, increase tax revenues and contribute to the on-going fiscal consolidation effort.

*JEL classification:* H26, E26, K42.

*Keywords:* taxation; audit; compliance.

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## 1. Introduction

Greece is currently implementing a relatively ambitious fiscal consolidation effort aiming at putting its fiscal house in order. On top of various measures underway, the Greek authorities have to take actions to improve tax administration and fight tax evasion.<sup>1</sup> These initiatives are expected to yield additional revenues supporting the fiscal consolidation effort in the period 2013-2014.<sup>2</sup>

The new three-party coalition government that came into power after the June 17 election decided to put additional effort into the fight against tax evasion. One of the immediate actions was to intensify tax audits during the summer of 2012, in particular in areas with increased economic activity and in key tourist destinations (both islands and mainland), where there is anecdotal evidence of high tax evasion.<sup>3</sup> These intensified tax audits targeting VAT fraud were carried out by the Economic Crime Fighting Unit (SDOE) of the Ministry of Finance (MoF) and covered the period from 6 July to 3 September 2012. In the period under consideration 5,167 tax audits took place, SDOE pressed charges in 2,852 cases (tax offenders) for 34,836 tax infringements; the overall tax offenders-to-audits ratio was 55.2%.<sup>4</sup>

In this paper we use this data in order to study the links between tax audits and tax offenders. Our findings show that an intensification of audits reduces tax offenders, controlling for time and fixed effects. Moreover, the effect of tax audits on tax compliance is bigger in areas with high unemployment, in islands and in areas with lower educational attainment. Finally, we find that improvements in economic sentiment are associated with lower tax offenders-to-audits ratio.

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

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<sup>1</sup> Keen and Smith (2007) discuss the issue of VAT fraud and evasion. According to studies cited therein in Mediterranean countries VAT tax evasion ranges from 20.2% in Greece, to 22.6% in Spain and 34.5% in Italy. 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).

<sup>2</sup> According to European Commission (2012a) the expected yield is estimated at 1.5% of GDP.

<sup>3</sup> See Alm (1999) and Slemrod and Yitzhaki (2002) for a discussion on the importance of audits and penalties as part of tax enforcement policy.

<sup>4</sup> No information on the penalties and the fines imposed was unveiled.

additional evidence, and Section 4 concludes. The appendix provides additional information on the data used.

## 2. Data information, methodology and main findings

According to MoF press releases, the SDOE tax inspections took place in the following 6 time periods: 6-23 July, 27-30 July, 3-6 August, 10-13 August, 16-19 August, 24-27 August and 31 August – 3 September. Based on the MoF data, we classify the information available on audits and tax offenders in the 13 regions of Greece according to NUTS-II<sup>5</sup>. Additional information on the data used is found in the Appendix. The highest tax offenders' ratio (tax offenders/tax audits) was found in Crete and reached 74.8%, followed by Sterea Ellada (66.3%), the south Aegean (65.8%), and Ionian Islands (63.3%).<sup>6</sup>

Using data for 13 regions and 6 tax inspection periods in the summer of 2012, we estimate equation (1), where  $i$  ( $i=1 \dots 13$ ) stands for region and index  $t$  ( $t=1 \dots 6$ ) indicates tax inspection period:

$$\text{Ratio of tax offenders}_{it} = \alpha_1 * \text{Ratio of tax offenders}_{it-1} + \alpha_2 * \Delta \log(\text{audits})_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

$\lambda_i$  stand for unobserved regional effects, and  $\mu_t$  for time effects,  $\varepsilon_{it}$  is the random component satisfying the usual properties.<sup>7</sup> An increase in the number of audits corresponds to an intensification of tax inspections, which could lower the number of tax offenders, and eventually induce tax compliance.

Controlling for fixed effects, we find that 1% increase in the number of audits (in  $\Delta \log$ ) lowers the offenders' ratio by about 5 percentage points (Table 1, column 1). The data presented by the MoF have not been adjusted for the days that each of the 6 tax inspection periods lasted. For example, the first tax audit period from 6-23 July lasted 18 days, whereas each of the remaining audit periods lasted 4 days. Taking this into account,

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<sup>5</sup> 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](http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction).

<sup>6</sup> The data reported do not include sufficient amount of information for the region of Attica which includes the greater metropolitan area of Athens.

<sup>7</sup> In columns 1-3 in Table 1 we have not incorporated a lagged dependent variable. In the supplementary material appendix we consider additional specifications.

we adjust the data on audits and tax offenders so that they now represent audits and offenders per day of audit. As can be seen in Table 1 (column 2), a 1% increase in the number of audits per day (in  $\Delta\log$ ) lowers the ratio of tax offenders by just below 4 p.p.

However, as several other studies have pointed out (e.g., Kleven et al., 2011), if the sample has not been randomly selected from the population then there is an issue of endogeneity, because tax infringements could lead to more tax inspections, so our finding could just reveal a simple correlation not a causal relationship.<sup>8</sup> To address these concerns we re-estimate the previous specification by means of instrumental variables (IV), using as instrument the first lag of the independent variable ( $\Delta\log(\text{audits})_{t-1}$ ). As shown in Table 1 (column 3) we still get a statistically significant effect, i.e., a 1% increase in the number of audits per day lowers the ratio of tax offenders by about 9.4 p.p.

[Table 1 about here]

Both series (tax audits and tax offenders) could be autoregressive; to address this concern we add a lagged dependent variable in our specification and re-estimate the model with a system and difference GMM (Blundell and Bond, 1998).<sup>9</sup> Our findings indicate that audits (and audits per day) have a very significant and negative impact effect on the ratio of tax offenders, with the coefficient ranging from -5.3 pp to -9.3 pp (see Table 1, columns 4-7).

### 3. Robustness checks

First we examine the effects of audits per day (in  $\Delta\log$ ) on tax offenders per day (in  $\Delta\log$ ). We examine several variations on the baseline fixed effects regression, i.e., a fixed effects IV specification, two step difference and two step system GMM specifications. Moreover, in the GMM specifications, we consider both first differencing transformation and forward orthogonal deviations (that perform better in unbalanced panels). According

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<sup>8</sup> The sample under examination is based on the data reported by the MoF. The data could indeed focus on areas and groups of individuals with higher probability to commit tax fraud, i.e., they focus on high tourist and economic activity areas in island and mainland Greece.

<sup>9</sup> We consider both first differencing and forward orthogonal deviations (fod) transformations. Fod performs better in unbalanced panels.

to our findings, a 1% increase in the number of tax inspections per day of audit lowers the number of tax offenders per day of audit by about 0.3-0.4% (see Table 2, column 1-7).<sup>10</sup>

[Table 2 about here]

Bad economic conditions (low income and high unemployment) could be associated with lower tax compliance, increased tax offences and ultimately higher tax evasion. As pointed out before the tax audit data cover the period from 6 July to 3 September 2012, unfortunately there are no regional data covering this period. However, as a proxy we can use 2011 regional unemployment rate data from Eurostat. These data are characterized by variation across regions, but not across time. Having already used fixed effects the best way to use the information available in the data is to split the 13 regions in areas of high and low unemployment and investigate the effect of tax audits on tax offenders in each area. Taking into account that the overall unemployment rate in Greece was 17.7% in 2011, and in order to have enough data points in the two groups, we divide the regions in high and low unemployment groups depending on whether their unemployment rate is above or below 17%.<sup>11</sup> According to the findings presented in Table 3 (columns 1 and 2) although the average tax offenders ratio is bigger in low unemployment areas (as shown by the constant term), the sensitivity of tax inspections to the ratio of tax offenders ratio is greater in the areas with high unemployment. Hence, bad economic conditions and unemployment reduce tax compliance, but increased audits could reduce tax offences.<sup>12</sup>

[Table 3 about here]

The summer 2012 tax inspections included many islands that are well-known tourist destinations. There is anecdotal evidence that there is widespread tax code violations and evasion in islands during the summer period. In order to examine whether an intensification of tax inspections could curb tax infringements we split the 13 regions

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<sup>10</sup> Evidence summarized in Alm (1999) suggests that higher audit rates lead to more compliance, with the estimated reported-income-audit elasticity being 0.1-0.2. Analogous findings are presented in Slemrod and Yitzhaki (2002).

<sup>11</sup> In the high unemployment group we assign: Attica, Sterea Ellada, Central Macedonia, East Macedonia and Thrace, Western Greece, Western Macedonia. In the low unemployment group we assign: Crete, Epirus, Ionian Islands, North Aegean, Peloponnese, South Aegean and Thessaly..

<sup>12</sup> Sancak et al. (2010) have reported that the VAT tax efficiency plummets when the output gap turns negative.



in two groups, one includes islands, the other mainland areas.<sup>13</sup> We find that the intensification of tax inspections in islands characterized by high tourist activity and low tax compliance can lower to a great extent both the number and the ratio of tax offenders (See Table 3, columns 3-8).<sup>14</sup>

As discussed in relevant literature (McGee, 2012), tax evasion and tax compliance is associated with education. For example, a higher level of education could imply greater respect for the rule of law and less inclination to commit tax offenses. However, given that higher educated people tend to earn more than the low educated ones, they are taxed more heavily if the tax system is progressive. This could induce them to evade taxation. In order to investigate the effect of educational attainment on the sensitivity of audit and tax offenders we use as index of educational level across regions the number of pupils and students in all levels of education (ISCED 0-6) at regional level (NUTS 2) as a percentage of the total population at the same regional level published by Eurostat. This ratio reflects 2008 information and an increase in the ratio implies a higher educational level. Given that these data are not characterized by variation across time, we choose to investigate the effect of audits on tax offenders in areas with high and low education attainment.

Taking into account that the average nation-wide ratio was 19.2% in 2008, we split the regions into two groups, a high and a low education attainment level, depending on whether the ratio of students at all levels of education to total population is above or below 18%.<sup>15</sup> <sup>16</sup> Our findings indicate that low education regions have lower tax compliance (see constant terms in Table 4, columns 1-6), as well as that an intensification of tax audits in these regions will bear more fruit compared to the high education regions.

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<sup>13</sup> In the islands group we assign: Crete, Ionian Islands, North Aegean, and South Aegean. In the mainland group we assign all the rest. Unfortunately, according to the NUTS-II classification some islands are classified in the mainland Greece for example, Euboea and Skyros which are part of Sterea Ellada, and Sporades which are part of Thessaly.

<sup>14</sup> Note that if islands like Sporades, Euboea and Skyros, which are classified in mainland Greece, have similar tax offenders' ratios as the rest of the island regions, then our findings could possibly underestimate the difference in the sensitivities of tax inspections to tax offenders in the island and mainland regions.

<sup>15</sup> The cut off rate was decided in order to have enough data points on both groups.

<sup>16</sup> In the high education group we assign: Attica, Central Macedonia, Crete, East Macedonia and Thrace, Epirus, Western Greece and Western Macedonia. In the low education group we assign: Sterea Ellada, Ionian Islands, North Aegean, Peloponnese, South Aegean and Thessaly.

Alternatively, educational attainment should be increased, while at the same time the importance of tax compliance should be part of the education reform agenda.

[Table 4 about here]

Finally, we also investigate whether tax compliance is affected by economic prospects. We include in our analysis the Economic Sentiment Indicator (ESI) which is available on a monthly basis from Eurostat. We use data for July-August 2012. Although ESI reflects up-to-date information on expectations, it is not characterized by cross section variation. Our estimates indicate that improved economic sentiment (which could reflect expectations about improved economic conditions and reduced tax burden) increases tax compliance (see Table 5, columns 1-4).

The time series dimension is not sufficient to investigate whether increased tax burden leads reduces tax compliance. However, the improvement in economic sentiment could be perceived as reflecting both better future prospects for economic activity and the fiscal situation of the country (and consequently prospects for a lower tax burden).

[Table 5 about here]

## 4. Conclusions

Using a novel dataset on summer 2012 tax inspections in tourist and high economic activity areas in 13 Greek regions, we found statistically significant evidence that the intensification of tax audits can induce tax compliance. A 1% increase in the number of audits lowers the ratio of tax offenders by about 4-9 pp, and reduces the number of tax offenders by 0.3-0.4%.<sup>17</sup> Moreover, the sensitivity of the ratio of tax offenders to increases in tax inspections is greater in high unemployment and low educational level

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<sup>17</sup> Galbiati and Zanella (2012) using a cross-sectional data set of tax audits of 80.000 of small businesses and professionals in Italy show that if the probability of punishment decreases when more people behave illegally and the enforcer's available resources are fixed (enforcement congestion externality), then the social multiplier is about 3; which implies that the equilibrium aggregate response to a shock that affects concealed income is about 3 times the initial average response. As Galbiati and Zanella (2012) point out "loosening tax enforcement would reduce tax revenues more when externalities are present". Hence, "tax evasion can be reduced significantly by first removing social externalities among potential tax cheaters". Essentially this is what the summer 2012 MoF audits did; they increased tax audit resources in areas that are more inclined to tax evasion.

areas, and in islands. A better economic outlook as reflected in increased economic sentiment indicators encourages tax compliance.

These findings are highly significant at the current juncture for Greece as they show that an intensification of audits can be a useful enforcement strategy for tax legislation. They can contribute to deterring tax evasion, increasing tax collection efficiency and raising tax revenues.<sup>18</sup> Of course, much depends on the ability of the State to enforce the penalties and collect the fines imposed. If this is not done in a forceful and effective manner, the intensification of audits as a deterred device for tax evasion will be compromised.<sup>19</sup>

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<sup>18</sup> Sancak et al. (2010) have shown that an increase in the ability to control tax evasion increases the efficiency of VAT collection. Several international organizations have reported that Greece lags behind in the efficiency of tax collection vis-à-vis its EU partners, e.g. if Greece were to increase its 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 (2011), if Greece could collect, VAT, social security contributions and corporate taxes with the same efficiency as its main partners, it could increase tax revenues by about 4¾% of GDP per year (OECD, 2011), halving its 2011 general government deficit of 9.4% of GDP. However, there is no one-to-one link between tax audits (control of tax evasion) and improved tax efficiency. As Sancak et al (2010) have shown 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, bad economic conditions etc.

<sup>19</sup> As reported in OECD (2011) there is a stock of €33 billion in tax arrears outstanding at the end of 2009, with only €8 billion being judged as recoverable. There is modest progress on this front, only €983 million have been collected so far against a 2012 benchmark of €2 billion. However, both the number of audits and the collection rates of tax and penalties assessed for those not filing VAT returns are in line with the 2012 targets (European Commission, 2012b).

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**Table 1: Regression results for the ratio of tax offenders**

	Dependent variable: Ratio of tax offenders						
	1	2	3	4	5	6	7
Estimation:	Fixed-effects (within) regression	Fixed-effects (within) regression	Fixed-effects (within) IV regression	2-step system GMM (forward orthogonal transformation)	2-step system GMM (first difference transformation)	2-step difference GMM (first difference transformation)	2-step system GMM (first difference transformation)
$\Delta \log(\text{audits})$	<b>-4.97 (-4.84) ***</b>			<b>-5.332 (-2.48) **</b>	<b>-7.275 (-2.65) ***</b>		
$\Delta \log(\text{audits per day})$		<b>-3.87 (-2.52) **</b>	<b>-9.42 (-1.74) *</b>			<b>-9.270 (-3.28) ***</b>	<b>-8.426 (-3.57) ***</b>
Dependent variable (t-1)				0.155(1.05)	0.175 (0.79)	0.393 (1.83)*	0.415 (2.35)**
Constant	55.01 (299.28)***	56.16 (541.89)***	54.51 (31.78)***	45.797 (5.09)***	45.300 (3.37)***	-	23.974 (2.32)**
No. obs	61	61	50	61	61	50	61
R <sup>2</sup>	0.1698	0.0992	-	-	-	-	-
F-test (p-value)	F(1,10): 23.43 (0.0007)	F(1,10) :6.36 (0.0303)	Wald chi2(1): 1042.34 (0.0000)	Wald chi2(2) : 9.63 (0.008)	Wald chi2(1) : 7.66 (0.022)	Wald chi2(5) : 126.46 (0.000)	Wald chi2(6) : 175.50 (0.000)
No of Instruments				9	9	11	12
AR(2) (p-values)				0.816	0.885	0.788	0.854
Sargan/Hansen test of over.				0.727/0.518	0.242/0.312	0.726/0.648	0.986/0.947
Restrictions (p-values)							
Time dummies	No	No	No	No	No	Yes	Yes

Notes: \*\*\*, \*\*, \* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. In case of the IV estimation we have used as instrument the first lag of  $\Delta \log(\text{audits per day})$ . In columns 4-7 a collapsed subset of the available instrument matrix was used: namely the t-1 to t-3 (t-2) lags of the lagged independent variable of interest and the lagged dependent in columns 4-6 (7).

**Table 2: Regression results for tax offenders per day**

Dependent variable:	Log(offenders per day)	$\Delta$ Log(offenders per day)					
	1	2	3	4	5	6	7
Estimation:	Fixed-effects (within) regression	Fixed-effects (within) regression	Fixed-effects (within) IV regression	2-step difference GMM (first difference transformation)	2-step difference GMM (forward orthogonal deviations)	2-step system GMM (first difference transformation)	2-step system GMM (forward orthogonal deviations)
Log(audits per day)	<b>-0.37 (-4.13) ***</b>						
$\Delta$ log(audits per day)		<b>-0.27 (-3.01)***</b>	<b>-0.36 (-1.90)*</b>	<b>-0.336 (-3.43)***</b>	<b>-0.305 (-4.85)***</b>	<b>-0.310 (-3.82)***</b>	<b>-0.267 (-2.82)***</b>
Dependent variable (t-1)				0.012 (0.05)	-0.064 (-0.44)	0.065 (0.16)	-0.011 (-0.05)
Constant	1.802 (9.17) ***	-0.260 (-42.58)***	-0.068 (-1.12)	-	-	0.0657 (0.16)	-0.237 (-2.53)**
No. obs	78	61	50	39	39	50	50
R <sup>2</sup>	0.1741	0.1429	-	-	-	-	-
F-test (p-value)	F(1,12): 17.07(0.0014)	F(1,10) = 9.07 (0.0131)	Wald chi2(1) : 4.43 (0.1092)	Wald chi2(4) : 38.17 (0.000)	Wald chi2(6): 284.61 (0.000)	Wald chi2(5):115.23 (0.000)	Wald chi2(6): 121.86 (0.000)
No of Instruments				8	10	11	13
AR(2) (p-values)				0.679	0.761	0.695	0.709
Sargan/Hansen test of over. Restrictions (p-values)				0.851/0.844	0.992/0.986	0.837/0.882	0.990/0.940
Time dummies	No	No	No	Yes	Yes	Yes	Yes

Notes: \*\*\*, \*\*, \* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. In case of the IV estimation we have used as instrument the first lag of  $\Delta$ log(audits per day). In columns 4-7 a collapsed subset of the available instrument matrix was used: namely the t-1 to t-3 (t-2) lags of the lagged independent variable of interest and the lagged dependent in columns 5 and 7 (4 and 6).

**Table 3: The role of unemployment and island/mainland effects**

	1	2	3	4	5	6	7	8
Dependent variable:	Offenders ratio	Offenders ratio	Offenders ratio	Offenders ratio	Offenders ratio	Offenders ratio	$\Delta\text{Log}(\text{offenders per day})$	$\Delta\text{Log}(\text{offenders per day})$
	High unemployment (>17%)	Low unemployment (<17%)	Islands	Mainland	Islands	Mainland	Islands	Mainland
$\Delta\text{log}(\text{audits})$	<b>-5.09</b> (-6.15)***	<b>-4.74</b> (-1.71)*	<b>-7.39</b> (-2.89)**	<b>-4.16</b> (-4.26)***				
$\Delta\text{log}(\text{audits per day})$					<b>-7.04</b> (-2.17)*	-2.69 (-1.50)	<b>-0.43</b> (-3.60)***	<b>-0.21</b> (-2.21)*
Constant	51.21 (281.71)***	57.18 (132.42)***	66.070 (216.71)***	49.22 (239.43)**	67.63 (218.37)***	50.24 (531.02)***	-0.203(-17.76) ***	-0.286 (-55.96)***
No. obs	22	39	21	40	21	40	21	40
R <sup>2</sup>	0.2765	0.0928	0.2893	0.1324	0.2756	0.0515	0.2821	0.0972
F-test (p-value)	F(1,3):37.84 (0.0086)	F(1,6): 2.94(13,72)	F(1,3):8.38 (0.0628)	F(1,6): 18.17 (0.0053)	F(1,3):4.72 (11,18)	F(1,6): 2.24 (0.1847)	F(1,3): 12.99 (0.0367)	F(1,6): 4.87 (0.0694)

Notes: \*\*\*, \*\*, \* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. Estimation: Fixed-effects (within) regression. The nation-wide unemployment rate in 2011 was 17.7%. High unemployment regions: Attica, Sterea Ellada, Central Macedonia, Eas Macedonia and Thrace, Western Greece, Western Macedonia. Low unemployment regions: Crete, Epirus, Ionian Islands, North Aegean, Peloponnese, South Aegean, Thessaly. Island regions: Crete, Ionian Islands, North Aegean, South Aegean. Mainland regions: all the remaining.

**Table 4: Tax offenders, audits and educational level**

	1	2	3	4	5	6
Dependent variable:	Offenders ratio	Offenders ratio	Offenders ratio	Offenders ratio	$\Delta\text{Log}(\text{offenders per day})$	$\Delta\text{Log}(\text{offenders per day})$
	High educational level (>18%)	Low educational level (<18%)	High educational level (>18%)	Low educational level (<18%)	High educational level (>18%)	Low educational level (<18%)
<b><math>\Delta\log(\text{audits})</math></b>	<b>-4.012</b> (-4.76)***	<b>-6.82</b> (-2.88)**				
<b><math>\Delta\log(\text{audits per day})</math></b>			-2.45 (-1.12)	<b>-6.07</b> (-2.51)*	<b>-0.17</b> (-2.16)*	<b>-0.42</b> (-4.09)***
Constant	49.22 (242,07)***	59.88 (19,61)***	50.26 (833,82)***	61.36 (200,49)***	-0.30 (-136,61)***	-0.21 (-20.05)***
No. obs	28	33	28	33	28	33
R <sup>2</sup>	0.1377	0.2318	0.0452	0.2043	0.0774	0.2507
F-test (p-value)	F(1,4): 22.62 (0.0089)	F(1,5): 8.27 (0.0348)	F(1,4): 1.25 (0.3263)	F(1,5): 6.30 (0.0539)	F(1,4): 4.68 (0.0966)	F(1,5): 16.74 (0.0094)

Notes: \*\*\*, \*\*, \* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. Estimation: Fixed-effects (within) regression. Educational level index: the number of pupils and students in all levels of education (ISCED 0-6) at regional level (NUTS 2) as a percentage of the total population at the same regional level. The nation-wide ratio was 19.2% in 2008. High educational level: Attica, Central Macedonia, Crete, East Macedonia and Thrace, Epirus, Western Greece, Western Macedonia. Low educational level: Sterea Ellada, Ionian Islands, North Aegean, Peloponnese, South Aegean, Thessaly.



**Table 5: Tax offenders, audits and economic sentiment**

	1	2	3	4
Dependent variable	Offenders ratio	Offenders ratio	Offenders ratio	$\Delta \text{Log}(\text{offenders per day})$
Estimation	Fixed-effects (within) regression	Fixed-effects (within) regression	2 step system GMM (first differencing transformation)	Fixed-effects (within) regression
<b><math>\Delta \text{log}(\text{audits})</math></b>	<b>-4.89</b> (-3.71)***	-	-	-
<b><math>\Delta \text{log}(\text{audits per day})</math></b>		<b>-4.89</b> (-3.71)***	<b>-10.059 (-1.82)*</b>	<b>-0.21</b> (-2.98)***
<b>Economic sentiment indicator</b>	-0.53 (-0.17)	<b>-8.71</b> (-4.26)***	<b>-11.930 (-2.60)***</b>	<b>-0.83</b> (-9.33)***
Dependent variable (t-1)	-	-	0.251 (1.03)	-
Constant	95.396 (0.40)	725.483 (4.62)***	958.817 (2.72)***	65.171 (9.67)***
No. obs	61	61	61	78
R <sup>2</sup>	0.1700	0.1700	-	0.4741
F-test (p-value)	F(2,10) :17.40 (0.0006)	F(2,10) :17.40 (0.0006)	Wald chi2(2): 9.18 (0.027)	F(2,12): 99.39 (0.0000)
No of Instruments	-	-	8	-
AR(2) (p-values)	-	-	0.918	-
Hansen test of over. restrictions (p-values)	-	-	0.131	-

Notes: \*\*\*, \*\*, \* statistically significant at 1%, 5%, and 10% respectively; t-statistics in parenthesis; the standard error are robust. In column 3 a collapsed subset of the available instrument matrix was used: namely the t-1 to t-2 lags of the lagged independent variable of interest and the lagged dependent.

## A. Appendix

### A1. Data information

The audits and tax offenders' data cover the period 6 July to 3 September 2012 and are the outcome of the summer 2012 Ministry of Finance tax inspections in areas with high tourist and economic activity. This is the first time that such data become public and mainly refer to cases of VAT fraud. Table A1 presents the summary data per period of audit and Tables A2-A3 summarize the data at a regional level.

**Table A1 : – Summary data on tax offenders and audits – Summer 2012 tax audits**

06/07/2012 -23/07/2012	18	1410	805	22435	57.1%	27.9
27/07/2012-30/07/2012	4	642	367	3256	57.2%	8.9
03/08/2012-06/08/2012	4	604	356	2010	58.9%	5.6
10/08/2012-13/08/2012	4	707	373	1631	52.8%	4.4
16/08/2012-19/08/2012	4	704	365	1905	51.8%	5.2
24/08/2012-27/08/2012	4	638	350	2530	54.9%	7.2
31/08/2012-03/09/2012	4	462	236	1069	51.1%	4.5
<b>Total</b>		<b>5167</b>	<b>2852</b>	<b>34836</b>	<b>55.2%</b>	<b>12.2</b>

Source: Hellenic Ministry of Finance, Economic Crime Fighting Unit (SDOE). [www.minfin.gr](http://www.minfin.gr)

**Table A2 : Regional data on tax offenders and audits**

Attica	7	4	7	57.1%	1.8
Stereia Ellada	374	248	13348	66.3%	53.8
Central Macedonia	1037	423	1543	40.8%	3.6
Crete	250	187	685	74.8%	3.7
East Macedonia and Thrace	379	192	610	50.7%	3.2
Epirus	204	90	1047	44.1%	11.6
Ionian Islands	403	255	1854	63.3%	7.3
North Aegean	154	89	229	57.8%	2.6
Peloponnese	412	253	2225	61.4%	8.8
South Aegean	1146	754	11280	65.8%	15.0
Thessaly	557	251	778	45.1%	3.1
Western Greece	179	68	1109	38.0%	16.3
Western Macedonia	65	38	121	58.5%	3.2
<b>Greece</b>	<b>5,167</b>	<b>2,852</b>	<b>34,836</b>	<b>55.2%</b>	<b>12.2</b>

Source: Hellenic Ministry of Finance, Economic Crime Fighting Unit (SDOE). [www.minfin.gr](http://www.minfin.gr)

**Table A3 : Regional data per day**

Attica	0.4	10.3	0.7	0.1
Stereia Ellada	74.1	27.1	1498.6	16.9
Central Macedonia	193.1	17.5	753.3	6.4
Crete	52.6	33.0	206.0	6.1
East Macedonia and Thrace	78.8	19.1	246.8	5.2
Epirus	37.8	18.2	187.3	6.1
Ionian Islands	97.1	30.4	626.4	9.4
North Aegean	38.5	11.7	100.9	3.3
Peloponnese	87.1	26.3	780.7	12.9
South Aegean	219.4	28.3	2743.4	17.0
Thessaly	115.5	19.9	349.2	5.8
Western Greece	29.2	15.3	465.7	13.9
Western Macedonia	12.9	14.8	47.1	2.1

Source: Hellenic Ministry of Finance, Economic Crime Fighting Unit (SDOE). [www.minfin.gr](http://www.minfin.gr)

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