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Assessing the variability of indirect tax elasticity in Greece

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ASSESSING THE VARIABILITY OF INDIRECT TAX ELASTICITY IN GREECE

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Abstract

This paper shows that the variability of indirect tax elasticity relative to GDP has increased significantly in recent years in Greece. Based on this finding we show that the budgetary sensitivity of indirect taxes following a 1% change in real GDP has increased dramatically since 2010. This finding has substantial policy implications; failure to account for these higher elasticities will lead to recurrent revenue shortfalls requiring new policy measure to meet previously set fiscal targets. This could lead to a downward spiral of continuously declining economic activity, new revenue shortfalls and additional fiscal measures and so on.

JEL classification: C32; E32; H20; O52

Keywords: indirect taxes; elasticity; GDP; Greece

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1. Introduction

The success of the on-going fiscal consolidation effort is a prerequisite for the recovery of the Greek economy. This implies that all possible interactions between fiscal consolidation and economic activity have to be fully understood. Recently, and driven by an IMF initiative, there has been a discussion on the size of fiscal multiplier, which is key determinant of the short-term recessionary effects of fiscal consolidation. As a result, the average fiscal multiplier in Greece was revised upwards to around 1 from 0.5.¹ Despite progress with pinpointing the impact on output of an exogenous change in fiscal policy variables, there has been little discussion on the impact of changes in economic activity on revenue and budget performance.

Yet analysis of this relationship is important for understanding issues surrounding the implementation of the Economic Adjustment Programme (EAP) for Greece from May 2010 onwards. The programme has been characterized by frequent revenue shortfalls, in particular as regards indirect taxes. Despite successive increases in VAT rates and excise taxes since the start of the EAP, indirect tax revenues have been declining in line with the declining path of private consumption and economic activity (IMF, 2012a; 2013).

According to recently released Ministry of Finance (MoF) data for the period January-February 2013, indirect tax revenues show a quite significant shortfall from target of about €496 million or about 0,25% of GDP.² Substantial shortfalls were also recorded in 2012. According to the March 2012 IMF report on Greece, indirect tax revenues for 2012 were projected at €26.9 billion (IMF, 2012a). The most recent IMF report (IMF, 2013, January) revised downward that figure by about €700 million, i.e., to about €26.2 billion.³

What lies behind these recurrent revenue shortfalls and why are successive EAP projections not updated so that the revenue shortfall is minimized? Two possible explanations that have been put forward related to the continuous and dramatic decline in

¹ See IMF (2012b), World Economic Outlook, Autumn; Blanchard and Leigh, 2013.

² According to MoF data indirect tax receipts in January-February 2012 amounted to €3,966 million vis-à-vis a target of €4,462 million.

³ Recently published MoF data revised the indirect tax receipts figure to €26,082 million, i.e., further below the recent IMF estimates.

economic activity in Greece (from 2008 to 2012) and the inability of revenue administration to fight tax evasion.⁴

In this study, driven by the findings of earlier IMF studies, like Poghosyan (2011), Brondolo (2009), Sansak et al. (2010), we examine how the indirect tax elasticity varies across time and economic activity. The results of the aforementioned studies have shown that the variability of the elasticity of indirect taxes to economic activity tends to increase in the course of the crisis. Hence, continuously declining economic activity (as in the case of Greece) could be associated with a higher indirect tax elasticity, which in turn translates into bigger revenue shortfalls.

On this point it should be mentioned the reference value for the indirect tax elasticity in Greece is usually assumed to be 1 (constant through the cycle unitary elasticity) based on the influential OECD study of Girouard and Andre (2005) and a recent European Commission (2005) working document.

Our findings indicate that the elasticity of indirect taxes with respect to real GDP has increased in the course of the crisis lying between 1.23-1.84 in recent years. This is due both to increased variability of the tax base to GDP (composition effects) and increased variability of indirect tax revenues to tax base. Based on these elasticities we calculate budgetary sensitivity parameters of indirect taxes which range from 0.15-0.23 percentage point (pp) of GDP, i.e. substantially higher than what is implied by the unitary elasticity assumption (0.11-0.12 pp of GDP). This implies that the constant along the cycle unitary elasticity assumption has to be reconsidered, in order to better understand the interaction between fiscal consolidation and economic activity and to improve the design of economic policy making.

In the remainder of the paper we examine the following: Section 2 discusses data issues, methodology and presents the main findings. Section 3 summarizes and concludes.

⁴ The IMF (2013) has criticized the slow progress in the area of revenue administration reforms. However, there has been recent evidence pointing to the effectiveness of tax audits in Greece in lowering VAT tax related offenses (Tagkalakis, 2013).

2. Data, methodology and findings

We use quarterly data on indirect taxes (VAT and other indirect taxes), private consumption and GDP over the period 2000:Q1-2012:Q3. The GDP deflator is used to transform the data into real terms.⁵ As noted above, Girouard and Andre (2005) have estimated a unitary elasticity of indirect taxes with respect to economic activity through the cycle. In line with Girouard and Andre (2005), we calculate the elasticity of indirect taxes to GDP as the product of two elasticities⁶:

$$\begin{array}{lcl} \text{Elasticity of indirect} & & \text{Elasticity of indirect} \\ \text{taxes to real GDP} & = & \text{taxes to real private} \\ & & \text{consumption} \end{array} * \begin{array}{l} \text{Elasticity of real} \\ \text{private consumption} \\ \text{to real GDP} \end{array} \quad (1)$$

Following earlier IMF studies like Poghosyan (2011), we split indirect taxes into VAT and other indirect taxes. Using data over the period 2000:Q1 – 2012:Q3 we regress by means of OLS (with robust standard errors) the following specification:⁷

$$\begin{aligned} \Delta \log(\text{VAT})_t = & \alpha + \beta * \Delta \log(\text{Private consumption})_t + \sum_{i=1}^{N=4} \gamma_i * \Delta \log(\text{Private consumption})_{t-i} \\ & + \text{Elections}_t + \text{EAP}_t + \text{Changes in VAT rates}_t + \text{time trend}_t + \varepsilon_t \end{aligned} \quad (2)$$

The variables of interest are the following: the year-on-year growth rate of VAT revenues i.e., $\Delta \log(\text{VAT})_t = \log \text{VAT}_t - \log \text{VAT}_{t-4}$.⁸ The “election” dummy captures election periods, in line with anecdotal evidence that revenue collection and budgetary performance deteriorates in election periods. The “EAP” dummy captures the period that Greece is under joint EU-IMF surveillance (since May 2010). The sign of this variable is

⁵ Data are seasonally adjusted by means of the census X12 procedure.

⁶ Girouard and Andre (2005) examine the elasticity of indirect taxes with respect to the output gap. However, we consider the elasticity of indirect taxes with respect to real GDP (and real private consumption) because since 2008-2009 economic activity in Greece has been continuously declining and making it difficult to obtain reliable estimates of potential GDP and consequently the output gap.

⁷ We also considered OLS with Newey-West standard errors, i.e., the error structure is assumed to be heteroskedastic and auto-correlated up to one lag. Additionally, we 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.

⁸ According to data reported by the General Secretariat of Information Systems (GSIS) of the Hellenic Ministry of Finance there is exceptional seasonality in VAT revenues; namely VAT revenues pick in January, April, July and October.

not clear. On the one hand, measures have been taken during the period of the adjustment programme to improve revenue administration and fight tax evasion. On the other hand, anecdotal evidence suggests that the strong deterioration in economic activity and credit conditions during the EAP years have led to sharply increased tax evasion. The time trend captures time related effects that affect the relationship between VAT and private consumption (e.g. over the course of the recent years, efforts to fight tax evasion have intensified). Finally, the variable “Changes in VAT rates” captures changes in VAT rates⁹. ε_t is a well behaved error term. The coefficient β captures the elasticity of VAT to private consumption. The empirical estimates are presented in Table A.1 (column 1) in the Appendix.

Following Poghosyan (2011), we link other indirect taxes directly to real GDP.¹⁰ Hence, we estimate by means of OLS (with robust standard errors) the following specification:¹¹

$$\Delta \log(\text{Other indirect taxes})_t = \alpha_1 + \beta_1 * \Delta \log(\text{GDP})_t + \sum_{i=1}^{N=4} \gamma_{1i} * \Delta \log(\text{GDP})_{t-i} + \text{Elections}_t + \text{EAP}_t + \text{time trend}_t + \text{EAP} * \text{time trend}_t + \text{EDP}_t + \varepsilon_t \quad (3)$$

Turning to the control variables, EDP captures the period that Greece was in excessive deficit procedure, i.e. 2004:Q3-2007:Q2 and from 2009:Q1-2010:Q1, taking into account tax policy changes that occurred in that period. Greece continues to be in EDP in the post 2010:Q2 period, however, we differentiate between the pre- and post-EAP period because in the period during which Greece has been receiving EU-IMF funding, surveillance procedures are stricter and much more intense relative to the pre-EAP EDP surveillance. Moreover, tougher consolidation measures were implemented in the more recent period. The time trend captures time related effects that affect the

⁹ In Greece a series of VAT rate changes has been observed particularly in the period under EU-IMF surveillance, e.g. in 2010 Q1 the VAT rates increased 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%); see Bank of Greece (2009-2013).

¹⁰ In one of the alternative specifications of the model we do link other indirect taxes to real private consumption. The findings are presented in Table A.1.

¹¹ See footnote 7.

relationship between other indirect taxes and GDP. The interaction term “EAP*time trend” captures the successive measures undertaken in more recent years, as well as efforts to tackle tax evasion by improving tax revenue administration.¹² The coefficient β_1 reflects the elasticity of other indirect taxes with respect to real GDP. The empirical estimates are presented in Table A.1 (column 2) in the Appendix.

Building on the abovementioned studies, we evaluate the relationship between the tax base and (real private consumption) and real GDP. Hence, we estimate by means of OLS (with robust standard errors) the following specification:¹³

$$\Delta \log(\text{Private consumption})_t = \alpha_2 + \beta_2 * \Delta \log(\text{GDP})_t + \sum_{i=1}^{N=4} \gamma_{2i} * \Delta \log(\text{GDP})_{t-i} + \text{trend}_t + \varepsilon_t \quad (4)$$

The coefficient β_2 is the elasticity of private consumption to GDP.¹⁴ The empirical estimates are presented in Table A.1 (column 3) in the Appendix.

We recursively estimate equations (2)-(4). We estimate specification (2) and (3) over the period 2000:Q1-2008:Q1, and then we repeat the estimation adding one data point at a time until the end of the sample (2012:Q3). This way we get recursive estimates of “ β ” and “ β_1 ” over the period 2008:Q1-2012:Q3. The findings are depicted in Figures 1-2 and reveal that both VAT revenue and other indirect taxes have shown increased variability in recent years. This conclusion is particularly pronounced for VAT revenue (vis-à-vis changes in real private consumption). As regards specification (4) we repeat the above exercise, though we start our estimations using the sample 2000:Q1-2009:Q1 in order to get more reliable estimates of β_2 and then we add one data point at a time till the end of the sample. The results are shown in Figure 3.¹⁵ In all cases we try to start the

¹² In this setting we do not consider each specific tax policy changes related to other indirect taxes; however we believe that these are reflected in the EDP, EAP and EAP*time trend variables. Since the start of the implementation of the Greek EAP (and just before that), there have been a series of excise tax increases on tobacco, alcohol, fuel; see Bank of Greece (2009-2013). All these changes are reflected in the EDP, EAP and EAP*time trend variables that are intended to capture tax policy changes in the period under investigation. Tax policy changes were undertaken to abide by the requirements of the excessive deficit procedure and the Economic Adjustment Programme for Greece.

¹³ See footnote 7.

¹⁴ We have also examined an alternative specification that includes the EAP dummy; the findings are qualitatively similar.

¹⁵ As in Poghosyan (2011), we have also repeated the same exercise using rolling regression with fixed windows of 32 (and/or 36) quarters. The results are qualitatively similar.

estimates of the recursive regressions either in early 2008 or in early 2009 in order to capture the period prior to the deepening of the economic recession in the more recent years. The findings reported in Figure 3 indicate that the variability of the tax base (private consumption) vis-à-vis real GDP increased substantially in recent years, highlighting the important role of composition effects in the decline of indirect tax revenues.

Figure 4 depicts the recursive estimates of the elasticity of indirect taxes to real GDP over the period 2009:Q1-2012:Q3, which is the outcome of the recursive estimates obtained from specifications (2)-(4) and definition (1). In more detail we calculate the recursive estimate of the elasticity of indirect taxes to real GDP as follows:

$$\begin{aligned}
 & \text{Elasticity of} & & \text{(Elasticity of} & & \text{Elasticity of} & & \text{(VAT/indirect} & & \text{Elasticity of} & & \text{(other} \\
 & \text{indirect} & = & \text{VAT to real} & * & \text{real private} & * & \text{taxes)} & + & \text{other} & * & \text{indirect} & (5) \\
 & \text{taxes to real} & & \text{private} & & \text{consumption} & & & & \text{indirect} & & \text{taxes/indir} \\
 & \text{GDP} & & \text{consumption} & & \text{to real GDP)} & & & & \text{taxes to} & & \text{ect taxes)} \\
 & & & & & & & & & \text{real GDP} & &
 \end{aligned}$$

In Figure 4, we also present two alternative estimates of the elasticity of indirect taxes to GDP.¹⁶ In the first, we calculate the elasticity of other indirect taxes to real GDP in the same way as the elasticity of VAT to private consumption, i.e., as the product of the estimated elasticity of other indirect taxes to real private consumption¹⁷ times the estimated elasticity of real private consumption to real GDP. In the second case, we consider only the aggregate indirect tax series, i.e., we do not differentiate between VAT and other indirect taxes. In this case the elasticity of indirect taxes to real GDP is the

¹⁶ See also the supplementary material appendix for a more detailed presentation of the findings (including 95% confidence bands).

¹⁷ The elasticity of other indirect taxes to private consumption resembles specifications (3), see Table A.1 (column 4).

product of the estimated elasticity of indirect taxes to real private consumption¹⁸ and the estimated elasticity of real private consumption to real GDP.

According to the findings displayed in Figure 4, the estimated elasticity of indirect taxes with respect to GDP has shown great variability in recent years, a finding verified by all three specifications considered (the elasticity increased above 1 after 2010:Q3). According to the baseline and first alternative estimate, the elasticity of indirect taxes to GDP (controlling for tax policy changes) reached as high as 2 at the end of 2010, oscillating around that level before gradually returning to around 1.8 by the end of the sample in 2012:Q3. The second alternative estimate based on the aggregate indirect tax series indicates that the elasticity of indirect taxes to GDP reached 1.45 at the end of 2010 and remained close to that level until 2011:Q3 before falling to more normal levels of around 1.10 at the end of 2011. Thereafter, it started rebounding reaching close to 1.25 at the end of the sample.

Although estimates presented here vary, our findings indicate that the elasticity of indirect taxes to GDP can be between 25% and 80% higher than the constant unitary elasticity of Girouard and Andre (2005).

¹⁸ The elasticity of indirect taxes to private consumption blends features of both specifications (2) and (3), i.e., it includes changes in VAT rate, the EDP dummy and the interaction dummy “EAP*time trend” that reflect among other things changes in other indirect taxes (see Table A.1, column 5).

Figure 1: The elasticity of VAT to private consumption

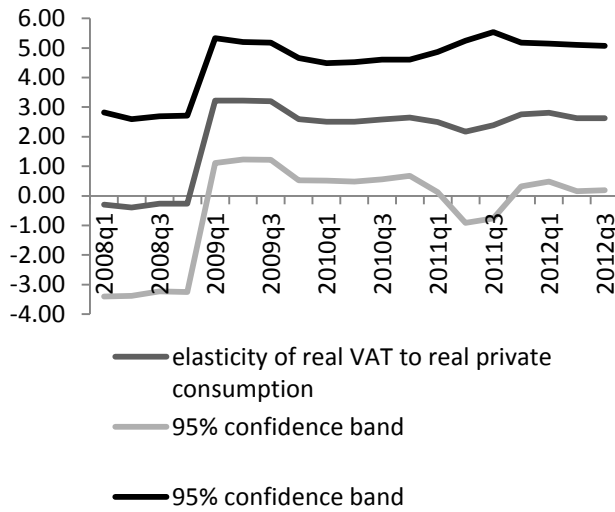


Figure 2: The elasticity of other indirect taxes to real GDP

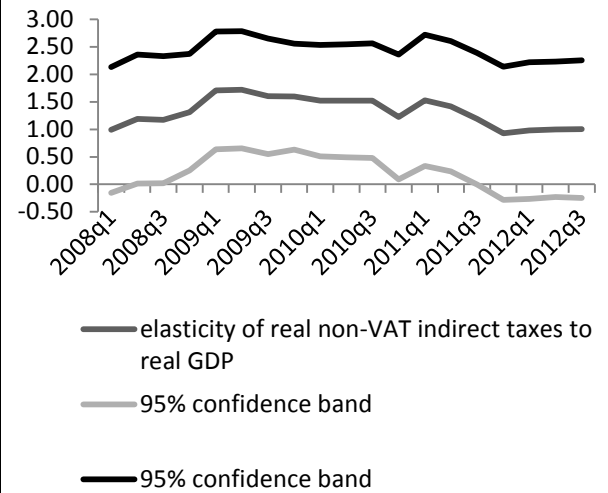


Figure 3: The elasticity of private consumption to real GDP

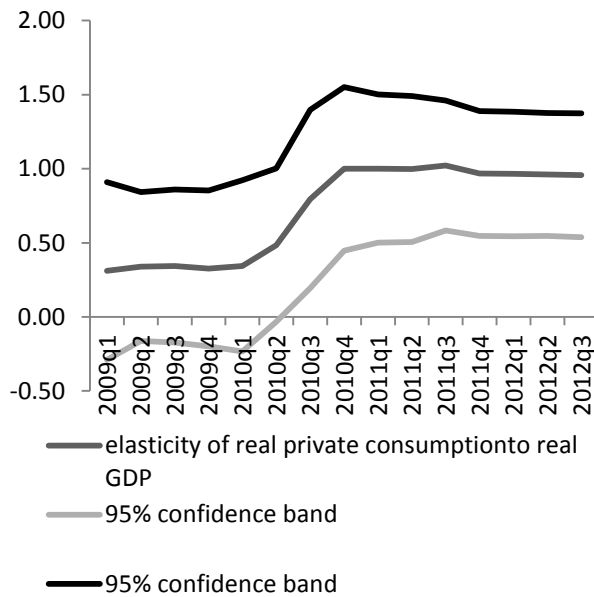
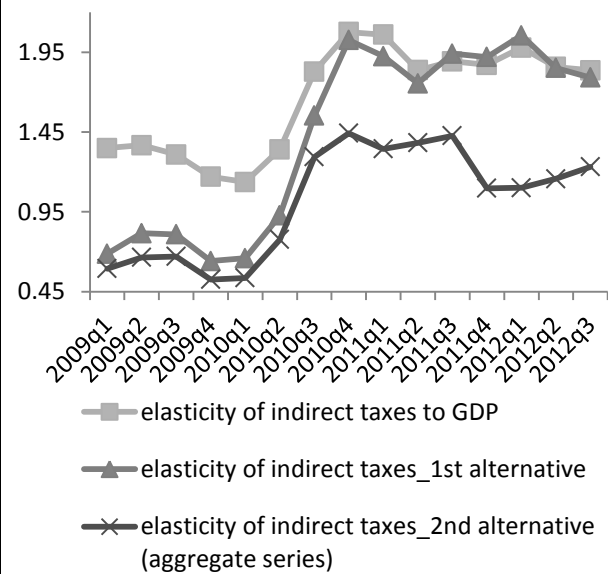


Figure 4: The elasticity of indirect taxes to real GDP (baseline and alternative estimates)



Next we transform the estimated elasticities of indirect taxes to GDP into measures of the sensitivity of the budget to indirect taxes. Following Girouard and Andre (2005), we multiply the estimated elasticities by the share of indirect taxes to GDP. The product of these two gives us the estimated budgetary sensitivity of indirect taxes, i.e. the change in the budget in percentage points (pp) of GDP (driven by indirect taxes) following a 1% change in GDP (see Figure 5). In Figure 5, we also present budgetary sensitivities based on the unitary elasticity assumption (which is merely the share of indirect taxes in GDP).

The baseline and first alternative estimate indicate that the budgetary sensitivity of indirect taxes increased to as high as 0.24-0.26 pp of GDP at the end of 2010 and into early 2011. This is almost twice as large as the sensitivity implied by the unitary elasticity assumption. In the following quarters it marginally declined approaching 0.22-0.23 p.p. of GDP at the end of the sample. The second alternative estimate based on the aggregate indirect tax series points to a smaller maximum effect of about 0.17-0.18 p.p. of GDP from 2010:Q3-2011:Q3, which then falls to 0.14 and increases up to 0.15 pp of GDP by the end of the sample.

Based on a projected GDP of about €193.7 billion in 2012, the unitary elasticity assumption implies that a 1% fall in GDP will reduce indirect taxes and increase the budget deficit by about €239.9 million. The second alternative elasticity estimate would worsen the deficit by €295.4 million, while the baseline and first alternative estimates raise the deficit impact to as high as €429.8 to €440.6 million. Thus, the impact on the deficit from a decline in GDP could be between €55.5 and €200.8 million higher than that derived assuming a unitary elasticity.

This revenue shortfall that will not be anticipated will have to be covered by additional measures to contain the impact on deficit.¹⁹ These additional consolidation

¹⁹ In order to put these numbers into perspective, they should be contrasted with some of the fiscal policy interventions detailed in the Medium Term Fiscal Strategy (MTFS) for 2013-2016 unveiled by the Ministry of Finance in early 2013 (MoF, 2013). More specifically, the 10% reduction in temporary public employment contracts over the period 2013-2016 will yield expenditure saving of €49.1 million, the cuts in the salaries of those employed in “special regimes” (judges, military personnel, university staff etc) will yield €161.4 million in 2013, the new mobility scheme of public sector employees involving lay-offs is expected to yield expenditure savings of €106.8 million in 2013-2016. The rationalization and cuts in social benefits will yield €68.3 million in 2013-2016. Co-payment for hospital services will yield €115 million in 2014 and, finally, cuts in educational spending will yield €129.5 million in the period 2013-2016. Hence, the underestimation of the budgetary impact of indirect taxes due to lower economic activity can have

measures further reduce output leading to additional unanticipated revenue shortfalls, which require new measures and so on. A better assessment of the elasticity of indirect taxes to GDP and of the sensitivity of the budget to changes in GDP can contribute to improving policy making and the design of fiscal consolidation measures.

3. Summary and conclusions

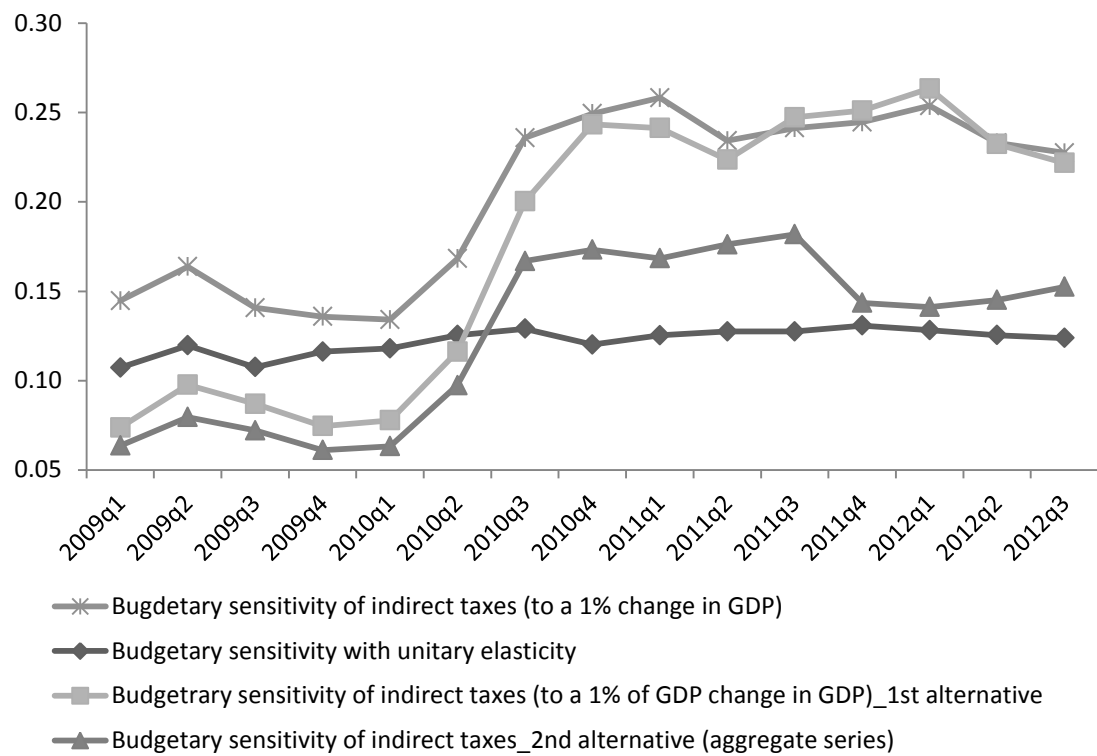
The above analysis provides empirical evidence on the variability of the indirect tax elasticity in Greece. This is explained both by increased variability of the tax base (private consumption) to GDP (composition effects) and by an increased sensitivity of indirect tax revenues to their tax base. Composition related changes, if they persist, could be associated with structural rather than temporary reductions in indirect tax revenue. This latter effect is consistent with tax compliance issues. As shown by Brondolo (2009), in times of economic stress, the collection of VAT revenue declines because people have more incentives to evade tax or face tougher credit and financial constraints that induce them to evade taxes. Sancak et al. (2010) also find that the efficiency of VAT collections tends to be lower in “bad” times (when the output gap is negative and the informal economy is expanding).

In addition, our analysis shows that the dramatically contracting economic activity in Greece since 2010 has had much larger adverse budgetary implications (through declining indirect taxes) than anticipated based on the unitary elasticity assumption.

The variability of the indirect tax elasticity in recent years has important policy implications. It implies that, if not taken into account in revenue projections, revenue shortfalls will constantly materialize, impairing the achievement of policy targets. New measures will then be required to meet the fiscal targets, which in turn impact negatively on economic activity, further lower tax revenues, and so on (i.e. generating a downward spiral).

substantial repercussions, requiring additional consolidation measures to fill the fiscal gap, something that would be hard to find given the small expected yield of some of the MTFS measures mentioned above.

Figure 5: Budgetary sensitivity of indirect taxes (in pp of GDP) following a 1% change in GDP.



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A. Appendix

In the appendix we report the OLS regression outcomes corresponding to specifications (2)-(4) in the main text of the paper. The regressions presented below (Table A.1) cover the whole sample, i.e. 2000 Q1-2012 Q3. The recursive estimation of specifications (2)-(4) provide us the elasticities presented in the main text of the paper.

Table 1: Regressions of indirect taxes, VAT, other indirect taxes with respect to private consumption or real GDP and regression of private consumption with respect to real GDP

	1	2	3	4	5
Dependent variable:	Growth rate of real VAT revenue	Growth rate of real other indirect taxes	Growth rate of real private consumption	Growth rate of real other indirect taxes	Growth rate of real indirect taxes
Growth rate of real GDP (t)		1.005 (1.57)	0.957 (4.48)***		
Growth rate of real GDP (t-1)		1.139 (1.24)	0.114 (0.48)		
Growth rate of real GDP (t-2)		0.172 (0.23)	-0.255 (-1.12)		
Growth rate of real GDP (t-3)		0.129 (0.23)	-0.056 (-0.24)		
Growth rate of real GDP (t-4)		-0.209 (-0.34)	0.445 (2.33)**		
Growth rate of real private consumption (t)	2.629 (2.11)**			0.945 (1.46)	1.410 (1.85)*
Growth rate of real private consumption (t-1)	-1.331 (-1.38)			0.013 (0.02)	-0.543 (-1.10)
Growth rate of real private consumption (t-2)	1.744 (3.23)***			1.552 (3.13)***	1.336 (3.83)***
Growth rate of real private consumption (t-3)	0.462 (0.67)			-1.397 (-2.45)**	-0.054 (-0.18)

Table 1: (Continued)

Growth rate of real private consumption (t-4)	-0.089 (-0.12)			1.298 (2.26)**	0.273 (0.87)
Time trend	-0.0003 (-0.11)	0.004 (2.82)***	0.0003 (0.56)	0.0004 (0.27)	-0.004 (-2.08)**
Constant	-0.071 (-0.18)	-0.814 (-3.01)***	-0.067 (-0.58)	-0.189 (-0.66)	0.505 (1.61)
Election	0.006 (0.14)	-0.059 (-2.25)**	-	-0.036 (-0.84)	0.008 (0.45)
EAP	0.288 (1.63)	0.959 (0.39)	-	-0.611 (-0.30)	6.565 (3.44)***
EAP*time trend	-	-0.004 (-0.34)	-	0.004 (0.43)	-0.032 (-3.30)***
VAT rate	0.012 (0.32)	-	-	-	0.095 (2.63)***
EDP	-	0.039 (2.17)**	-	0.067 (2.52)**	-
No of Obs.	43	43	43	43	43
F-test (p-value)	F(9, 33) = 4.73 (0.0004)	F(10, 32) = 3.51 (0.0033)	F(6, 36) = 32.75 (0.0000)	F(10, 32) = 4.42 (0.0006)	F(10, 32) = 8.10 (0.0000)
R-square	0.4631	0.4366	0.8263	0.3955	0.6053

Note: OLS regressions with robust standard errors; ***, **, * stand for statistically significant at 1%, 5% and 10%.

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