Austerity Plans and Tax Evasion: Theory and Evidence from Greece

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Austerity plans and fiscal adjustment

Greece (2010) : first adjustment program

- Objectives : deficit reduction 6% of GDP, decomposed into expenditure cuts (2.9%) and an increase in tax revenue (3.1%)

- Increase in tax revenues based on two pillars : increase in VAT and excise on oil

- Results : Greek authorities only collected an increase in tax revenue of 1.5% of GDP

Did the failure in collecting taxes lead to unsatisfactory results of the austerity plan ?
VAT vs. excise collection efficiency

The collection efficiency is defined as the ratio of realized tax revenues to expected tax revenues, given the value added generated in sectors subject to the different excises or VAT rates. On the right axis, we report the VAT standard rate and oil excise over the period 2005-2012 in Portugal (red bars) and Greece (green bars).

The drop in VAT collection efficiency seems to be driven by the response of tax evasion to tax hikes.
What we do in this paper

- We simulate the response of the Greek economy to the change in the VAT rates according to the austerity measures implemented in 2010.

- Define tax receipts as $T = \tau \gamma \nu$, where $\tau$ is the tax rate paid by firms on the reported share $\gamma$ of value added $\nu$. The elasticity of tax receipts to taxes is:

$$
\varepsilon_{\tau \gamma \nu} = \frac{dT}{T} / \frac{d\tau}{\tau} = (1 + \varepsilon_{\gamma} + \varepsilon_{\nu}),
$$

- We report the transparency response ($\varepsilon_{\gamma}$) and the value added response ($\varepsilon_{\nu}$) to the change in tax rates associated with the austerity plan.

Counterfactuals

- Tax monitoring
- Credit market frictions
- Firm size distribution
Preview of results

We quantify the elasticity of tax receipts to the austerity plans:

\[ \varepsilon_{\gamma \tau v} = (1 + \varepsilon_{\gamma} + \varepsilon_{v}) = 0.56 \]

- transparency response \( \varepsilon_{\gamma} = -0.34 \)
- value added response \( \varepsilon_{v} = -0.10 \)

The response of tax evasion affects the borrowing capacity of firms, and substantially reduces their investment.

The output drop (2%) is twice as big than with fixed transparency (1%).
Related Literature

- **Tax evasion in Greece:**
  Artavanis et al. (2012)

- **Fiscal multiplier and elasticity of output to taxes:**
  Alesina and Ardagna (2009), Romer and Romer (2010), Ilzetzki et al. (2013), Favero et al. (2011), Auerbach and Gorodnichenko (2012)

- **Empirical literature on tax evasion:**
  Kleven et al. (2011), Cai and Liu (2009)

- **Transparency and access to finance:**
  Straub (2005), Desai et al. (2007), Ellul et al. (2014)
The arbitrage tax evasion/credit access

A model of firm transparency and investment

Quantitative analysis

Concluding remarks
The credit-transparency trade-off for Greek firms

Data:

- Firm-level balance sheets data from Hellastat provided by the Foundation for Economic and Industrial Research (IOBE)

- We have comprehensive balance sheet information of Greek firms over the period 2001-2011

- Firms have to publish their balance sheets whenever two of the following three criteria are fulfilled: (i) Turnover: 3 million, (ii) Total Assets: 1.5 million, (iii) Average staff: 50 people.

We therefore observe the universe of registered firms above these thresholds in Greece. We also observe smaller firms that publish their accounts on a voluntary basis.
Firm profitability $\pi_T$ high vs low VAT

Two observations:

- firms face a **trade-off** between paying taxes and having access to credit. Declaring a larger fraction of its activity increases observable firm profitability and access to credit at the expense of higher VAT payments.
- when tax pressure is low (low rate or tradable), this trade-off is not relevant and firms declare activity more frequently: they do not necessitate external incentives.

Key features of the model

1. firms choose the extent to which they declare their activity (no binary choice).

2. access to external financing is conditional to the existence of pledgeable capital and concealed activity is less pledgeable than declared activity, such that tax evasion reduces the capacity to levy funds.

3. there is a traditional (linear) technology, and a more productive modern technology which requires an investment in innovation:
   - a larger investment increases the probability to produce with the modern technology
   - small firms invest less and mainly operate in the informal sector with the traditional technology and without external financing
A model of firm transparency and investment (1)

Entrepreneurs are heterogeneous in terms of their initial endowment $\omega$. They choose the fraction of plants whose value added is concealed: denote $\gamma$ (transparency) the fraction of declared plants.

Production

- two technologies: a traditional one and a modern one
- the traditional technology provides returns $r$
- the modern technology is $y = Ak^\alpha$

Tax audit

- tax authorities detect an informal plant with probability $z(\omega)$
- when audited, firms pay the tax $\theta \tau$ on the concealed value added
- taxes paid by firms after production: taxes on declared value added $\tau \gamma v$, and the fees $z \theta \tau (1 - \gamma) v$ paid tax authorities after controls.
A model of firm transparency and investment (2)

Investment decision

Given the audit schedule \( z(\omega) \), the entrepreneur solves:

\[
\max_c \left\{ p(c) \pi_{\omega}^{md}(z(\omega)) + [1 - p(c)]\pi_{\omega}^{tr}(z(\omega)) - c \right\}
\]

which brings:

\[
p'(c) \left[ \pi_{\omega}^{md}(z(\omega)) - \pi_{\omega}^{tr}(z(\omega)) \right] = 1.
\]

Traditional technology

\[
\pi_{\omega}^{tr} = \max_{\gamma} \left\{ [1 - \tau \gamma - (1 - \gamma)\theta z(\omega)\tau] \rho \omega \right\}
\]

The capital equals the endowment \( \omega \). Transparency depends on \( \theta z(\omega) \):

- if \( \theta z(\omega) \geq 1 \), full transparency, otherwise full informality
A model of firm transparency and investment (3)

Modern technology

\[ \pi_{\omega}^{md} = \max_{\gamma, k} \{ [1 - \tau \gamma - (1 - \gamma) \theta z(\omega) \tau] Ak^{\alpha} - r(k - \omega) \} \]

subject to the credit constraint:

\[ (1 + r)(k - \omega) \leq \lambda \gamma \omega. \]

The solution \( \hat{k} \) verifies:

\[ A\alpha k^{\alpha-1} \left[ 1 - \theta z \tau - \frac{(1 + r)[1 - \theta z(\omega)] \tau}{\lambda} \left( \frac{1 + \alpha k}{\alpha \omega} - 1 \right) \right] = r \]

and the transparency \( \hat{\gamma} \) is obtained by substituting \( \hat{k} \) into the CC
## Benchmark calibration

<table>
<thead>
<tr>
<th>Interpretation</th>
<th>Value</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$ Returns to scale</td>
<td>0.82</td>
<td>Sales - Hellastat (2009)</td>
</tr>
<tr>
<td>$r$ Interest rate</td>
<td>0.08</td>
<td>Bank of Greece (2009)</td>
</tr>
<tr>
<td>$A$ Productivity factor</td>
<td>0.92</td>
<td>Distrib. output - Hellastat (2009)</td>
</tr>
<tr>
<td>$\lambda$ Collateral pledgeability</td>
<td>0.50</td>
<td>Distrib. leverage - Hellastat (2009)</td>
</tr>
<tr>
<td>$\beta_p$ Innovation (scale)</td>
<td>0.30</td>
<td>Distrib. leverage - Hellastat (2009)</td>
</tr>
<tr>
<td>$c_0$ Innovation (factor)</td>
<td>2.10</td>
<td>Distrib. leverage - Hellastat (2009)</td>
</tr>
<tr>
<td>$\psi$ Shape (size dist.)</td>
<td>1.9</td>
<td>Distrib. size - Hellastat (2009)</td>
</tr>
<tr>
<td>$\theta$ Punishment</td>
<td>1.5</td>
<td>Tax Procedure Code (2010)</td>
</tr>
<tr>
<td>$\tau$ VAT - low rate</td>
<td>.045 (18%)</td>
<td>VAT - Greece (2009)</td>
</tr>
<tr>
<td>VAT - medium rate</td>
<td>.09 (12%)</td>
<td>VAT - Greece (2009)</td>
</tr>
<tr>
<td>VAT - high rate</td>
<td>.019 (70%)</td>
<td>VAT - Greece (2009)</td>
</tr>
</tbody>
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Specification of the innovation function: $p(c) = \left(\frac{c}{c_0}\right)^{\beta_p}$. 
Empirical vs. theoretical leverage and output

Note: Benchmark calibration. The solid black lines are the calibrated leverage and output, the dashed blue lines are the empirical leverage and output for firms with assets between 0.5 and 50M euro.
Numerical simulations

We simulate the response of the Greek economy to the austerity measures implemented in 2010.

Changes in VAT rates: 4.5 to 5.5%, 9 to 11%, 19 to 23%.

1. Actual outcome of austerity measures
   - Results by firm size
   - Aggregate results

2. Counterfactuals
   - Tax monitoring
   - Credit market frictions
   - Firm size distribution
The impact of the first adjustment program (2010)

Leverage and transparency by firm size

Leverage and transparency along firm size for the benchmark calibration (solid line) and the 2010 austerity plan simulation (dashed line).
Pre- and post-austerity plan leverage

Source Hellastat, 2009, 2011. This graph displays the leverage by firm size (total assets) before (2009) and after (2011) the austerity plan.
The impact of the first adjustment program (2010)

<table>
<thead>
<tr>
<th>Percentage changes</th>
<th>Austerity Plans</th>
<th>Fixed transparency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax rate</td>
<td>+21.41</td>
<td>+21.41</td>
</tr>
<tr>
<td>Tax base</td>
<td>-9.22</td>
<td>-1.50</td>
</tr>
<tr>
<td>Output</td>
<td>-2.07</td>
<td>-1.15</td>
</tr>
<tr>
<td>Transparency</td>
<td>-7.34</td>
<td>-0.33</td>
</tr>
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<tr>
<th>Elasticities</th>
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<tbody>
<tr>
<td>$\varepsilon_{\tau\gamma v}$</td>
<td>0.56</td>
<td>0.95</td>
</tr>
<tr>
<td>$\varepsilon_\gamma$</td>
<td>-0.34</td>
<td>0</td>
</tr>
<tr>
<td>$\varepsilon_v$</td>
<td>-0.10</td>
<td>-0.05</td>
</tr>
</tbody>
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- Aggregate transparency at the initial equilibrium is equal to 0.82

- According to the assumption on observed firms, the elasticity of transparency lies in the interval $-0.48 < \varepsilon_\gamma < -0.32$. The elasticity of output remains almost unchanged.

- The output response is $\varepsilon_v = \nu_\gamma + \nu_v$. When transparency is fixed : $\varepsilon_v = \nu_v$
Counterfactual 1

Tax monitoring and the elasticity of tax receipts $\varepsilon_{\tau \gamma \nu}$

Note: Response to the 2010 austerity plan. The solid blue line is the elasticity of tax receipts ($\varepsilon_{\tau \gamma \nu} = 1 + \varepsilon_\gamma + \varepsilon_\nu$), the dashed red line is the transparency component of the elasticity of tax receipts ($1 + \varepsilon_\gamma$).
Counterfactual 2

Credit frictions and the elasticity of tax receipts $\varepsilon_{\tau \gamma v}$

Note: Response to the 2010 austerity plan. The solid blue line is the elasticity of tax receipts ($\varepsilon_{\tau \gamma v} = 1 + \varepsilon_\gamma + \varepsilon_v$), the dashed red line is the transparency component of the elasticity of tax receipts ($1 + \varepsilon_\gamma$).
Counterfactual 3

Firm size distribution and the elasticity of tax receipts $\varepsilon_{\tau \gamma \nu}$

Note: Response to the 2010 austerity plan. The solid blue line is the elasticity of tax receipts ($\varepsilon_{\tau \gamma \nu} = 1 + \varepsilon_\gamma + \varepsilon_\nu$), the dashed red line is the transparency component of the elasticity of tax receipts ($1 + \varepsilon_\gamma$).
Conclusion

1. when firms adjust the degree to which they declare their activity, an increase in taxes is diluted through the usual contraction of output, but also through a lower aggregate transparency

2. since transparency guarantees a better access to credit market, its decrease aggravates the contraction in formal activity. This mechanism is mainly carried out by small-medium firms, which are very sensitive to changes in the trade-off credit/tax evasion

3. we identify some evidence that small and medium size Greek firms modify their transparency in order to get access to credit and then calibrate our model to the pre-crisis characteristics of our micro dataset

4. following a tax increase, our theoretical predictions are in line with the differential responses of small firms compared to large firms

5. and with the behaviors of aggregate quantities in Greece: the transparency response accounts for about 3/4 of the elasticity of tax receipts to the austerity plan
Hints for policy

Transparency and output elasticity by firm size

The solid line is the elasticity of transparency $\varepsilon_\gamma$, the dashed line is the elasticity of output $\varepsilon_v$ as a function of firm size. Both are computed using the 2010 austerity plan.