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Fiscal multipliers with an informal sector

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Sixth Annual Workshop: ESCB Research Cluster 2

29-30 September 2022, Bank of Greece, Athens

Fiscal consolidation and economic informality in Greece

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- On the eve of its sovereign debt crisis in 2010, Greece initiated a large fiscal consolidation program
- Deep and persistent recession → Greek GDP declined by around 26% over 2009-2015
- Despite the large, broad increase in tax rates, tax revenue barely bulged, triggering further tax rate increases

- Greece possesses a large informal sector (see e.g., Hassan and Schneider, 2016)
- The presence of an informal sector may amplify the negative macroeconomic effects of a fiscal adjustment
  - Shift of economic activities to the informal sector to avoid taxes → failure to satisfy tax revenue targets → need for further fiscal adjustment

Objectives of the paper

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- Estimate the contribution of economic informality to the Greek recession
- Quantitative assessment of the fiscal policies pursued during the debt crisis
- Draw general lessons about how the informal sector impacts on the absolute and relative size of tax and government spending multipliers

- The set-up is a variant of the DSGE model of the BoG, suitably augmented to include an informal sector

Relevant literature

- The paper is related and contributes to two strands in the literature
  - Performance of the Greek economy during the sovereign crisis (Gourinchas et al. 2016, Chodorow-Reich et al. 2021)
  - Implications of the informal sector for the magnitude of fiscal multipliers and macroeconomic volatility (Pappa et al. 2015 and Pappada and Zylberberg, 2014, Restrepo-Echavarria, 2014)

- Our paper bridges the two strands of the literature
  - Assesses the contribution of fiscal policy and its individual components to the Greek recession
  - Allows the investigation of the role played by the informal sector in Greece

Preview of main findings

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- Fiscal policy was the main force behind the collapse in economic activity in Greece
  - The consolidation package accounts for at least 2/3 of the observed decline in Greek GDP
- The fiscal package triggered a rise in informal activities as share of output of about 7pp
  - The tax component of the package contributes to the bulk of this increase
- A large share of the decline in output comes from the leakage of resources to the informal sector
  - Failure to satisfy the tax revenue targets leading to further increase in taxes
  - The fiscal adjustment and decline in output could have been much milder had the informal sector been curtailed
- Tax multipliers are significantly affected by the presence of underground activities
  - Relying heavily on tax hikes without tax enforcement can be self defeating

The model: Key features

- Small open economy that belongs to a currency area
  - The domestic interest rate equals to an exogenously given risk-free policy rate

- Production (firms that operate at different stages)
  - **1st stage**: firms produce a *homogeneous intermediate* good using labour and capital (formal sector) or labor only (informal sector)
  - **2nd stage**: firms convert the formal *homogeneous intermediate* good into a formal *differentiated* intermediate good
    (Price setting: Calvo price friction)
  - **3rd stage**: firms combine domestic and imported *intermediate* goods to produce a formal *final* good

The model: Key features (cont.)

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- Tax evasion
  - Firm level: firms do not report the revenue from the sale of the informal good they produce
  - Households: do not declare the labour income earned from working in the informal sector
  - Firms/households that get detected – which happens with an exogenous probability – have to pay a fine

- A relatively detailed fiscal policy block
  - Public spending (gov. investment, gov. intermediate consumption, public sector wages, gov. transfers)
  - Tax rates (consumption, labour income, capital earnings, corporate income)

The model: Key equations

- *Production (homogeneous intermediate goods firms)*

$$Y^p_{f,t} = A^p_t \left(K^p_{f,t}\right)^a \left(H^p_{f,t}\right)^{1-a} \left(K^g_t\right)^{a_G}, \quad \textit{formal good}$$

$$Y^u_{f,t} = A^u_t \left(H^u_{f,t}\right)^{\zeta} - F, \quad \textit{informal good}$$

Production of informal good uses only labour

- *Profits*

$$\Pi_t = \max_{K^p_{f,t}, H^p_{f,t}, H^u_{f,t}} \left\{ \left(1-\tau^f_t\right) \frac{P^p_{f,t}}{P^C_t} Y^p_{f,t} + \left(1-\pi\phi^F\right) \frac{P^u_{f,t}}{P^C_t} Y^u_{f,t} - r^k_t K^p_{f,t} - w^p_t H^p_{f,t} - w^u_t H^u_{f,t} - F \right\}$$

The firms pay a corporate tax τ^f per unit of formal good produced. For the informal good, the firm can evade the revenue tax if the activity does not get detected.

Detection of informal activity with probability π, leading to fine ϕ^F of undeclared revenues

The model: Key equations (cont.)

- *Household budget constraint*

$$(1+\tau_t^c)C_{i,t}^p + \frac{P_t^u}{P_t^C}C_{i,t}^u + \frac{P_t^I}{P_t^C}I_t^i + \frac{S_t F_{i,t+1}^p}{P_t^C} =$$

$$= (1-\tau_t^l)\left(w_t^p H_{i,t}^p + w_t^g H_{i,t}^g\right) + (1-\pi\phi^W)w_t^u H_{i,t}^u + (1-\tau_t^k)\left(r_t^k u_{i,t} K_{i,t}^p\right) + Div_{i,t}$$

$$+R_{t-1}^H \frac{S_t F_{i,t}^p}{P_t^C} + \bar{G}_{i,t}^{tr} - T_{i,t} - \Gamma_{i,t}$$

Households employed in the production of the informal good do not declare their labor income.

Detection of informal labour income with constant probability π, leading to a fine ϕ^W (fraction of undeclared income)

The model: Key equations (cont.)

- *Resource constraints*
  - Informal goods are used only for household consumption

$$Y_t^u = C_t^u, \qquad \textit{informal output}$$

  - Formal goods are exported or used domestically for consumption and investment purposes, by both the private and public sector

$$Y_t^p = u_t^d\left(C_t^d + I_t^d + G_t^c + G_t^i\right) + u_t^x Y_t^x,$$

$$p_t^y Y_t^F = p_t^y Y_t^p + w_t^g H_t^g, \qquad \textit{formal output}$$

$$Y_t^T \equiv Y_t^F + Y_t^u, \qquad \textit{total output}$$

Calibration of the model

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- The model is calibrated at an annual frequency
  - The exogenous fiscal policy instruments are set equal to their values in 2009
  - The TFP in the informal sector is calibrated so that the **informal output is 15% of GDP**
    - Production of informal goods is less productive, $A_t^u < A_t^p$

Calibration of key parameters of the informal sector

Description	Parameter	Value	Source
Probability of detection	π	0.14	Data
TFP formal sector	A^p	1	Set
TFP informal sector	A^u	0.48	Calibrated
Fine for firms	Φ^F	0.1	Set
Fine for households	Φ^W	0.5	Set

Fiscal multipliers

- Steady-state analysis
  - Effects of changes in the tax-spending instruments in an economy with and without an informal sector

Fiscal multipliers: tax rate on labour income

- Economy without an informal sector

Description	Variable					
Labour tax rev./ output	TR^l/y^T	0.17	**0.18**	0.19	0.20	0.21
Tax rate	τ^l	0.321	**0.34**	0.358	0.377	0.395
% Change output	$d\widetilde{y^F}, d\widetilde{y^T}$	-1.04	**-1.06**	-1.08	-1.10	-1.13

- Economy with an informal sector

Description	Variable					
Labour tax rev./ total output	TR^l/y^T	0.15	**0.16**	0.17	0.18	0.19
Tax rate	τ^l	0.317	**0.34**	0.363	0.387	0.411
Informal / Total output	s^u	0.14	**0.15**	0.16	0.17	0.18
% Change Total output	$d\widetilde{y^T}$	-1.59	**-1.68**	-1.79	-1.92	-2.1
% Change Formal output	$d\widetilde{y^F}$	-2.51	**-2.70**	-2.90	-3.14	-3.41

- **With an informal sector**:
  - Hitting any given tax revenue level requires higher tax rates
  - The tax multipliers are much bigger and much more responsive to tax increases due to migration of activities from the formal to informal sector

Fiscal multipliers: government consumption

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- Economy without an informal sector

Description	Variable					
Gov. consumption/ total output	G^c/y^T	0.09	**0.10**	0.11	0.12	0.13
% Change Output	$\widetilde{dy^F}, \widetilde{dy^T}$	0.701	**0.712**	0.723	0.734	0.745

- Economy with an informal sector

Description	Variable					
Gov. consumption/ total output	G^c/y^T	0.09	**0.10**	0.11	0.12	0.13
Informal / Total output	s^u	0.151	**0.15**	0.149	0.147	0.146
% Change Total output	$\widetilde{dy^T}$	0.745	**0.756**	0.768	0.779	0.791
% Change Formal output	$\widetilde{dy^F}$	0.911	**0.922**	0.934	0.945	0.957

- Gov. spending multipliers do not depend on the existence and the size of the informal sector
- The effects of gov. spending on the informal sector is quantitatively very small
- The shadow economy magnifies the difference between government spending and tax multipliers

Fiscal consolidation in Greece

- Quantitative evaluation of the fiscal package in Greece during 2010-2015
- How we work
  - We start the economy in its steady state and then plug in the model the actual values of the fiscal (tax-spending) instruments for the period 2010-2015
  - Examine the effects of the total fiscal package as well as its individual components on macroeconomic activity and tax revenue

The fiscal consolidation package and economic activity

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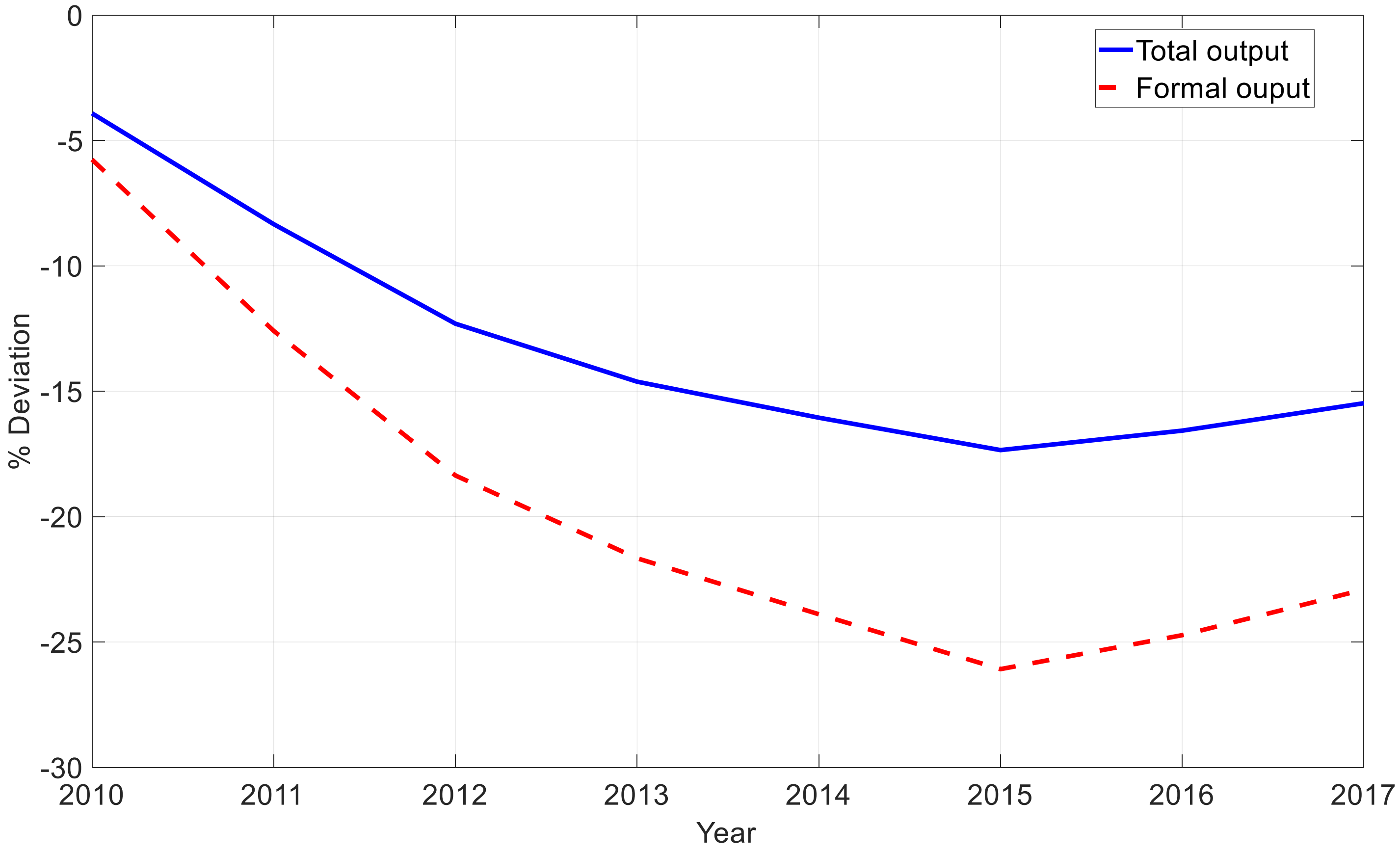
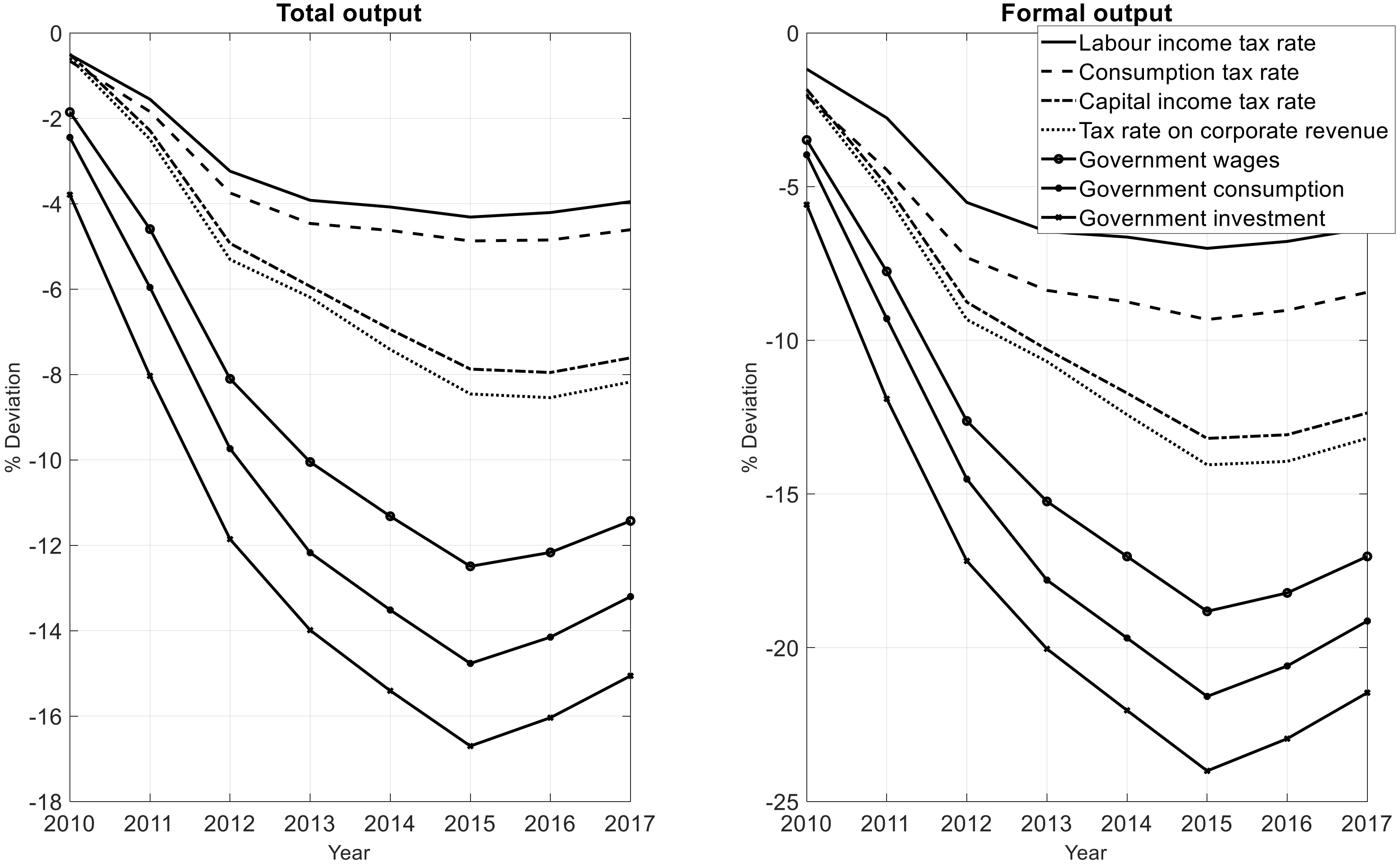


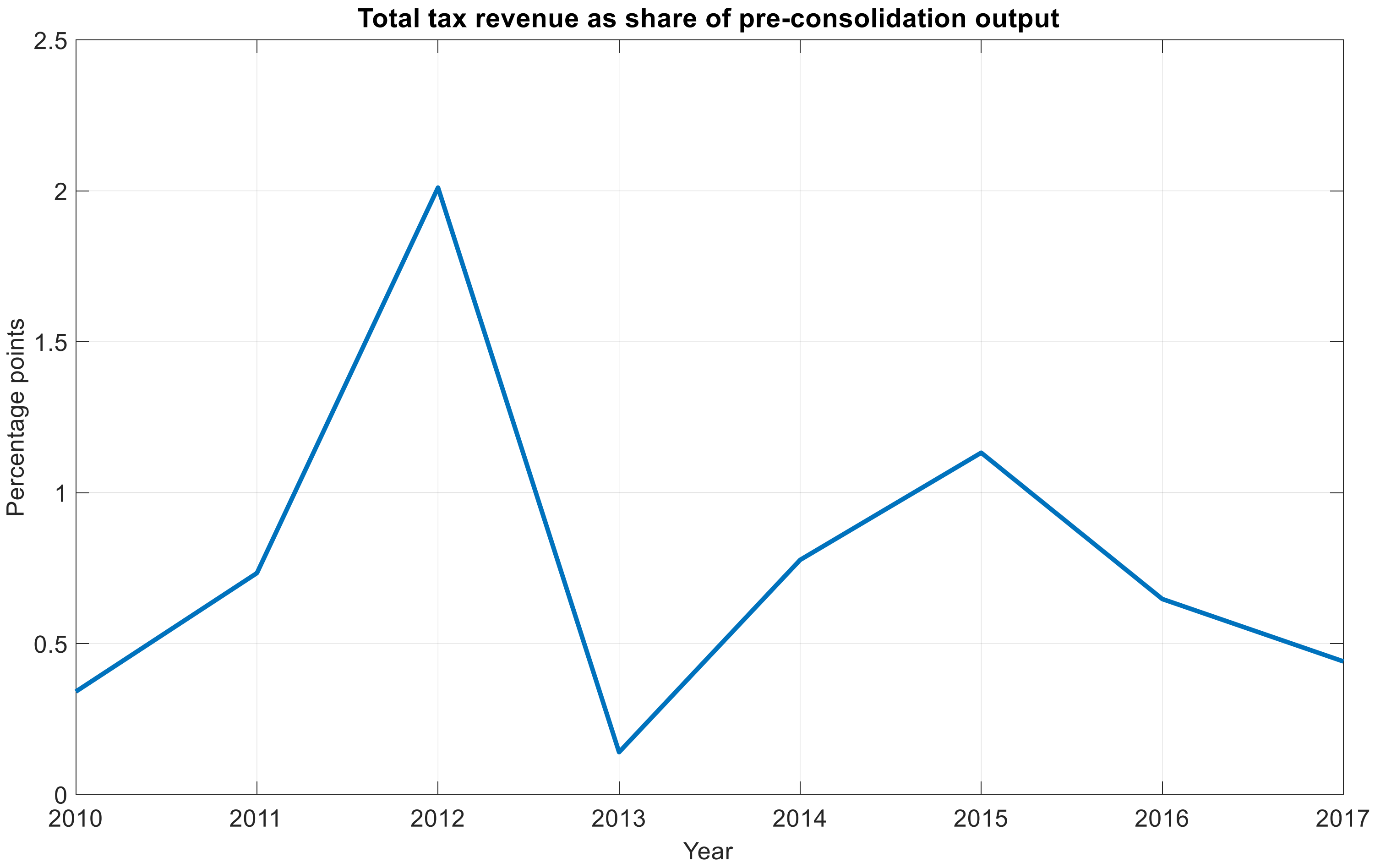
- **Formal output** decreases by 26% in 2015
- **Total output** decreases by 17%
- Depending on the share of informal activities included in the official GDP figures the model can account for
  - 2/3 of the reduction in Greek GDP (when official GDP includes 100% of the informal activities and thus it coincides with total output)
  - 100% of the reduction (when official GDP only includes formal output)

Contribution of individual fiscal instruments



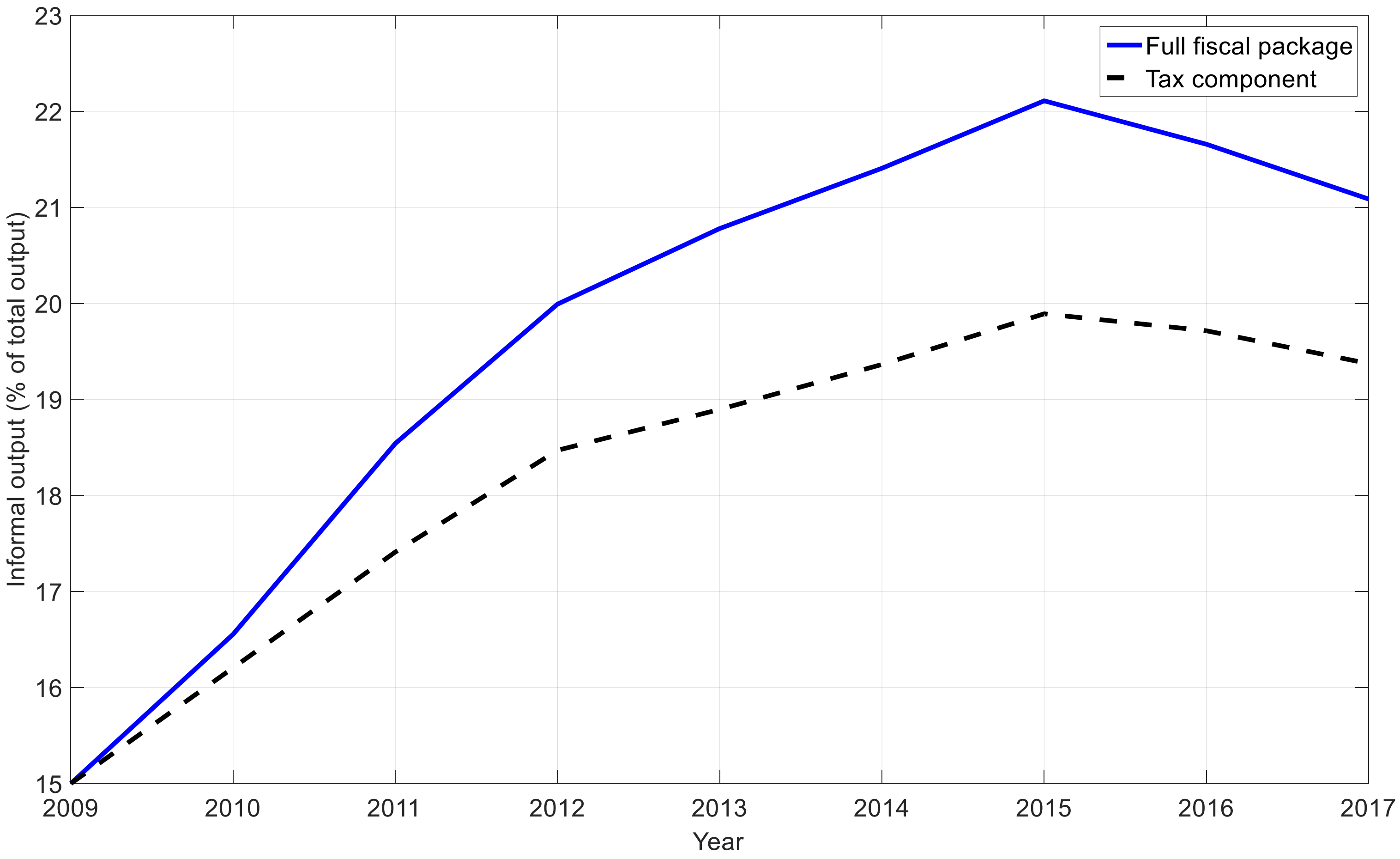
- The labour income tax hike has the biggest effect, accounting for about 1/4 of the decrease in total and formal output
- It is followed by the decrease in the public sector wage bill and the increase in the capital income tax
- Overall, tax increases account for slightly more than half of the predicted decline in total (and formal) output and spending cuts for the remaining

The effects on tax revenue



- The average extra revenue raised (as percentage of pre-consolidation output) is only around 1pp

Share of informal output to total output



- Substantial growth in informal activities from an average of 15% of pre-consolidation total output to 22% by 2015
- The tax component of the package contributes the bulk of this increase (from 15% to 20%)

Counterfactuals

- We examine how the economy would have fared under the exact same policy package if it had managed to restrict growth in the informal sector

1. We feed the actual paths of the fiscal instruments in the model while at the same time varying tax compliance in order to keep either its level or its share in total output constant at its pre crisis level

2. We impose a tax revenue requirement, keep the size of the informal sector fixed and compute the labor tax rate needed to support the revenue target

Fixing the size of the informal sector: effects on tax revenue

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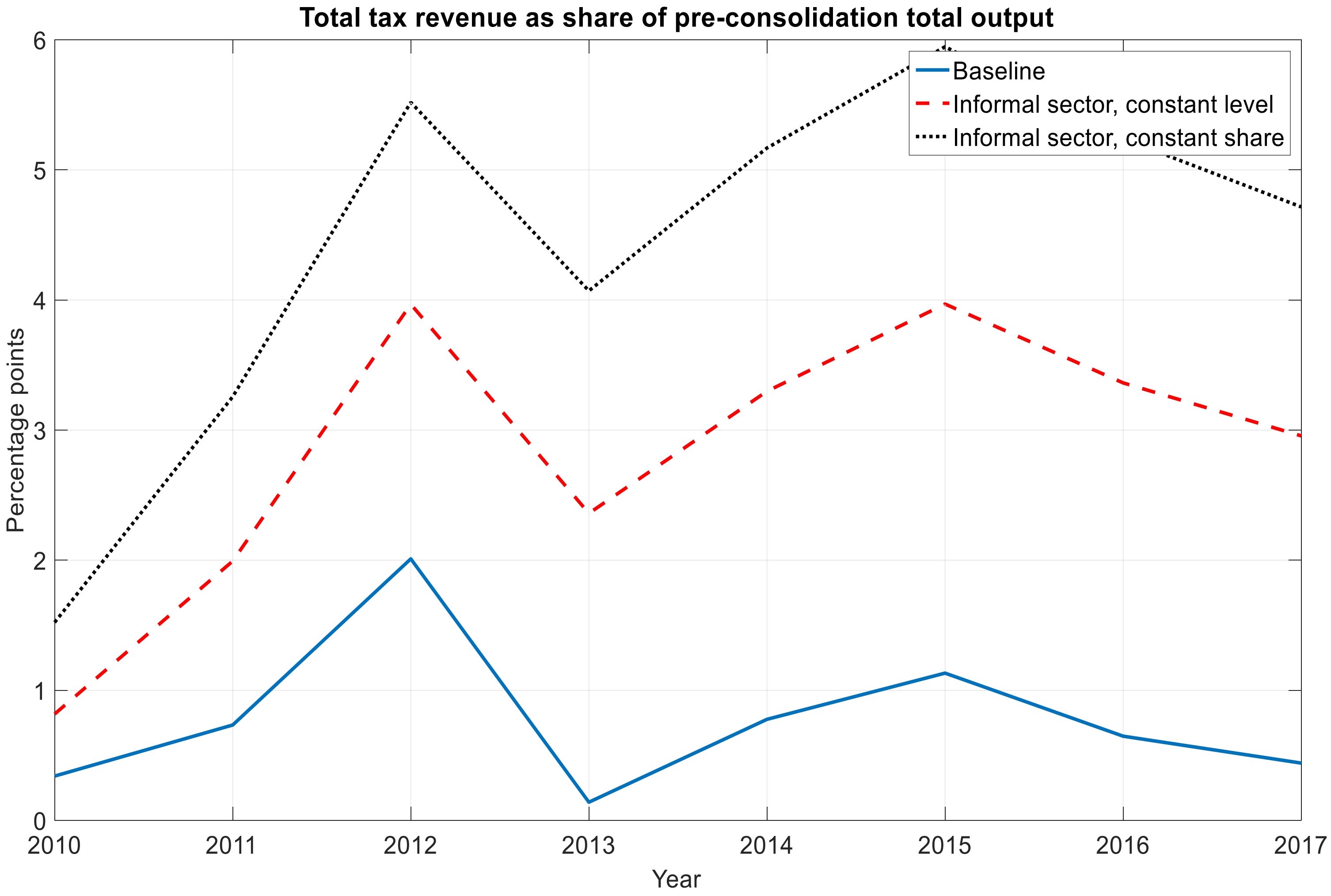
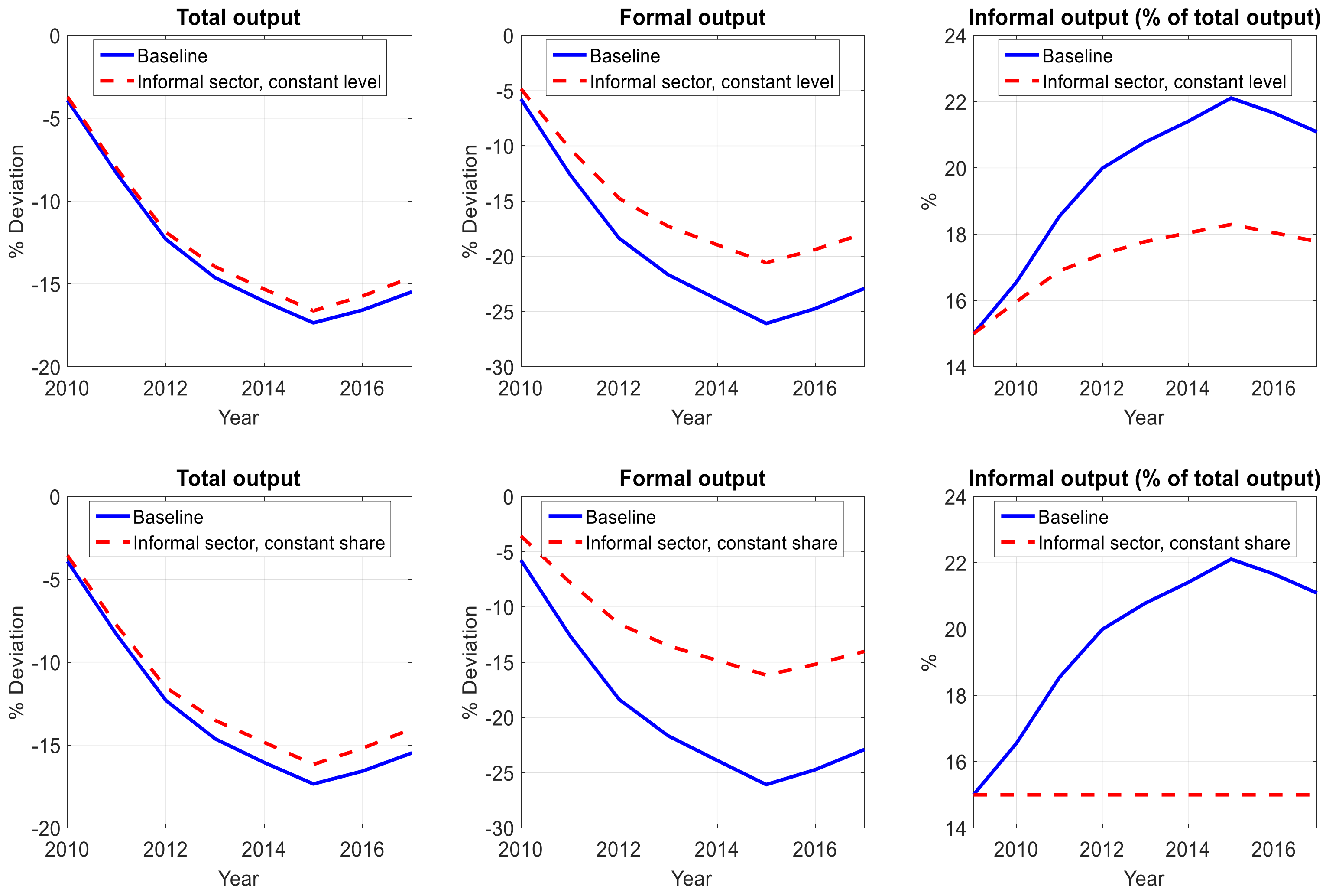


- Significant impact of stricter compliance on tax revenues that **increase by a factor of three to five**

Fixing the size of the informal sector : effects on output



- Limiting growth in informal activities would have saved about 1% of total output
- Much larger gains for formal output depending on the ways of fixing the informal sector (gains between 5% and 10%)

Fixing the size of the informal sector for a tax revenue target

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- Impose a tax revenue requirement → keep the size of the informal sector fixed and compute the labor tax rate needed to support the revenue target
- Revenue targets (total revenue as share of total output)
  - 1pp increase (model implied **average** increase over 2010-2015)
  - 2pp increase (model implied **maximum** increase)

Fiscal consolidation when fixing the size of the informal sector

Target Revenue gain	Endogenous labour tax rate (avg 2010-2015)	Total output	Formal output
Baseline	*0.39*	*-17%*	*-26%*
1pp	0.34	-11%	-14%
2pp	0.37	-13%	-17%

- The implied average labor tax rate is 0.34, about 15% less than the average labor tax rate in the fiscal package
- The output gains in formal and total output are quite substantial:
  - the decline is 14% and 11% respectively (compared to 26% and 17% in the baseline)

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Conclusions

- Fiscal consolidation was the main culprit for the severity of the recession in Greece
- The large growth of the informal sector in Greece in response to the tax hikes significantly magnified the adverse effects of fiscal consolidation
- The recession would have been much milder, had the informal sector been contained
- The multipliers associated with government spending and taxes are comparable in size in the absence of informal activities. But they diverge significantly with an informal sector

Thank you!

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Back up slides

Measuring the informal sector in Greece

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- Definition of the informal or underground economy
  - Consists of activities that lead to economic transactions on the marketplace that escape government monitoring/taxation (household production is excluded)

- Three types of estimates
  - Embedded in the SNA (available for a small number of countries and usually not public available)
  - Estimates using reduced form macro-models (Schneider, 2012, and Hassan and Schneider, 2016)
  - Based on surveys

- Our approach
  - Is based on information provided by the VAT gap and the level of the underground activity captured by the official statistics

Measuring the informal sector in Greece (cont.)

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Table 1: Share of informal sector in official GDP

	2010	2011	2012	2013	2014	2015	2001-09 avg
VAT Gap based estimate	0.20	0.24	0.28	0.29	0.26	0.26	0.15
Hassan and Schneider, 2016	0.24	0.27	0.28	0.25	-	-	0.19

Source: Author's calculations and Hassan and Schneider, 2016 (Table 4.4.)

- The share jumped significantly upwards following the initiation of the fiscal consolidation program
- The average share of the informal sector in official GDP over 2001-2013 is 18%, close to the average share of 19% reported in Hassan and Schneider, 2016.