Macroeconomic effects of Fiscal Policy Shocks in Presence of Informal Labour and Goods Markets

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December 20, 2018

Overview

Definition of Informal Sector

- Informal economy includes unreported income from all market-based legal production of goods and services, either from monetary or barter transactions – and so includes all economic activities that would generally be taxable were they reported to the state (tax) authorities, Schneider (2005)).

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- Informal sector employment has shown a tendency to increase rather than to decrease (ILO (2002) and Schneider (2005)).
- The OECD documents recommend "governments should face this reality and incorporate informal employment into their policy making".
- This implies that for the better understanding of the response of an economy to external and internal shocks it is important to have the knowledge about how formal and informal sectors respond to the various kinds of shocks and how they interact with each other.

Literature Review

- The majority of studies on the informal sector, have been more concerned with its determinants and less with its impact on macroeconomic variables and policy making (Aureo de Paula (2007), Feld and Larsen (2012),Marjit (2009) and Schneider(2015)).

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- Ihrig and Moe (2001), find the same evidence of pro-cyclical behaviour of informal employment in different emerging economies.
- Busato and Chiarini (2004) and Galli and Kucera (2003) suggest informal sector might be countercyclical.

Literature Review

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- Castillo and Montoro (2008) are among the first to incorporate the existence of this duality in NK-DSGE monetary model and verify the buffer hypothesis. The effect of demand shocks on inflation is relatively low in the presence of informality, so monetary policy is more effective in increasing the real output with less inflationary impact.

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- Presence of informal sector mitigate the impacts of productivity, monetary and government spending shock to the economy. Ahmad et. al. (2012)

- Regassa (2013) shows more variability in the impulse responses of macroeconomic variable in the presence of informal labor and goods market hence do not verify the buffer hypothesis

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- In the presence of informal sector optimal tax rate reduces and macroeconomic volatility increases (Samir Bandaogo (2015)).

Research Objectives

- Presence of informal sector amplifies or mitigates the effects of different shocks.

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- Change in expenditure or distortionary tax instruments can reallocate the productive resources of formal and informal sector.
- It would be interesting to compare the effect of different fiscal policy shocks in the presence of informal sector and their role in determining the size of fiscal policy multiplier

Research Objectives

- This study will analyze the impact of five fiscal policy instruments on key macroeconomics variables in the presence of informal labour and good markets and assess the importance of fiscal policy shocks in determining the size of multiplier in segmented market.

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- Fiscal policy instruments used in my research are government consumption, government investment and distortionary taxes on consumption, labour and capital income.

The Household

- Objective function of the household

$$U(C_t, L_t) = \frac{(C_t - hC_{t-1})^{1-\sigma_c}}{1 - \sigma_c} - \frac{(L_t)^{1+\sigma_l}}{1 + \sigma_l} \qquad (1)$$

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- Total labour supply, L_t, is given by the following CES function.

$$L_t = \left[\gamma_L^{-\theta_L} (L_{F,t})^{1+\theta_L} + (1 - \gamma_L)^{-\theta_L} (L_{I,t})^{1+\theta_L} \right]^{\frac{1}{1+\theta_L}} \tag{2}$$

where γ_L, is a share parameter that can also be interpreted as the probability that a household member is employed in the formal sector ,(Juan Carlos Conesa, Carlos DmHaz-Moreno(2002)). θ_L is the inverse of elasticity of substitution between formal and informal labour.

- This formulation ensure that households are willing to supply positive number of hours in each sectors even if the wages are not equal (Bouakez (2009), Dagher (2012), Rossi (2009)).

The Household

- Budget constraint

$$C_t(1 + \tau_t^c) + I_t + b_t = b_{t-1}(1 + R_{t-1}) + \\ (1 - \tau_t^k)R_t^k K_t + W_t L_t + Div \tag{3}$$

where

$$W_t L_t = (1 - \tau_t^l)W_{F,t} L_{F,t} + W_{I,t} L_{I,t}$$

The Household

- Consumption Euler Equation

$$\beta R_t E_t \left[\frac{(C_{t+1} - bC_t)^{-\sigma}(1 + \tau_t^c)}{(C_t - bC_{t-1})^{-\sigma}(1 + \tau_{t+1}^c)} \right] = 1 \tag{4}$$

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- Physical assets optimization equation

$$E_t \left[(1 - \delta) + (1 - \tau_{t+1}^k)r_{t+1}^k \right] = R_t \tag{5}$$

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$$E_t \left[(1 - \delta) + (1 - \tau_{t+1}^k)r_{t+1}^k \right] = R_t \qquad (5)$$

- Consumption leisure choice

$$\frac{(L_t^{\sigma_l})(1 + \tau_t^c)}{(C_t - hC_{t-1})^{-\sigma}} = W_t \qquad (6)$$

Household Consumption Decision

- Aggregate consumption of HH is composite of both formal and informal consumption

$$C_t = \left[(1-\gamma)^{\frac{1}{\nu}} C_{F,t}^{\frac{\nu-1}{\nu}} + \gamma^{\frac{1}{\nu}} C_{I,t}^{\frac{\nu-1}{\nu}} \right]^{\frac{\nu}{\nu-1}} \tag{7}$$

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- FOC yield the demand function of formal and informal consumption

$$C_{F,t} = (1-\gamma) \left(\frac{P_{F,t}}{P_t} \right)^{-\nu} C_t \tag{8}$$

$$C_{I,t} = \gamma \left(\frac{P_{I,t}}{P_t} \right)^{-\nu} C_t \tag{9}$$

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- Overall consumer price level

$$P_t = \left[(1-\gamma)P_{F,t}^{1-\nu} + \gamma P_{I,t}^{1-\nu} \right]^{\frac{1}{1-\nu}} \tag{10}$$

- Household conditional labour supply to formal sector

$$L_{f,t} = \gamma_l \left(\frac{(1 - \tau_t^l) W_{f,t}}{W_t} \right)^{\frac{1}{\theta_l}} L_t \qquad (11)$$

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- Household conditional labour supply to informal sector

$$L_{i,t} = (1 - \gamma_l) \left(\frac{W_{i,t}}{W_t} \right)^{\frac{1}{\theta_l}} L_t \qquad (12)$$

Formal Goods Producing Sector

- Formal sector producer indexed by,f,employ the following Cobb Douglas production function.

$$Y_{F,t(f)} = A_{F,t}K_t^{\alpha}L_{F,t(f)}^{1-\alpha}(K_{g,t}^{\alpha_g}) \tag{13}$$

Where $A_{f,t}$ is the exogenous level of technology, $L_{F,t(f)}$, amount of formal labour and K_t is the quantity of physical capital, K_g denotes the public capital and α_g is output elasticity of public capital

- The problem of cost minimization subject to production function yield marginal cost

$$MC_{F,t} = (\frac{1}{1-\alpha})^{1-\alpha}(\frac{1}{\alpha})^{\alpha}A_{F,t}^{-1}(W_{F,t})^{1-\alpha}(r_{k,t})^{\alpha}k_{g,t-1}^{-\alpha_g} \tag{14}$$

Formal Goods Producing Sector

- Wages in the formal sector given as

$$W_{f,t} = P_{f,t}(1 - \alpha)\frac{Y_{f,t}}{L_{f,t}} \tag{15}$$

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$$W_{f,t} = P_{f,t}(1-\alpha)\frac{Y_{f,t}}{L_{f,t}} \qquad (15)$$

- Rent of the capital is given as

$$r_t^k = P_{f,t}\frac{\alpha Y_{f,t}}{K_t} \qquad (16)$$

Informal Goods Producing Sector

- Informal sector firm produce intermediate informal goods by only labor at given wages

$$Y_{I,t(i)} = A_{I,t}L_{I,t}K_{g,t}^{\alpha_g} \tag{17}$$

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- Marginal cost of informal firm

$$MC_{I,t} = (A_{I,t})^{-1} W_{I,t} k_{g,t-1}^{-\alpha_g} \tag{19}$$

Government Behavior

- Government budget constraint

$$\left(\frac{R_{t-1}}{P_t}\right) b_{t-1} + G_t + GI_t = \tau_t^c C_t + \tau_t^l w_{f,t} L_{f,t} + \tau_t^k r_t^k K_t + b_t \quad (20)$$

- Equation of law of motion of public capital

$$K_{g,t} = (1 - \delta_g) K_{g,t-1} + IG \quad (21)$$

Fiscal Policy Rules

- Five fiscal policy rules are set as follows
  - Public consumption

$$\hat{G}_t = -\psi_{b,g}\hat{b}_{t-1} - \psi_{g,y}\hat{y}_{f,t} + \epsilon_{g,t} \tag{22}$$

  - Public investment

$$\hat{GI}_t = -\psi_{b,gi}\hat{b}_{t-1} - \psi_{gi,y}\hat{y}_{f,t} + \epsilon_{gi,t} \tag{23}$$

  - Consumption tax rate

$$\hat{\tau}_t^c = \psi_{b,\tau^c}\hat{b}_{t-1} + \psi_{\tau^c,y}\hat{y}_{f,t} - \epsilon_{\tau^c,t} \tag{24}$$

  - Labour income tax rate

$$\hat{\tau}_t^c = \psi_{b,\tau^l}\hat{b}_{t-1} + \psi_{\tau^l,y}\hat{y}_{f,t} - \epsilon_{\tau^l,t} \tag{25}$$

  - capital income tax rate

$$\hat{\tau}_t^k = \psi_{b,\tau^k}\hat{b}_{t-1} + \psi_{\tau^k,y}\hat{y}_{f,t} - \epsilon_{\tau^k,t} \tag{26}$$

Goods Market Equilibrium

- Formal sector resource constraint is the sum of formal sector consumption,$(C_{f,t})$, private investment,(I_t) , government (G_t) and government investment, (GI_t).

$$Y_{f,t} = C_{f,t} + I_t + G_t + GI_t \qquad (27)$$

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- Output of informal sector is consumed by household, its resource constraint is given

$$Y_{i,t} = C_{i,t} \tag{28}$$

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- Aggregate level of output is the sum of formal and infromal sector output.

$$Y_t = Y_{f,t}P_{f,t} + Y_{i,t}P_{i,t} \qquad (29)$$

Calibration

Table: Structural Parameters

Parameter	Value	Parameter	Value
β	0.991	h	0.36
σ_c	2.61	σ_l	1.5
δ	0.03	δ_g	0.02
α	0.45	α_g	0.010
γ_L	0.29	θ_L	2
μ	0.7	γ	0.55

Calibration

Table: Steady State

Parameter	value
Steady state price of formal sector	0.53
Steady state price of informal sector	0.47
Consumption tax to GDP	0.17
Labour income tax to GDP	0.25
Capital tax to GDP	0.35
Government consumption to GDP	0.20
Debt to GDP	0.9
Government investment to GDP	0.02

Impulse Response Functions
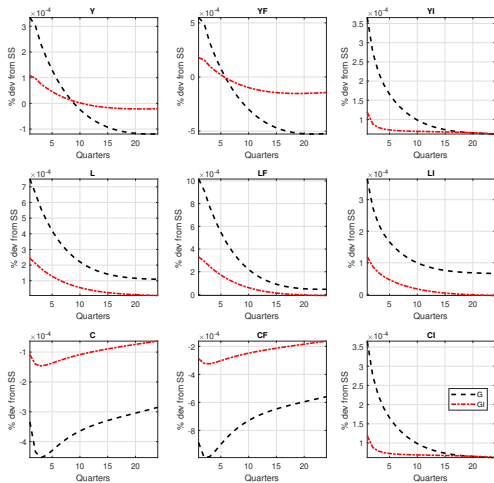
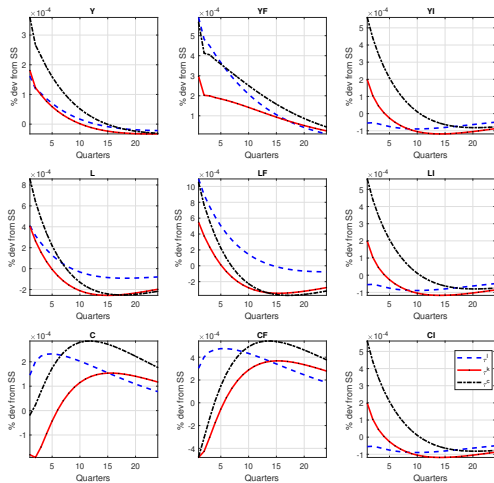Figure: Government Consumption and Investment Shock

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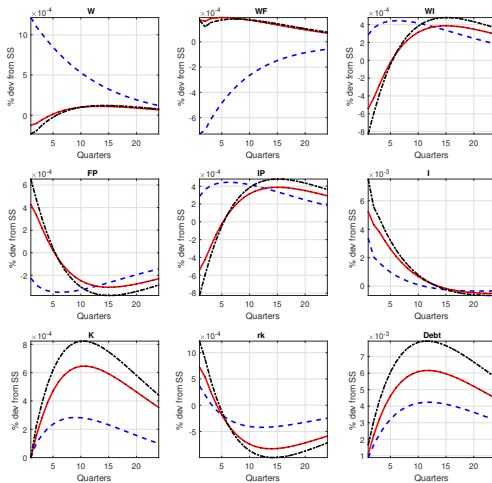
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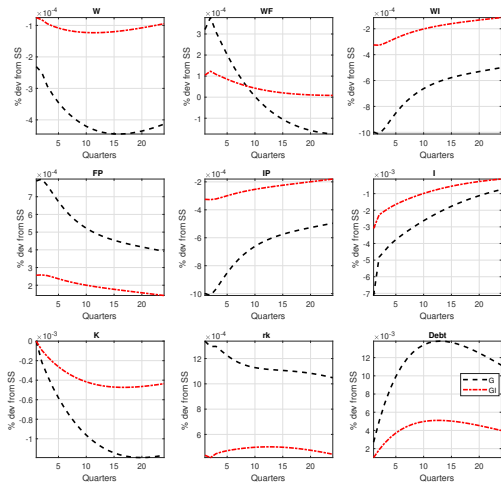
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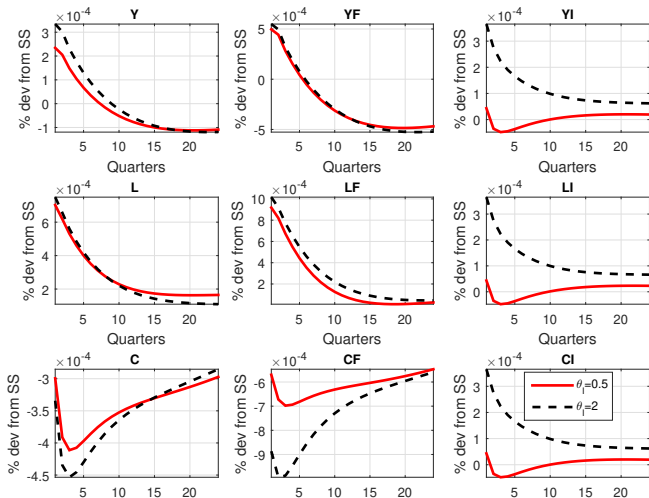Figure: Tax Shocks

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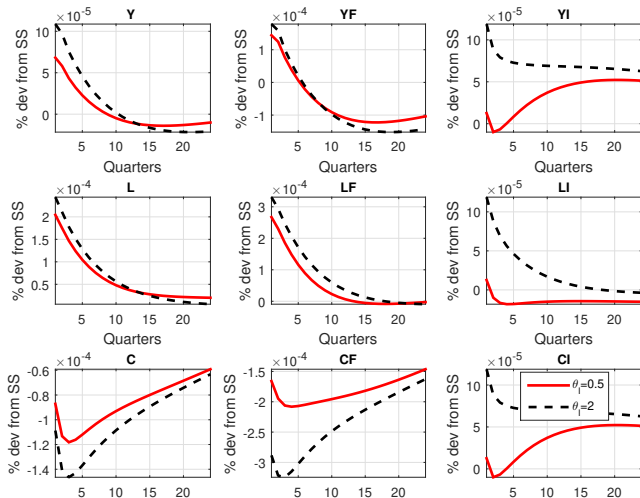
Figure: Tax Shocks

Impact of Sectoral Labour mobility

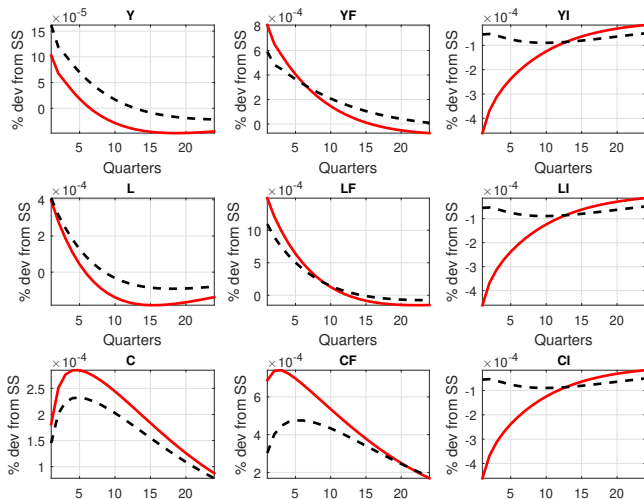Figure: Government Consumption Shock

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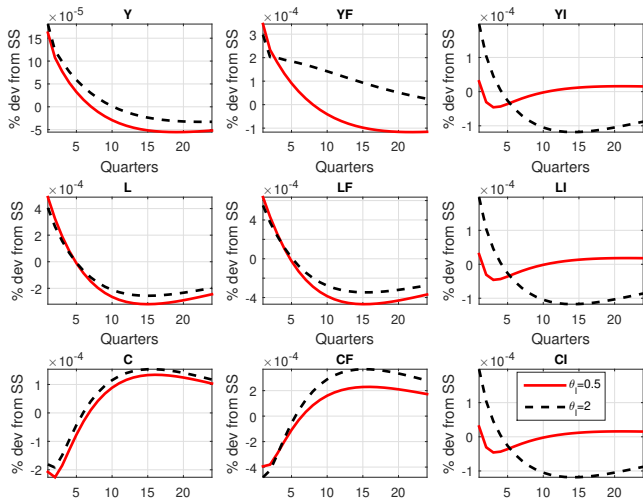

Figure: Government Investment Shock

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Figure: Labour Tax Shock

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Figure: Capital Tax Shock

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Figure: Consumption Tax Shock
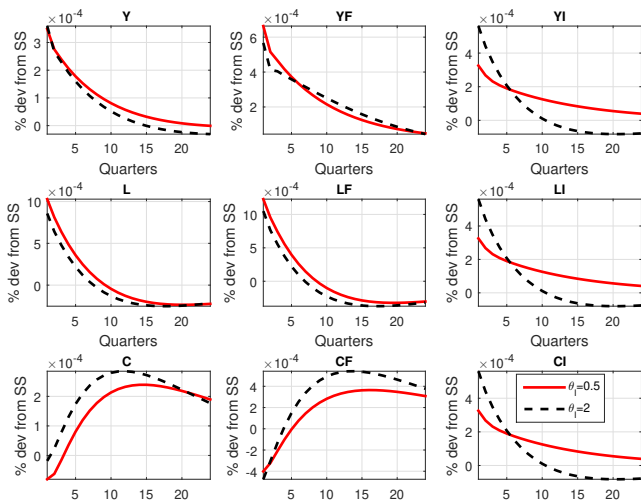
Present Value Multiplier

- The present value multipliers are widely used in the literature for example Uhlig(2009),Leeper(2010) and Coenen(2013). Present value multiplier are calculated by using the following formula

$$PV = \frac{\sum\limits_{j=0}^{k} \left(\prod\limits_{i=0}^{j} R_{t+i}^{-1} \right) \triangle Y_{t+j}}{\sum\limits_{j=0}^{k} \left(\prod\limits_{i=0}^{j} R_{t+i}^{-1} \right) \triangle X_{t+j}}$$

Where X=$(G, GI, \tau^c, \tau^l and \tau^c)$

Table: Government investment present value multiplier

Variables	1	2	4	12	20	250
$\frac{PV(\triangle Y)}{PV(\triangle GI)}$	0.13	0.10	0.14	0.15	0.18	0.23
$\frac{PV(\triangle YF)}{PV(\triangle GI)}$	0.1	0.09	0.12	0.13	0.15	0.18
$\frac{PV(\triangle YI)}{PV(\triangle GI)}$	0.04	0.01	0.07	0.1	0.11	0.13

Table: Government consumption present value multiplier

Variables	1	2	4	12	20	250
$\frac{PV(\triangle Y)}{PV(\triangle G)}$	0.28	0.27	0.26	0.24	0.20	0.21
$\frac{PV(\triangle YF)}{PV(\triangle G)}$	0.17	0.12	0.09	0.06	0.04	0.05
$\frac{PV(\triangle YI)}{PV(\triangle G)}$	0.09	0.10	0.12	0.12	0.11	0.10

Table: Consumption tax present value multiplier

Variables	1	2	4	12	20	250
$\frac{PV(\triangle Y)}{PV(\triangle \tau^c)}$	- 0.22	-0.24	- 0.23	-0.14	-0.10	-0.19
$\frac{PV(\triangle YF)}{PV(\triangle \tau^c)}$	- 0.16	-0.19	- 0.17	-0.05	-0.08	-0.14
$\frac{PV(\triangle YI)}{PV(\triangle \tau^c)}$	- 0.06	-0.06	- 0.07	-0.07	-0.03	-0.05

Table: Labour tax present value multiplier

Variable	1	2	4	12	20	250
$\frac{PV(\triangle Y)}{PV(\triangle \tau^l)}$	- 0.04	-0.02	0.023	0.17	0.27	0.1
$\frac{PV(\triangle YF)}{PV(\triangle \tau^l)}$	- 0.22	-0.20	- 0.18	-0.07	-0.07	-0.15
$\frac{PV(\triangle YI)}{PV(\triangle \tau^l)}$	0.08	0.09	0.1	0.14	0.20	0.13

Table: Capital tax present value multiplier

Variable	1	2	4	12	20	250
$\frac{PV(\triangle Y)}{PV(\triangle \tau^k)}$	- 0.04	-0.04	- 0.05	-0.06	0.029	0.031
$\frac{PV(\triangle YF)}{PV(\triangle \tau^k)}$	- 0.02	-0.03	- 0.07	-0.13	-0.1	-0.05
$\frac{PV(\triangle YI)}{PV(\triangle \tau^k)}$	- 0.01	-0.009	0.008	0.1	0.18	-0.04

Conclusion

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- Decrease in taxes has negative impact on the level of informal sector output in long run. It implies that the size of informal sector decreases as a result of decrease in distortionary taxes.

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- The impact of decrease in the labour tax is more pronounced on both sectors with higher labour mobility.

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- Capital tax cut has the lower multiplier among all fiscal policy instruments in presence of informal sector.
- The increase in labour mobility weakens the impact of government investment and consumption shocks on the output of both formal and informal sector.
- The impact of decrease in the labour tax is more pronounced on both sectors with higher labour mobility.
- The output of the informal sector declines more because of the large movement of the labour from informal to the formal sector which results in larger increase in the level of output of the formal sector