Optimal Taxation and Public Provision for Poverty Minimization

Ravi Kanbur (Cornell University)
Jukka Pirttilä (UNU-WIDER)
Matti Tuomala (University of Tampere)
Tuuli Ylinen (Aalto University)

UNU-WIDER Conference on Inequality
5 September 2014
Introduction

- Many developing countries suffer from high inequality
- Typically the only way for a government to affect inequality and poverty is via redistributive taxes and transfers, as well as public good provision
- In low-income countries, these systems are still in early age: need to upgrade towards more comprehensive systems
Our paper

- Characterize the optimal redistributive tax-transfer system for developing countries
  - Labour income tax, commodity taxes
  - Cash transfer, public provision of public and private goods
- Employ optimal tax theory framework (Miryles 1971)
Our paper

▶ Modifications to optimal tax framework for developing countries

▶ Depart from fully nonlinear taxes
  ▶ Consider a linear income tax, universal benefit
  ▶ Follow linear tax literature (Dixit & Sandmo 1977, Piketty & Saez 2013)

▶ Depart from social welfare maximization as objective (based on individual utilities)
  ▶ Consider poverty minimization as explicit objective
  ▶ Follow general non-welfarist literature (Seade 1980, Kanbur, Pirttilä & Tuomala 2006) and poverty minimization literature (Kanbur, Keen & Tuomala 1994, Pirttilä & Tuomala 2004)
Our paper

- Modifications to optimal tax framework for developing countries
- Depart from fully nonlinear taxes
  - Consider a linear income tax, universal benefit
  - Follow linear tax literature (Dixit & Sandmo 1977, Piketty & Saez 2013)
- Depart from social welfare maximization as objective (based on individual utilities)
  - Consider poverty minimization as explicit objective
  - Follow general non-welfarist literature (Seade 1980, Kanbur, Pirttilä & Tuomala 2006) and poverty minimization literature (Kanbur, Keen & Tuomala 1994, Pirttilä & Tuomala 2004)
Our paper

- Modifications to optimal tax framework for developing countries
- Depart from fully nonlinear taxes
  - Consider a linear income tax, universal benefit
  - Follow linear tax literature (Dixit&Sandmo 1977, Piketty&Saez 2013)
- Depart from social welfare maximization as objective (based on individual utilities)
  - Consider poverty minimization as explicit objective
  - Follow general non-welfarist literature (Seade 1980, Kanbur, Pirttilä&Tuomala 2006) and poverty minimization literature (Kanbur,Keen&Tuomala 1994, Pirttilä&Tuomala 2004)
Preview of results

- Changing from welfare maximization to poverty minimization, some of the standard optimal tax results change
  - More sensitive to labour supply behaviour
  - Uniform commodity taxes are never optimal; favour differentiated commodity taxes
Preview of results

- Changing from welfare maximization to poverty minimization, some of the standard optimal tax results change
  - More sensitive to labour supply behaviour
  - Uniform commodity taxes are never optimal; favour differentiated commodity taxes
Changing from welfare maximization to poverty minimization, some of the standard optimal tax results change

- More sensitive to labour supply behaviour
- Uniform commodity taxes are never optimal; favour differentiated commodity taxes
Outline

Introduction

Model of optimal taxation for developing countries
   Model basics
   Linear income taxation
   Linear income tax & Public provision of public and private goods
   Linear income tax & Commodity taxation

Summary and applications of the model
   Summary
   Applications/Future work
Outline

Introduction

Model of optimal taxation for developing countries
  Model basics
    Linear income taxation
    Linear income tax & Public provision of public and private goods
    Linear income tax & Commodity taxation

Summary and applications of the model
  Summary
  Applications/Future work
The model

- Government’s instruments:
  - linear income tax $\tau$
  - universal lump-sum benefit $b$
  - public provision: pure public good $G$ or quasi-private good $s = G + h$
  - commodity taxes (subsidies) $t_j$
The model

- 
  - \( N \) individuals with labour income \( z^i = w^i L^i \), consumption \( c^i = (1 - \tau)z^i + b \)

- Government’s objective
  - Social welfare maximization
    \[
    \max \sum_i W\left( V^i(1 - \tau, b) \right) \text{ s.t. } \tau \sum_i z^i = Nb + R
    \]
  - General non-welfarism
    \[
    \max \sum_i F(c^i, z^i) \text{ s.t. } \tau \sum_i z^i = Nb + R
    \]
  - Poverty minimization as a case of non-welfarism
    \[
    \sum_i F(c^i, z^i) = \sum_i D\left( c^i, \bar{c} \right) \left( = \frac{1}{N} \sum_{i=1}^{h} \left( \frac{\bar{c} - c^i}{\bar{c}} \right)^\alpha \right)
    \]
The model

- $N$ individuals with labour income $z^i = w^i L^i$, consumption $c^i = (1 - \tau)z^i + b$

- Government’s objective
  - Social welfare maximization
    $$\max \sum_i W \left( V^i (1 - \tau, b) \right) \ \text{s.t.} \ \tau \sum_i z^i = Nb + R$$
  - General non-welfarism
    $$\max \sum_i F(c^i, z^i) \ \text{s.t.} \ \tau \sum_i z^i = Nb + R$$
  - Poverty minimization as a case of non-welfarism
    $$\sum_i F(c^i, z^i) = \sum_i D \left( c^i, \bar{c} \right) \left( = \frac{1}{N} \sum_{i=1}^h \left( \frac{\bar{c} - c^i}{\bar{c}} \right)^{\alpha} \right)$$
The model

- $N$ individuals with labour income $z^i = w^i L^i$, consumption $c^i = (1 - \tau)z^i + b$

- Government’s objective
  - Social welfare maximization
    $\max \sum_i W(V^i(1 - \tau, b))$ s.t. $\tau \sum_i z^i = Nb + R$
  - General non-welfarism
    $\max \sum_i F(c^i, z^i)$ s.t. $\tau \sum_i z^i = Nb + R$
  - Poverty minimization as a case of non-welfarism
    $\sum_i F(c^i, z^i) = \sum_i D(c^i, \bar{c}) \left( = \frac{1}{N} \sum_{i=1}^{h} \left( \frac{\bar{c} - c^i}{\bar{c}} \right)^{\alpha} \right)$
The model

- $N$ individuals with labour income $z^i = w^i L^i$, consumption $c^i = (1 - \tau)z^i + b$

- Government’s objective
  - Social welfare maximization
    \[
    \max \sum_i W(V^i(1 - \tau, b)) \quad \text{s.t.} \quad \tau \sum_i z^i = Nb + R
    \]
  - General non-welfarism
    \[
    \max \sum_i F(c^i, z^i) \quad \text{s.t.} \quad \tau \sum_i z^i = Nb + R
    \]
  - Poverty minimization as a case of non-welfarism
    \[
    \sum_i F(c^i, z^i) = \sum_i D(c^i, \bar{c}) \quad (= \frac{1}{N} \sum_{i=1}^{h} \left( \frac{\bar{c} - c^i}{\bar{c}} \right)^\alpha)
    \]
Outline

Introduction

Model of optimal taxation for developing countries
   Model basics
   \textbf{Linear income taxation}
   Linear income tax & Public provision of public and private goods
   Linear income tax & Commodity taxation

Summary and applications of the model
   Summary
   Applications/Future work
Results: Linear income taxation

When the government is welfaristic, we have the optimal tax rate:

$$\frac{\tau^*}{1 - \tau^*} = \frac{1}{e} (1 - \Omega)$$

- $e$ aggregate labour supply elasticity: $e \uparrow \Rightarrow \tau \downarrow$
- $\Omega$ takes inequality into account via welfare-weighted incomes: more unequal $= \Omega \downarrow \Rightarrow \tau \uparrow$
Results: Linear income taxation

When the government is welfaristic, we have the optimal tax rate:

$$\frac{\tau^*}{1 - \tau^*} = \frac{1}{e} (1 - \Omega)$$

- $e$ aggregate labour supply elasticity: $e \uparrow \Rightarrow \tau \downarrow$
- $\Omega$ takes inequality into account via welfare-weighted incomes: more unequal $= \Omega \downarrow \Rightarrow \tau \uparrow$
Results: Linear income taxation

When the government’s objective is to minimize poverty (deprivation $D(c^i, \bar{c})$), the optimal tax rule becomes:

$$\frac{\tau^*}{1 - \tau^*} = \frac{1}{e} \left(1 - \tilde{D}\right)$$

- $e \uparrow \Rightarrow \tau \downarrow$
- $\tilde{D} = \frac{1}{z} \frac{\sum_i D_c(z^i + (1 - \tau)z^i_{1-\tau})}{\sum_i D_c(1 + (1 - \tau)z^i_b)} = \frac{1}{z} \frac{\sum_i D_c(1 + e^i)z^i}{\sum_i D_c(1 + (1 - \tau)z^i_b)}$ measures the relative efficiency of taxes in reducing deprivation: $\tilde{D} \downarrow \Rightarrow \tau \uparrow$
- additional efficiency impact $e^i$ within $\tilde{D}$: induce the poor to work more by lowering $\tau$ (on everyone) (cf. Kanbur, Keen & Tuomala 1994)
Results: Linear income taxation

When the government’s objective is to minimize poverty (deprivation $D(c_i, \bar{c})$), the optimal tax rule becomes:

$$\frac{\tau^*}{1 - \tau^*} = \frac{1}{e} \left( 1 - \tilde{D} \right)$$

- $e \uparrow \Rightarrow \tau \downarrow$
- $\tilde{D} = \frac{1}{z} \sum_i D_c(z^i + (1 - \tau)z_{1-\tau}^i) = \frac{1}{z} \sum_i D_c(1 + e^i)z^i$ measures the relative efficiency of taxes in reducing deprivation: $\tilde{D} \downarrow \Rightarrow \tau \uparrow$
  - additional efficiency impact $e^i$ within $\tilde{D}$: induce the poor to work more by lowering $\tau$ (on everyone) (cf. Kanbur, Keen & Tuomala 1994)
Outline

Introduction

Model of optimal taxation for developing countries
  Model basics
  Linear income taxation
  Linear income tax & Public provision of public and private goods
  Linear income tax & Commodity taxation

Summary and applications of the model
  Summary
  Applications/Future work
Results: Public provision with linear income taxation

Provision of pure public good $G$

When the government is welfaristic, public provision rule is:

$$\sigma^* = \frac{p - \tau \bar{Z}_G}{1 - \tau \bar{Z}_b}$$

- $\sigma^*$ welfare-weighted sum of marginal rates of substitution between $G$ and $b$
- RHS reflects relative cost of public provision
  - $p$ (price of $G$) reflects the marginal rate of transformation
  - $\tau \bar{Z}_G$, $\tau \bar{Z}_b$ reflect tax revenue effects
Results: Public provision with linear income taxation

Provision of pure public good $G$

When the government is welfaristic, public provision rule is:

$$\sigma^* = \frac{p - \tau \bar{z}_G}{1 - \tau \bar{z}_b}$$

- $\sigma^*$ welfare-weighted sum of marginal rates of substitution between $G$ and $b$
- RHS reflects relative cost of public provision
  - $p$ (price of $G$) reflects the marginal rate of transformation
  - $\tau \bar{z}_G$, $\tau \bar{z}_b$ reflect tax revenue effects
When the government’s objective is to minimize poverty (deprivation \( D = D(x^i, G, \bar{x}, \bar{G}) \)), the public provision rule becomes:

\[
D^* = \frac{p - \tau \bar{z}_G}{1 - \tau \bar{z}_b}
\]

- \( D^* = \frac{\sum_i D_G + \sum D_x(1-\tau)z^i_G}{\sum_i D_x(1+(1-\tau)z^i_G)} \) relative efficiency of \( G \) in reducing deprivation
- Additional impact on deprivation via labour supply impacts \( z^i_G \)
- RHS reflects relative cost of public provision
Results: Public provision with linear income taxation

Provision of pure public good $G$

When the government’s objective is to minimize poverty (deprivation $D = D(x^i, G, \bar{x}, \bar{G})$), the public provision rule becomes:

$$D^* = \frac{p - \tau \bar{Z}_G}{1 - \tau \bar{Z}_b}$$

- $D^* = \frac{\sum_i D_G + \sum D_x(1-\tau)z^i_G}{\sum_i D_x(1+(1-\tau)z^i_b)}$ relative efficiency of $G$ in reducing deprivation
- Additional impact on deprivation via labour supply impacts $z^i_G$
- RHS reflects relative cost of public provision
Results: Public provision with linear income taxation

Other types of public provision

- Provision of quasi-private good $s = G + h$
  - Deprivation $D(x^i, s^i, \bar{x}, \bar{s})$: people can make private purchases $h^i$ but total amount $s^i$ defines deprivation
  - If do not crowd out private purchases, equal to pure public good case
  - If crowd out private purchases entirely, and provision is funded with a matching increase in tax rate, no impact on poverty

- Publicly provided good $G$ affects productivity:
  - Consumption of good $G$ is not valued as such ($D_G = 0$), but it has an impact on the wage rate: $z^i = w(G)L^i$ such that $w' > 0 \Rightarrow z^i_G = w \frac{\partial L}{\partial G} + w'L$
  - Public provision can be desirable even if no direct impact on individual deprivation
Results: Public provision with linear income taxation

Other types of public provision

- Provision of quasi-private good $s = G + h$
  - Deprivation $D(x^i, s^i, \bar{x}, \bar{s})$: people can make private purchases $h^i$ but total amount $s^i$ defines deprivation
  - If do not crowd out private purchases, equal to pure public good case
  - If crowd out private purchases entirely, and provision is funded with a matching increase in tax rate, no impact on poverty

- Publicly provided good $G$ affects productivity:
  - Consumption of good $G$ is not valued as such ($D_G = 0$), but it has an impact on the wage rate: $z^i = w(G)L^i$ such that $w' > 0 \Rightarrow z^G_G = w \frac{\partial L}{\partial G} + w'L$
  - Public provision can be desirable even if no direct impact on individual deprivation
Outline

Introduction

Model of optimal taxation for developing countries
   Model basics
   Linear income taxation
   Linear income tax & Public provision of public and private goods
   Linear income tax & Commodity taxation

Summary and applications of the model
   Summary
   Applications/Future work
Results: Commodity taxation with linear income taxation

Welfaristic tax rule:

$$\frac{1}{N} \sum_i \sum_j t_j \frac{\partial \tilde{x}_k^i}{\partial q_j} = \frac{1}{\lambda} \text{cov}(\gamma^i, x_k^i)$$

Poverty-minimizing tax rule:

$$\frac{1}{N} \sum_i \sum_j t_j \frac{\partial \tilde{x}_k^i}{\partial q_j} = -\frac{1}{\lambda} \left[ \frac{1}{N} \sum_i D_c x_k^i + \frac{1}{N} \sum_i \sum_j D_c q_j \frac{\partial \tilde{x}_k^i}{\partial q_j} \right]$$

$$+ \frac{1}{\lambda} \text{cov} \left( D_c q_j \frac{\partial x_j^i}{\partial b}, x_k^i \right) - \frac{1}{\lambda} \text{cov} \left( \sum_j t_j \frac{\partial x_j^i}{\partial b}, x_k^i \right)$$
Results: Commodity taxation with linear income taxation

Welfaristic tax rule:

\[
\frac{1}{N} \sum_i \sum_j t_j \frac{\partial \hat{x}_k^i}{\partial q_j} = \frac{1}{\lambda} \text{cov}(\gamma^i, x_k^i)
\]

Poverty-minimizing tax rule:

\[
\frac{1}{N} \sum_i \sum_j t_j \frac{\partial \hat{x}_k^i}{\partial q_j} = -\frac{1}{\lambda} \left[ \frac{1}{N} \sum_i D_c x_k^i + \frac{1}{N} \sum_i \sum_j D_c q_j \frac{\partial \hat{x}_k^i}{\partial q_j} \right] \\
+ \frac{1}{\lambda} \text{cov} \left( D_c q_j \frac{\partial x_j^i}{\partial b}, x_k^i \right) - \frac{1}{\lambda} \text{cov} \left( \sum_j t_j \frac{\partial x_j^i}{\partial b}, x_k^i \right)
\]
Results: Commodity taxation with linear income taxation

- Interpretation of welfaristic and poverty-minimizing tax rules is similar:
  - The more low-income people consume the good the more its consumption should be encouraged (when income is low, impact on $D$ is higher)

- Uniformity result changes:
  - Deaton 1979: uniform commodity taxes ($t_j = t$) optimal only under strict assumptions (preferences separable between consumption and leisure; linear Engel curves)
  - Under poverty minimization, result does not hold even under the same assumptions - favour differentiated taxes for the benefit of the poor
Outline

Introduction

Model of optimal taxation for developing countries
   Model basics
   Linear income taxation
   Linear income tax & Public provision of public and private goods
   Linear income tax & Commodity taxation

Summary and applications of the model
   Summary
   Applications/Future work
Summary

- Use optimal tax framework to characterize comprehensive redistributive tax and transfer systems for developing countries
  - Use linear income tax (and commodity taxes) to finance universal lump-sum income transfer (and public provision of public or private goods)
  - Objective is to reduce poverty in the country
- Illustrate key tax results under these features - find that having poverty minimization as objective matters
  - Tax rules more sensitive to labour supply behaviour
  - Uniform commodity taxes are never optimal; favour differentiated commodity taxes
- Model can also be used for further developing country applications
Outline

Introduction

Model of optimal taxation for developing countries
  Model basics
  Linear income taxation
  Linear income tax & Public provision of public and private goods
  Linear income tax & Commodity taxation

Summary and applications of the model
  Summary
  Applications/Future work
Applications

Framework suitable for other developing country applications, e.g.:

- **Informality**
  - Not everyone is registered to pay taxes
  - Impacts poverty reduction efficiency

- **Low administrative capacity**
  - Part of collected tax revenue “leaks out”
  - Ineffective administration, corruption, etc.
  - Impacts poverty reduction efficiency
Applications

Framework suitable for other developing country applications, e.g.:

- **Informality**
  - Not everyone is registered to pay taxes
  - Impacts poverty reduction efficiency

- **Low administrative capacity**
  - Part of collected tax revenue “leaks out”
  - Ineffective administration, corruption, etc.
  - Impacts poverty reduction efficiency
Informality: consider a wider inability to move to the formal sector

- Formal sector: pay linear income tax $\tau$, receive income transfer
- Informal sector: don’t pay taxes, receive income transfer
- Probability to be in the formal sector: $\kappa = \kappa(\tau, z^i(\tau, b))$
  - $\kappa' = \kappa_\tau + \kappa_z z_\tau$ where $\kappa_\tau < 0$, $\kappa_z > 0$ and $z_\tau < 0$ so that the result is $\kappa' < 0$
  - $\kappa_z z_b < 0$

Illustrates:

- smaller income transfer $b$ for everyone because $\sum_i \kappa \tau z^i < \sum_i \tau z^i$
- but reduce poverty: the poor and informal ($\kappa_z > 0$) have disposable income $c = z + b$