Three stylized facts about wealth:
1. Wealth concentration increases.

Source: Saez and Zucman (2015), U.S. data
Three stylized facts about wealth:
1. Wealth concentration increases.
2. Bequests increase.

Figure 15.21 The inheritance flow in Europe, 1900–2010.

Source: Piketty and Zucman (2014)
Three stylized facts about wealth:
1. Wealth concentration increases.
2. Bequests increase.
3. Land prices drive evolution of wealth.
Knoll et al. (2014): 80% of housing price increase caused by land price increase.

Possible reasons for the land price increase:

- Decline in transport costs subsides after WWII.
  \[\rightarrow\] Land increasingly becomes fixed factor.
- Increasing density of cities.
- Bubbles.
Requirements for analyzing distributional impacts of taxes:

• Distinguish life-cycle and dynastic savings motives.
• Distinguish capital and land components of wealth.
• Distinguish public spending options.
Recent literature on distributional impacts of taxes


- Classic result: Optimal capital taxes zero in the long run (Judd, 1985; Chamley, 1986)

Recent literature on distributional impacts of taxes

Common approach: Multiplicative shocks \( \omega \) to transmission of wealth \( z \) give rise to distributions with Pareto upper tails:

\[
Z_{t+1,i} = \omega Z_{t,i} + \epsilon \quad \text{(1)}
\]

\[
\omega = se^{(\bar{r}-g)H} \quad \text{(2)}
\]

\[
\frac{db}{d(\bar{r} - g)} > 0 \quad \text{(3)}
\]

Note: \( \epsilon \) = additive shock, \( s \) = savings rate, \( \bar{r} := r(1 - \tau) \),
\( H \) = one generation = 30 years, \( b \) = inverted Pareto coefficient.

\( \implies \) Inequality is an increasing function of \( r - g \).

\( \implies \) higher gap \( \bar{r} - g \) implies more inequality, higher taxes \( \tau \) imply less inequality.
Why is the common approach not enough?

1. No endogenous effects with respect to factor prices.
2. No endogenous asset portfolio choices (in particular no land).
3. No distinction between life-cycle and dynastic savings motives.
Research Questions

• What is the scope of action for governments to reduce wealth inequality with taxes on capital, land rents, and bequests?
• How is output affected by these instruments?
• How do different tax revenue recycling options affect the wealth distribution and output?
Results

- Governments have considerable freedom in reducing wealth inequality without sacrificing output by implementing combinations of land rent- and bequest taxes.

- Underlying mechanism: asset portfolio effect. Taxing land rents enhances output by shifting investment towards capital – and vice versa.

- Land rent and capital income taxes reduce inequality moderately, bequest taxes strongly.

- Recycling revenues to young generation enhances output and reduces inequality, relative to other recycling options.
A simple model without land

to show that factor prices matter
A simple model without land

- Acemoglu (2008), Kap. 9.6.: 'OLG with impure altruism', 'warm glow preferences for bequest':

\[ u_t = \log(c_t) + \beta \log(b_t). \]

- Households live for one period, generations do not overlap:

- First extension: Heterogeneity in preferences, \( i \in \{1, \ldots, N\} \).

\[ u_{i,t} = \log(c_{i,t}) + \beta_i \log(b_{i,t}) \]

Note: Preference parameter \( \beta \geq 0 \) determines utility weight of the 'warm glow' of leaving bequests.
A simple model without land

Households:

\[ u_{i,t} = \log(c_{i,t}) + \beta_i \log(b_{i,t}) \]  

(utility)

\[ c_{i,t} + b_{i,t} = y_{i,t} = w_t + (1 + R_t(1 - \tau_K))b_{t-1}^i(1 - \tau_B) \]  

(budget equation)

\[ \max u \Rightarrow b_t^i = \frac{\beta_i}{1 + \beta_i} y_t^i \]  

(FOC)

Firms:

\[ k_t = \frac{1}{N} \sum_i b_{t-1}^i \]  

(capital input)

\[ f(k_t) = w_t + R_t k_t \]  

(production)

\[ \max \pi \Rightarrow f'(k_t) = R_t \]  

(FOC)
Lemma 1. 
If the curvature of the production function satisfies a certain condition (fulfilled, e.g., by CES-functions), there exists a steady-state with capital-labor ratio $k^*$, factor prices $w^*$, $R^*$, and bequest levels

\[
b_i^* = \frac{w^* \beta_i}{1 + \beta_i - \beta_i(1 + R^*(1 - \tau_K))(1 - \tau_B)} \tag{4}
\]

Corollary 2. 
For $\beta_i > \beta_j$, it holds that $b_i^* > b_j^*$.
Lemma 3.
Assume a steady state exists.

1. An increase in the bequest tax leads to a decrease in wealth inequality, if and only if

$$
\frac{dR^*}{d\tau_B} < -\frac{1 + R^*(1 - \tau_K)}{(1 - \tau_K)(1 - \tau_B)}.
$$

2. An increase in the capital income tax leads to a decrease in wealth inequality, if and only if

$$
\frac{dR^*}{d\tau_K} < \frac{R^*}{1 - \tau_K}.
$$

Proof in the Appendix, Frame 36

Definition. Let $\beta_1 < ... < \beta_N$. By Corollary 2, $b_1 < ... < b_N$. Wealth inequality decreases if $b_i^*/b_j^*$ decreases $\forall i > j$. 
Simple model: Analytical result 2/2 – notes

Conditions for progressivity:

\[
\frac{dR^*}{d\tau_B} < -\frac{1 + R^*(1 - \tau_K)}{(1 - \tau_K)(1 - \tau_B)}. \tag{5}
\]

\[
\frac{dR^*}{d\tau_K} < \frac{R^*}{1 - \tau_K}. \tag{6}
\]

• Intuition: For taxes to be progressive, wages should not decrease too strongly. (5) and (6) imply upper bound for increases in \( R^* = f'(k^*) \), thus lower bound for decreases in \( k^*, f(k^*), \) and \( w^* \).

• Prices matter for policy instrument analysis! Statements about impact of taxes on wealth distribution should consider endogenous factor prices. (Benhabib et al., 2011; Piketty and Saez, 2013: exogenous interest rate).
Extended model with land

and truly overlapping generations
Extended model: Heterogeneous households

Each household $i$, born in $t$ optimizes utility

$$u_i(c^r_{i,t}, c^o_{i,t+1}, b_{i,t+1}) = \frac{1}{1-\eta} \left[(c^r_{i,t})^{1-\eta} + \mu_i(c^o_{i,t+1})^{1-\eta} + \beta_i b_{i,t+1}^{1-\eta}\right]$$

where $\eta =$ elasticity parameter, $\mu =$ preferences for life-cycle savings, $\beta =$ preferences for leaving bequests,

subject to the budget equations

$$c^r_{i,t} + s_{i,t} = w_t + b_{i,t}(1 - \tau_B)$$

$$s_{i,t} = a_{i,t+1} + p_t l_{i,t+1}$$

$$c^o_{i,t+1} + b_{i,t+1} = (1 + R_{t+1}(1 - \tau_K))a_{i,t+1} + \ldots$$

$$l_{i,t+1}(p_{t+1} + q_{t+1}(1 - \tau_L))$$

with $a_i =$ capital assets, $p =$ land price, $l_i =$ land holdings, $q =$ land rent.
Extended model: Heterogeneous households

Household’s FOCs for $i \in \{1, \ldots, N\}$ and $t \in \{1, \ldots, T - 1\}$.

\[
\frac{u_{c_i}^y}{u_{c_i}^o} = \frac{1 + R_{t+1}(1 - \tau_K)}{r_{t+1}}
\]

(7)

\[
\frac{u_{b_i}}{u_{c_i}^o} = (1 - \tau_B)^{\eta - 1}
\]

(8)

\[
\frac{p_{t+1} + q_{t+1}(1 - \tau_L)}{p_t} = r_{t+1}.
\]

(9)

\[
p_T \overset{!}{=} 0
\]

(10)

Budget equation

\[
b_{i,t} + w_t - \text{taxes}(\tau_B) = c_{i,t}^y + \left(c_{i,t+1}^o + b_{i,t+1}\right)/r_{t+1}
\]

(11)
Extended model: Firm and government

Firm:

\[
f(k_t, l) = A(\alpha k^\sigma_t + \gamma l^\sigma + 1 - \alpha - \gamma)^\frac{1}{\sigma}
\]

\[
k_{t+1} = \frac{1}{N} \sum_{i=1}^{N} a_{i,t}, \quad \text{and} \quad l = \frac{1}{N} \sum_{i=1}^{N} l_{i,t}
\]

FOCs:

\[
R_t = f_k(k_t, l)
\]

\[
q_t = f_l(k_t, l)
\]

\[
w_t = f(k_t, l) - R_t k_t - q_t l
\]

Government:

\[
g_t = \tau_K R_t k_t + \tau_L q_t l + \frac{1}{N} \sum_i \tau_B b_{i,t}
\]
Extended model: At a glance

- Heterogeneous households: Continuous variation between life-cycle and bequest savings motives.

- Public income: Analysis of capital income, bequest, and land rent taxes.

- Public spending: Analysis of different recycling schemes.

- Intertemporal land market: Model framework offers flexibility to calibrate price paths to real data.

![Graph showing land rent over time from 1880 to 2020]
Numerical Results

generated with GAMS software,
model calibrated to OECD data
on wealth quintiles, 2010
(see Appendix, Frames 37 and 38)
The system converges nicely to a steady state

Sensitivity analysis of final period on Slide 42 in the Appendix.
The system converges nicely to a steady state.

The steady-state wealth distribution is independent of initial endowments.

Sensitivity analysis of final period on Slide 42 in the Appendix.
Output-neutral tax reforms

steady-state values, $\tau_K = 0.2$, exogenous variation of $\tau_B$, smallest $\tau_L$ such that output equal to level of no-tax case

Data on Slide 39 in Appendix.
Output-neutral tax reforms

steady-state values, $\tau_K = 0.2$, exogenous variation of $\tau_B$, smallest $\tau_L$ such that output equal to level of no-tax case

Data on Slide 39 in Appendix.
Output-neutral tax reforms

steady-state values, $\tau_K = 0.2$, exogenous variation of $\tau_B$, smallest $\tau_L$ such that output equal to level of no-tax case

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Output-neutral tax reforms

steady-state values, $\tau_K = 0.2$, exogenous variation of $\tau_B$, smallest $\tau_L$ such that output equal to level of no-tax case

Data on Slide 39 in Appendix.
Output-neutral tax reforms

steady-state values, $\tau_K = 0.2$, exogenous variation of $\tau_B$, smallest $\tau_L$ such that output equal to level of no-tax case

Data on Slide 39 in Appendix.
Option space for policy
Why the different impacts on output?

- $\tau_L$ spurs capital investments.
- $\tau_K$ achieves the opposite.
- $\tau_B$ hardly affects asset portfolio’s composition, since it doesn’t appear in no-arbitrage condition (9).
Why do $\tau_K$ and $\tau_L$ reduce inequality?

<table>
<thead>
<tr>
<th>household $i$</th>
<th>$\tau_K = 0.2$</th>
<th>$\tau_L = 0.2$</th>
<th>$\tau_B = 0.2$</th>
<th>$\tau_K = 0.7$</th>
<th>$\tau_L = 0.7$</th>
<th>$\tau_B = 0.7$</th>
</tr>
</thead>
<tbody>
<tr>
<td>income $y^*$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.990</td>
<td>1.007</td>
<td>0.995</td>
<td>0.938</td>
<td>1.03</td>
<td>0.98</td>
</tr>
<tr>
<td>2</td>
<td>0.990</td>
<td>1.007</td>
<td>0.995</td>
<td>0.938</td>
<td>1.03</td>
<td>0.98</td>
</tr>
<tr>
<td>3</td>
<td>0.989</td>
<td>1.005</td>
<td>0.989</td>
<td>0.934</td>
<td>1.02</td>
<td>0.96</td>
</tr>
<tr>
<td>4</td>
<td>0.987</td>
<td>1.003</td>
<td>0.975</td>
<td>0.925</td>
<td>1.01</td>
<td>0.91</td>
</tr>
<tr>
<td>5</td>
<td>0.974</td>
<td>0.989</td>
<td>0.910</td>
<td>0.882</td>
<td>0.97</td>
<td>0.73</td>
</tr>
<tr>
<td>Bequests $b^*$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.957</td>
<td>0.972</td>
<td>1.014</td>
<td>0.819</td>
<td>0.90</td>
<td>1.03</td>
</tr>
<tr>
<td>2</td>
<td>0.957</td>
<td>0.972</td>
<td>1.014</td>
<td>0.819</td>
<td>0.90</td>
<td>1.03</td>
</tr>
<tr>
<td>3</td>
<td>0.956</td>
<td>0.970</td>
<td>1.008</td>
<td>0.816</td>
<td>0.89</td>
<td>1.01</td>
</tr>
<tr>
<td>4</td>
<td>0.954</td>
<td>0.968</td>
<td>0.994</td>
<td>0.808</td>
<td>0.88</td>
<td>0.97</td>
</tr>
<tr>
<td>5</td>
<td>0.941</td>
<td>0.955</td>
<td>0.928</td>
<td>0.771</td>
<td>0.84</td>
<td>0.77</td>
</tr>
</tbody>
</table>

fraction of no-tax-case

- All taxes reduce $b^*$ and $y^*$ of rich stronger than that of the poor.
- $\tau_L$ shifts investments towards capital, hence reduces interest rate $R$.
- $\tau_K$ does the opposite, but the induced increase of $R$ is overcompensated in the after-tax return on savings $1 + R(1 - \tau_K)$,

$\implies \tau_L$ and $\tau_K$ both discourage savings and reduce bequests.
- $\tau_B$ reduces income (especially of the rich), but increases demand for leaving bequests (in particular that of the poor).
Revenue recycling

steady-state values

transfers to young $\tau_K$
transfers to both $\tau_L$
transfers to old $\tau_B$

per capita output [million 2005 US$ / 30 years]

Gini coefficient of wealth distribution
Revenue recycling

steady-state values

- transfers to young $\tau_K$
- transfers to both $\tau_L$
- transfers to old $\tau_B$

per capita output [million 2005 US$ / 30 years]

Gini coefficient of wealth distribution

no recycling of tax revenues
('wasteful government spending')
Revenue recycling

- Transferring tax revenues to the old reduces output and increases inequality.
- This is due to the
  a) missing capital problem (the young cannot invest)
  b) missing incentive problem (the young prefer not to invest)
Sensitivity analysis 1/2

steady state values

per capita output [million 2005 US$ / 30 years]

Gini coefficient of wealth distribution

$\eta = 2, \tau_K$

$\tau_L$

$\tau_B$

$\eta = 0.96$

$\eta = 0.5$
Sensitivity analysis 2/2

The graph shows the steady state values for different values of $\eta$ and $\tau$. The x-axis represents the Gini coefficient of wealth distribution, while the y-axis represents tax revenues (fraction of output). Different lines correspond to different values of $\eta$: $\eta = 2$, $\eta = 0.96$, and $\eta = 0.5$. The Gini coefficients range from 0.5 to 0.64 on the x-axis, and the tax revenues range from 0 to 0.25 on the y-axis.
Summary of results

• Land rent taxes enhance output due to a portfolio effect. Analogously, capital taxes reduce output.

• Bequest taxes: no portfolio effect, moderate effect on output.

• All taxes reduce wealth inequality. Bequest taxes have the highest potential.

• The more tax revenues are directed to the young, the higher is output, and the lower is wealth inequality.
• With combinations of bequest and land rent taxes, governments have considerable freedom to redistribute wealth without sacrificing output.

• We complement the common approach along the lines of Benhabib et al. (2011) and Piketty and Saez (2013)
  1. by modeling prices *endogenously*,
  2. by including rents associated with a fixed factor, and
  3. by discussing different revenue recycling options.
Piketty-Stiglitz-Dystopia

- Combined with demographic change, Piketty’s and Stiglitz’ dystopia of a *rentier capitalism* and *rent exploitation* looms,

- due to increasing inheritances, land rents, and wealth inequality,

- which could jeopardize democracy.

*Figure 15.29* Observed and simulated inheritance flow, France 1820–2100.

*Figure 15.2* The changing level and nature of national wealth: France 1700–2010.
Our results support policies such as the Stakeholder Society: The young should receive a one-time transfer at adulthood financed by wealth- or inheritance taxes. (Ackerman and Alstot, 1999; Corneo, 2011; Atkinson, 2015)

Through the transfer both the missing capital and the missing incentive problem can be solved.
Next steps

- Include further drivers of inequality: Entrepreneurial risk taking, income inequality, differences in education.

- Include social welfare functions to bridge the gap between the theory of optimal taxation and the debate about wealth inequality and heterogeneous agent models.
THANK YOU!
References


Proof of Lemma 3

Recall that

\[ b_i^* = \frac{w^* \beta_i}{1 + \beta_i - \beta_i(1 + R^*(1 - \tau_K))(1 - \tau_B)}. \] (4)

Let \( i, j \in \{1, ..., N\} \) such that \( \beta_i > \beta_j \) and thus \( b_i^* > b_j^* \) holds. Using (4) it is straightforward to calculate whether a marginal increase of a tax increases or decreases the ratio of steady-state bequest levels:

1. \[ \frac{d}{d \tau_B} \left( \frac{b_i^*}{b_j^*} \right) = \frac{\beta_i}{\beta_j} (\beta_i - \beta_j) \psi_i^{-2} \left[ (1 + R^*(1 - \tau_K)) + \frac{dR^*}{d \tau_B}(1 - \tau_K)(1 - \tau_B) \right] \]

2. \[ \frac{d}{d \tau_K} \left( \frac{b_i^*}{b_j^*} \right) = \frac{\beta_i}{\beta_j} (\beta_i - \beta_j) \psi_i^{-2}(1 - \tau_B) \left[ \frac{dR^*}{d \tau_K}(1 - \tau_K) - R^* \right] \]

\[ > 0 \]
### Table 6.3. Selected indicators of the distribution of household net wealth

2010 or latest available year, values in 2005 USD

<table>
<thead>
<tr>
<th>Country</th>
<th>Mean 2005</th>
<th>Median</th>
<th>Bottom quintile</th>
<th>Average of three middle quintiles</th>
<th>Top quintile</th>
<th>Top 10%</th>
<th>Top 5%</th>
<th>Top 1%</th>
<th>Ratio (wealth of top 5% - median wealth)/median</th>
<th>Ratio (median wealth - bottom quintile)/median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>338,299</td>
<td>205,404</td>
<td>8,398</td>
<td>210,963</td>
<td>1,035,640</td>
<td>1,507,217</td>
<td>2,158,615</td>
<td>4,461,272</td>
<td>9.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Austria</td>
<td>288,275</td>
<td>74,465</td>
<td>-7,578</td>
<td>105,674</td>
<td>1,051,513</td>
<td>1,684,393</td>
<td>2,659,286</td>
<td>6,560,503</td>
<td>34.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Belgium</td>
<td>313,517</td>
<td>188,149</td>
<td>2,787</td>
<td>213,541</td>
<td>1,014,312</td>
<td>1,461,305</td>
<td>2,083,536</td>
<td>4,611,984</td>
<td>10.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Canada</td>
<td>337,238</td>
<td>152,818</td>
<td>4,906</td>
<td>177,899</td>
<td>1,147,721</td>
<td>1,697,591</td>
<td>2,461,832</td>
<td>5,219,761</td>
<td>15.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Finland</td>
<td>133,466</td>
<td>71,762</td>
<td>-7,636</td>
<td>82,060</td>
<td>440,670</td>
<td>611,660</td>
<td>933,886</td>
<td>1,685,044</td>
<td>10.6</td>
<td>1.1</td>
</tr>
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<td>211,330</td>
<td>106,497</td>
<td>-8,68</td>
<td>125,263</td>
<td>778,342</td>
<td>1,152,393</td>
<td>1,686,153</td>
<td>4,445,394</td>
<td>14.8</td>
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<td>792,676</td>
<td>1,214,445</td>
<td>1,874,432</td>
<td>5,033,122</td>
<td>33.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Greece</td>
<td>154,734</td>
<td>114,377</td>
<td>2,579</td>
<td>118,502</td>
<td>470,332</td>
<td>643,987</td>
<td>850,460</td>
<td>1,405,733</td>
<td>6.4</td>
<td>1.0</td>
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<tr>
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<td>171,764</td>
<td>5,495</td>
<td>175,675</td>
<td>851,664</td>
<td>1,239,524</td>
<td>1,772,755</td>
<td>3,064,572</td>
<td>9.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Korea</td>
<td>249,686</td>
<td>135,334</td>
<td>4,178</td>
<td>153,624</td>
<td>783,330</td>
<td></td>
<td>..</td>
<td>..</td>
<td>..</td>
<td>1.0</td>
</tr>
<tr>
<td>Luxembourg</td>
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<td>350,251</td>
<td>2,125</td>
<td>395,554</td>
<td>2,208,512</td>
<td>3,403,744</td>
<td>5,325,290</td>
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<td>1,024,772</td>
<td>1,534,566</td>
<td>4,105,305</td>
<td>43.9</td>
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<td>Norway</td>
<td>188,740</td>
<td>89,449</td>
<td>-43,260</td>
<td>100,325</td>
<td>586,002</td>
<td>845,275</td>
<td>1,221,517</td>
<td>3,124,719</td>
<td>12.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Portugal</td>
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<td>1,090</td>
<td>102,344</td>
<td>652,251</td>
<td>1,012,634</td>
<td>1,569,351</td>
<td>4,065,992</td>
<td>15.9</td>
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<tr>
<td>Slovak Republic</td>
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<td>86,542</td>
<td>18,470</td>
<td>90,820</td>
<td>278,106</td>
<td>374,125</td>
<td>498,284</td>
<td>902,533</td>
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<td>205,238</td>
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<td>217,442</td>
<td>997,264</td>
<td>1,434,765</td>
<td>2,049,066</td>
<td>5,003,514</td>
<td>9.0</td>
<td>0.9</td>
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<tr>
<td>United Kingdom</td>
<td>331,722</td>
<td>187,380</td>
<td>8,935</td>
<td>199,419</td>
<td>1,051,419</td>
<td>1,544,346</td>
<td>2,267,314</td>
<td>5,769,661</td>
<td>11.1</td>
<td>1.0</td>
</tr>
<tr>
<td>United States</td>
<td>411,044</td>
<td>56,724</td>
<td>-19,059</td>
<td>87,430</td>
<td>1,811,525</td>
<td>3,138,331</td>
<td>5,199,815</td>
<td>15,043,278</td>
<td>90.7</td>
<td>1.3</td>
</tr>
<tr>
<td>OECD18</td>
<td>258,486</td>
<td>132,615</td>
<td>-2,356</td>
<td>148,993</td>
<td>922,703</td>
<td>1,411,224</td>
<td>2,120,184</td>
<td>4,654,302</td>
<td>20.4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Note:** “.” refers to non-available data. Values are expressed in 2005 USD based on purchasing power parities and consumer price indexes.

**Source:** OECD Wealth Distribution Database.

StatLink: [http://dx.doi.org/10.1787/8889335209076](http://dx.doi.org/10.1787/8889335209076)
## Model parameters, standard calibration (Frame 20)

<table>
<thead>
<tr>
<th>Preferences</th>
<th>Elasticity parameter</th>
<th>$\eta$</th>
<th>0.96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferences for consumption when old</td>
<td>$\mu_1$</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\mu_2$</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\mu_3$</td>
<td>0.095</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\mu_4$</td>
<td>0.152</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\mu_5$</td>
<td>0.468</td>
<td></td>
</tr>
<tr>
<td>Preferences for leaving bequests</td>
<td>$\beta_1$</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\beta_2$</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\beta_3$</td>
<td>0.025</td>
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</tr>
<tr>
<td></td>
<td>$\beta_4$</td>
<td>0.082</td>
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<tr>
<td></td>
<td>$\beta_5$</td>
<td>0.398</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Share parameter of capital</td>
<td>$\alpha$</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Share parameter of land</td>
<td>$\gamma$</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Elasticity of substitution</td>
<td>$\epsilon$</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Total factor productivity</td>
<td>$A_0$</td>
<td>481.9</td>
</tr>
<tr>
<td>Tax rates</td>
<td>Capital income tax</td>
<td>$\tau_K$</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Land rent tax</td>
<td>$\tau_L$</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Bequest tax</td>
<td>$\tau_B$</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>Time horizon</td>
<td>$T$</td>
<td>40</td>
</tr>
</tbody>
</table>
Output-neutral tax reforms, data for Frame 21

<table>
<thead>
<tr>
<th>$\tau_B$</th>
<th>$\tau_L$</th>
<th>Gini</th>
<th>public revenue per capita [10$^3$ 2005 US$/30$ years]</th>
<th>[fraction of output]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>0.63</td>
<td>14</td>
<td>1.4%</td>
</tr>
<tr>
<td>0.10</td>
<td>0.07</td>
<td>0.62</td>
<td>28</td>
<td>2.8%</td>
</tr>
<tr>
<td>0.20</td>
<td>0.13</td>
<td>0.60</td>
<td>40</td>
<td>4.0%</td>
</tr>
<tr>
<td>0.30</td>
<td>0.18</td>
<td>0.59</td>
<td>52</td>
<td>5.3%</td>
</tr>
<tr>
<td>0.40</td>
<td>0.24</td>
<td>0.58</td>
<td>63</td>
<td>6.4%</td>
</tr>
<tr>
<td>0.50</td>
<td>0.28</td>
<td>0.57</td>
<td>73</td>
<td>7.4%</td>
</tr>
<tr>
<td>0.60</td>
<td>0.33</td>
<td>0.57</td>
<td>82</td>
<td>8.3%</td>
</tr>
<tr>
<td>0.70</td>
<td>0.37</td>
<td>0.56</td>
<td>91</td>
<td>9.2%</td>
</tr>
<tr>
<td>0.80</td>
<td>0.41</td>
<td>0.55</td>
<td>98</td>
<td>9.9%</td>
</tr>
<tr>
<td>0.90</td>
<td>0.45</td>
<td>0.54</td>
<td>105</td>
<td>10.6%</td>
</tr>
<tr>
<td>0.999</td>
<td>0.54</td>
<td>0.52</td>
<td>104</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

Combinations of $\tau_B$ and $\tau_L$ with same (or higher) steady-state level of output as in benchmark case ($\tau_K = 0.2, \tau_L = \tau_B = 0$). Tax revenue and output in 10$^3$ 2005 US$ / 30$ years.
Kaldor-Hicks Criterion 1/2

Could the winners of a 100% land rent tax compensate the losers?
Kaldor-Hicks Criterion 2/2

Assume tax revenues \( g_t \) are recycled to all households as \( X_{i,t}^y, X_{i,t}^o \):

\[
\begin{align*}
  c_{i,t}^y + s_{i,t} &= \omega_t + b_{i,t}(1 - \tau_B) + X_{i,t}^y \\
  c_{i,t}^o + b_{i,t} &= (1 + R_t(1 - \tau_K))k_{i,t}^s + l_{i,t}(p_t + q_t(1 - \tau_L)) + X_{i,t}^o.
\end{align*}
\]

Assume that funds can be shifted over time via banking and borrowing at the market interest rate \( R \). Then:

\[
\sum_{t} g_t \prod_{s=1}^{t}(1 + R_s) \geq \frac{1}{N} \sum_{i,t} X_{i,t}^y + X_{i,t}^o \prod_{s=1}^{t}(1 + R_s).
\]

Numerical experiments confirm that there are \( \{X_{i,t}^y, X_{i,t}^o\}_{i=1,...,N, \ t=1,...,T} \) such that

\[
u_{i,t}|_{\tau_L=1} \geq \nu_{i,t}|_{\tau_L=0} \quad \forall i, t.
\]
Wealth distribution invariant under variation of final period (cf. Slide 20)