Inter-Regional Redistribution and Income Convergence

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Goals of the analysis:

- Create a single theoretical construct for the analysis of interregional income redistribution and dynamics of income differentials across regions
- Derive indicators of interregional redistribution from that theoretical premise
- Present some evidence from Italian and U.S. samples
Introduction - 2

- Interregional income redistribution and factor relocation (should) produce same goal → reduction of income differences across regions (=convergence).
- They interact (e.g., effects of taxes on movement of capital, expenditures on labor migration and vice versa)
- Obstruct or reinforce each other? How do they interact?
- Drawn from chapter 4 and 5 of *The Politics and Economics of Regional Transfers*
Macroeconomic growth literature
- Little attention in macroeconomic literature (Blanchard and Katz, 1992, Sala-i-Martin and Sachs, 1992)
- Missing data on factor relocation (capital) → looked at growth rather than convergence.
- In a Solow world with DMR, institutions and policy do not matter – in endogenous models they might.

Public finance/regional literature
- Attention on risk sharing and redistribution (Decressin, 2002; Arachi et al. 2008) → less attention at convergence and long run phenomena (here Asdrubali et al. 1996 are an exception)
Goals of analysis

Develop a model and a measure of interregional redistribution that:

- Fits in endogenous growth (policy matters);
- Model of income convergence, rather than growth model with convergence as a corollary;
- Inter-regional redistribution through taxation and spending explicitly accounted for.
Main idea

- Taxes and expenditures open a wedge between factor prices and factor returns
- → Differences in fiscal policies thus become a potentially relevant determinant of factor migration and (under certain restrictions) income convergence.
Main results - Theory

- Fiscal policy may reverse the effects of factor relocation;
- Concept of geographical proportionality (progressivity, regressivity) of fiscal policy;
- IGR as a measure of incidence of interregional redistribution;
Main Results - Empirics

- Test of the theory on Italian Regions 1951-2002 (CRENOS and ISTAT data) and U.S. data 1929-2005 (BEA data)
- Analysis of $\sigma$ convergence;
- Evaluation of IGR 1963-2001;
- More progressive redistribution correlated with slower convergence.
- Comparison between highly centralized (Italy) and highly decentralized (U.S.) countries
Plan of the analysis

- Model of interregional income convergence based on Blanchard (1991) *cum* interregional redistribution;
- Relationship between convergence and redistribution in case of labor and capital mobility;
- Ways of testing model and IGR;
- Test of the model on Italian and U.S. data
Production and demand function

- Each region \( i \) a small open economy, each produces a single good

\[
(q_{it} - q_t) = \alpha(l_{it} - l_t) + (1 - \alpha)(k_{it} - k_t) + \theta_{it}
\]

\[
(p_{it} - p_t) = -\delta(q_{it} - q_t) + \varepsilon_{it}
\]

- Regional economies specialized \( \rightarrow \) shifts in relative productivity and demand contain a permanent component \( \rightarrow \theta_{it} \) and \( \varepsilon_{it} \) assumed nonstationary (“Full Mounty” hypothesis)
Factor mobility and taxation

- Factor relocation driven by relative net rates of returns (compare before and after taxes):

\[
(l_{it+1} - l_{t+1}) = (l_{it} - l_t) + \lambda[(w_{it} - w_t) - \eta(\tau w_{it} - \tau w_t)]
\]

\[
(k_{it+1} - k_{t+1}) = (k_{it} - k_t) + \gamma[(r_{it} - r_t) - \phi(\tau r_{it} - \tau r_t)]
\]

- The \((\tau w_{it} - \tau w_t)\) and \((\tau r_{it} - \tau r_t)\) terms are region \(i\) relative tax rates on wages and rates of return on investments.

- \(\eta \geq 0\) and \(\psi \geq 0\) are elasticities.
Geographic proportionality

If relative tax rates are proportional to relative wages and rates of return →

\[ (\tau W_{it} - \tau W_t), (\tau R_{it} - \tau R_t) = 0 \]

→ After-tax differences in wages and rates of return are identical to their pre-tax differences

→ Interregional (or “geographical”) proportionality in the tax structure is neutral wrt labor and capital migration

→ Does not affect income convergence
Geographical progressivity and regressivity

- Geographical progressivity means that relative after-tax wages and rates of return are *less* than their pre-tax values
  \[(\tau w_{it} - \tau w_t), (\tau r_{it} - \tau r_t) > 0\]

- Geographical regressivity *amplifies* the differences between pre- and after-tax wages and rates of return
  \[(\tau w_{it} - \tau w_t), (\tau r_{it} - \tau r_t) < 0\]
Relative public expenditures

- Taxation finances interregional income redistribution (balanced budget)

\[
\sum_{i=1}^{n} (s_{it} - s_t) = \sum_{i=1}^{n} [(\tau w_{it} - \tau w_t) + (\tau r_{it} - \tau r_t)]
\]

- After redistribution regional per capita incomes are

\[
x_{it} + s_{it} = q_{it} + p_{it} - l
\]
Growth, convergence, error term – capital mobility

- Equation for change in jurisdiction $i$ relative income

\[(y_{it} - y_t) = (1 - \beta)(y_{it-1} - y_{t-1}) + \zeta_{it}\]

- Expression for convergence parameter $\beta$

\[\beta = \gamma \{1 - (1 - \alpha)(1 - \delta)[1 - \phi(\tau_{it-1} - \tau_{t-1})]\}\]
Convergence under geographical proportionality

- If \((\tau r_{it} - \tau r_t) = 0\) (geographically proportional tax structure)
  \[
  \beta = \gamma [1 - (1 - \alpha)(1 - \delta)]
  \]

- \(\rightarrow\) convergence driven by equilibration of returns on capital (Solow)
Convergence under geographical progressivity

- If $(\tau r_{it} - \tau r_t) > 0$, $\beta$ becomes smaller → productivity differences exceed relative after-tax earnings → capital flows less towards poor jurisdictions → “engine of convergence” is slowed down.

- Same happens if relatively more transfers directed to jurisdictions with lower than average rates of return on capital \[ \frac{\partial (s_{it} - s_t)}{\partial (r_{it} - r_t)} < 0 \]

- If \[ \frac{\partial (s_{it} - s_t)}{\partial (r_{it} - r_t)} < 0 \] large enough → divergence
Convergence under geographical regressivity

- Opposite results
- Geographically regressive tax structure analytically equivalent to a subsidy on investments in relatively poor jurisdictions
- Transfers directed to jurisdictions with rates of return to capital above the national average analytically equivalent
Labor mobility

- Same logic applies
More on convergence – capital mobility - 1

- Suppose labor immobile and geographically proportional taxation
- $\beta > 0$ if $\alpha$ (rates of return parameter) > 0 or $\delta$ (elasticity of demand) > 0
- Convergence does not imply DMR to adjustable factor in endogenous growth models
More on convergence – capital mobility – 2

- $\zeta_{it} = [(1 - \delta)\theta_{it} + \varepsilon_{it}] - (1 - \gamma)(1 - \delta)\theta_{it} + \varepsilon_{it}$
- If jurisdiction specific shocks to technology $\theta$ and to relative demand $\varepsilon$ are nonstationary, we may have $\beta$ but not $\sigma$ convergence;
- Movement of capital amplifies effects of shocks on output per capita, by flowing to the jurisdictions that are experiencing positive shocks.
- Gap between low income and high income jurisdictions.
More on convergence – labor mobility - 1

- Economy exhibits convergence even if $\theta$ and $\epsilon$ nonstationary

$$\zeta_{it} = [(1 - \delta)\theta_{it} + \epsilon_{it}] - [(1 - \delta)\theta_{i,t-1} + \epsilon_{i,t-1}]$$

- Because $\theta$ and $\epsilon$ enter as first differences, even if they are nonstationary $\zeta$ and relative income are stationary
More on convergence – labor mobility - 2

- Labor relocation first amplifies the effects of the shocks on total output by moving to the jurisdictions that are experiencing positive shocks.

- But because of DMR, labor inflow decreases the effects of the shocks on output per capita.

- In response to a shock, labor moves in until wages are again equalized. At that point, outputs per capita are also equalized.
More on convergence – geographical redistribution

- In case of capital mobility → convergence to a strict positive value.
- In the case of labor mobility → convergence to 0.

*New Result:* In both cases a sufficiently geographically regressive (progressive) redistributive system may reverse the factor relocation outcome.
How to test for convergence – 1

- Model has 2 implications
  - Structure of the economy: factor mobility *per se* does not imply convergence, especially if capital more mobile than labor;
  - Fiscal policy: may force convergence in a nonconvex economy and vice versa.
How to test for convergence – 2

- Necessary to control for dynamics of regional income dispersion at every point of time.
- Regression of regional income average growth rates on initial income levels, as in $\beta$ convergence not very explicative.
- *Better test:* If there is really $\sigma$ convergence, controlling for initial levels, average rates of growth of regional incomes should become *more similar* as they are computed over longer periods of time.
- Possible shocks at any $t$ are accounted for in this way.
How to test for convergence – 3

- For the economy to exhibit convergence the $\zeta_{it}$ must be stationary;
- $\rightarrow$ the estimated standard error of the cross section regression of regional relative growth should go to zero as we increase $T$.

$$\left(\frac{1}{T}\right)(y_{iT} - y_{i0}) = \left(\frac{1}{T}\right)(y_T - y_0) + \left(\frac{1}{T}\right)[1 - (1 - \beta)^T](y_{i0} - y_0) + \psi_{iT}$$
Strategy of the empirical analysis

- Estimate $\sigma$ convergence in highly centralized country (Italy)
- ...then estimate IGR
- Examine correlation among the two
- Repeat the same analysis on data about a highly decentralized country (U.S.)
- Compare the results for the two cases
σ convergence among Italian Regions

Dispersion of per capita income 1951-2002
σ convergence in Italian Regions - 1

- Greatest part of convergence up to mid 1960s;
- From early 1970s to mid 1980s some divergence;
- From mid 1980s to early 2000s very slow convergence again (especially in 2\textsuperscript{nd} half of 1990s).
σ convergence in Italian Regions - 2

- Convergence to strict positive value, possibly because:
  - Capital more mobile than labor
  - Effects of fiscal policy
The IGR of year $t$ is the estimated coefficient of the cross section regression

$$\left( \frac{Y_i - Y_{disp_i}}{Y_i} \right) = C + IGR(Y_i) + \mu_i$$

- $Y_i$ is real per capita income in region $i$ and $Y_{disp_i}$ is real per capita disposable income in region $i$.
Estimating the IGR - 2

- Dependent variable is a proxy for region \( i \) average effective tax rate \( \rightarrow \) difference between total and disposable income approximates tax revenues, \( transfers\ included\ (Y_{disp})\).

- \( IGR \) coefficient measures the change in average tax rate across regions \( \rightarrow \) a change in per capita income across regions.

- It represents the marginal geographical tax rate.
Estimating the IGR - 3

- IGR=1 → geographical proportionality
- IGR>1 → geographical progressivity
- IGR<1 → geographical regressivity

- Estimates of cross section regression every year generates the IGR series
IGR series – Italy 1963-2001

Index of Geographic Redistribution
1963-2001

Geographical Marginal Tax Rate

Years

IGR series and stylized facts

- IGR regressive up to late 1970s – demise of Cassa del Mezzogiorno – with all shortcomings subsidy on investments in relatively poor jurisdictions (geographically regressive tax system);

- IGR progressive during 1980s – subsidy to wages in poorer regions (geographically progressive tax system);

- IGR again regressive in 1990s – Mezzogiorno less of an issue – policies of 1980s discontinued.
Test of theory - Italy

- Time series regression of change in $\sigma(T)$ on IGR.
- Positive coefficient $\rightarrow$ progressivity in geographical redistribution hinders convergence;
- Negative coefficient $\rightarrow$ progressivity in geographical redistribution fosters convergence.
Regression results - Italy

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>p-value</th>
<th>Coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-1.887</td>
<td>0.03</td>
<td>-0.92</td>
<td>0.16</td>
</tr>
<tr>
<td>log($\sigma(T)_{t-1}$)</td>
<td>0.668</td>
<td>0.00</td>
<td>0.84</td>
<td>0.00</td>
</tr>
<tr>
<td>log(IGR$_{t-1}$)</td>
<td>0.016</td>
<td>0.01</td>
<td>0.02</td>
<td>0.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Adj. R²</td>
<td>0.49</td>
<td>0.89</td>
</tr>
<tr>
<td>S.E.R.</td>
<td>0.052</td>
<td>0.014</td>
</tr>
<tr>
<td>F stat.</td>
<td>18.96</td>
<td>48.18</td>
</tr>
<tr>
<td>N</td>
<td>38</td>
<td>19</td>
</tr>
<tr>
<td>Breusch-Godfrey test</td>
<td>F stat 0.458</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Obs* R² 1.06</td>
<td>0.58</td>
</tr>
</tbody>
</table>
Stability test - Italy

CUSUM test

- CUSUM
- 5% Significance
σ convergence across U.S. States
\( \sigma \) convergence U.S. - comments

- BEA data
- Post-WWII years only \( \rightarrow \) significant convergence occurred in the 1930s
- Steady process with exception of mid 1970s
- Convergence to 0
  - \( \rightarrow \) labor more mobile than capital
  - \( \rightarrow \) Neutral or regressive fiscal policy
IGR for U.S. States
IGR for U.S. - comments

- Fairly stable and always between regressive and proportional
- Counterintuitive from the point of view of welfare economics theories of decentralizing redistribution
Test of the theory – U.S.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>- 0.436</td>
<td>0.00</td>
</tr>
<tr>
<td>log(σ(T)_{t-1})</td>
<td>0.926</td>
<td>0.00</td>
</tr>
<tr>
<td>log(IGR_{t-1})</td>
<td>0.079</td>
<td>0.00</td>
</tr>
</tbody>
</table>

| Adj. R²                   | 0.98        |
| S.E.R.                    | 0.03        |
| F stat.                   | 1382.8      | 0.00    |
| N                         | 56          |

<table>
<thead>
<tr>
<th>Breusch Godfrey LM test</th>
<th>F stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F stat</td>
<td>0.516</td>
<td>0.6</td>
</tr>
<tr>
<td>Obs* R²</td>
<td>1.11</td>
<td>0.57</td>
</tr>
</tbody>
</table>
Test of theory U.S. - comments

- Similar results to Italian sample → positive coefficient on IGR
- Geographic progressivity (regressivity) hinders (promotes) convergence
- Coefficient smaller than Italian case
Stability test – U.S.
## Comparison of IGR - 1

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Italy</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.591</td>
<td>0.696</td>
</tr>
<tr>
<td>Median</td>
<td>0.428</td>
<td>0.665</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.739</td>
<td>0.939</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.062</td>
<td>0.433</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.443</td>
<td>0.108</td>
</tr>
<tr>
<td>N. of obs.</td>
<td>39</td>
<td>57</td>
</tr>
</tbody>
</table>
Comparison of IGR – 2

Estimated IGR

Years


USA ITA
Comparison - comments

- 2 striking results
  - Highly decentralized country apparently redistributes more than highly centralized one (mean and median value of IGR for U.S. higher than Italy)
  - Highly decentralized country redistributes more steadily than highly centralized country (std. Deviation lower)
Conclusions

- Importance of collapsing redistribution and factor relocation into a single (nonconvex) theory;
- Attention at data;
- Comparison with other indicators (e.g. fiscal residuum);
- Approach highly aggregated here (look at end results) $\rightarrow$ test of the theory can be disaggregated, as data allow.