Panel Income Changes and Changing Relative Income Inequality

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Economic Growth vs. Economic Development

Economic growth: The economy produces more goods and services than before.

Economic underdevelopment: People's material standards of living are severely constrained.

Economic development: The process of relaxing these constraints so that people can achieve higher economic well-being.

The Distributional Question: Growth for Whom?

Who gains how much from economic growth?

Who is hurt how much by economic decline?

Two Ways to Answer These Questions

Cross-sectional changes in income, earnings, consumption, etc.

Panel changes in income, earnings, consumption, etc.

Cross-Sectional and Panel Earnings Changes in Dollars: Gold Standard Data in the United States (Administrative Records, Stacked One-Year Panels)

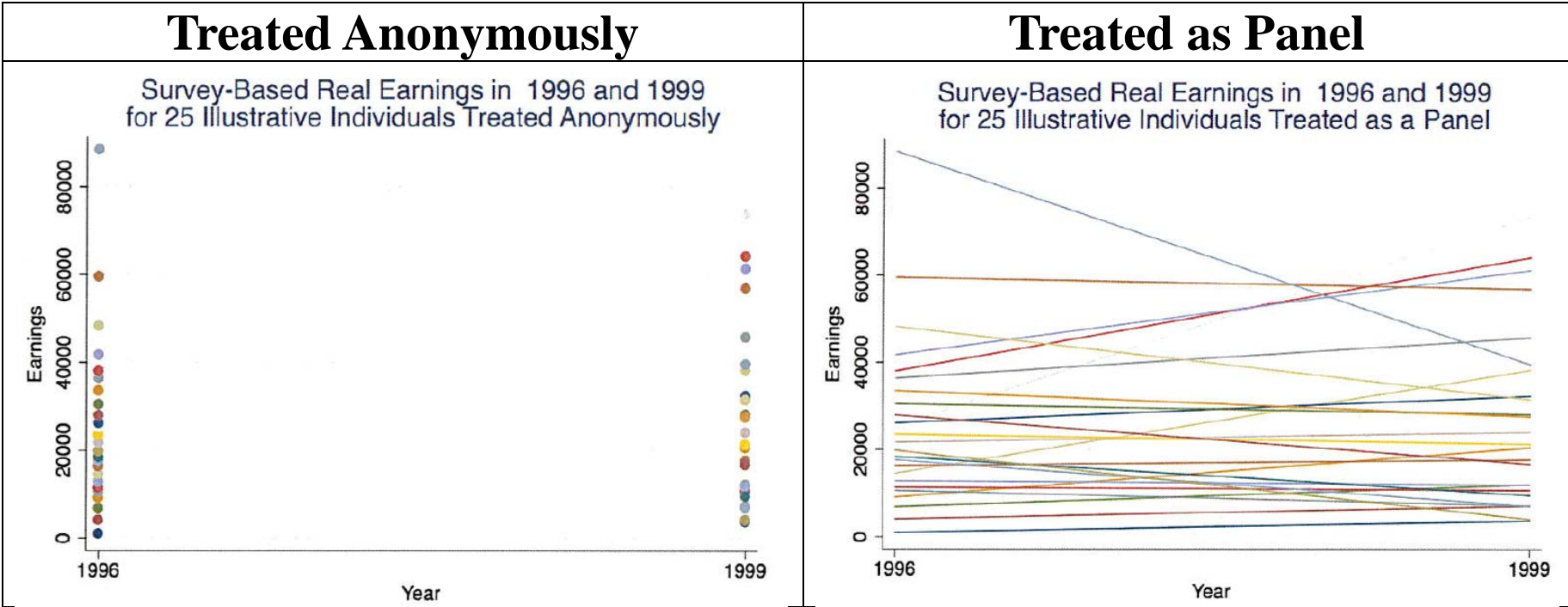| Initial Earnings Quintile	Mean Earnings Change Comparing Anonymous Cross-Sections	Mean Earnings Change by Initial Earnings Quintile: Panel Data Analysis
Lowest Quintile	-1	2527
Quintile 2	272	1160
Quintile 3	483	293
Quintile 4	741	157
Highest Quintile	1888	-464

Interpreting these results:

How can the panel income changes of the *initially* rich be *smaller* than the panel income changes of the *initially* poor, while the income changes of the *anonymous* rich are *larger* than the income changes of the *anonymous* poor?

The key to understanding this puzzle:
The *initially* rich/poor are *not <u>all</u> the same persons* as the *anonymous* rich/poor.

Illustration for the United States – Three-Year Panel

Treated Anonymously	Treated as Panel

Survey-Based Real Earnings in 1996 and 1999 for 25 Illustrative Individuals Treated Anonymously

Survey-Based Real Earnings in 1996 and 1999 for 25 Illustrative Individuals Treated as a Panel

Questions Addressed in This Paper

Q1: Theoretically, which combinations of rising/falling cross sectional inequality and divergent/convergent panel income changes can be proven to be possible?

Q2: Under what conditions might each combination arise?

Q3: Which combinations can be proven to be impossible?

The Two Basic Concepts and Measures of Them

1. **Changing Income Inequality in the Cross Section**
    - **Lorenz criteria**
    - **Commonly-used inequality indices**
        - **Lorenz-consistent indices**
        - **Lorenz-inconsistent indices**
    - **Judge inequality to have risen or fallen depending on what the Lorenz curves or the indices show.**
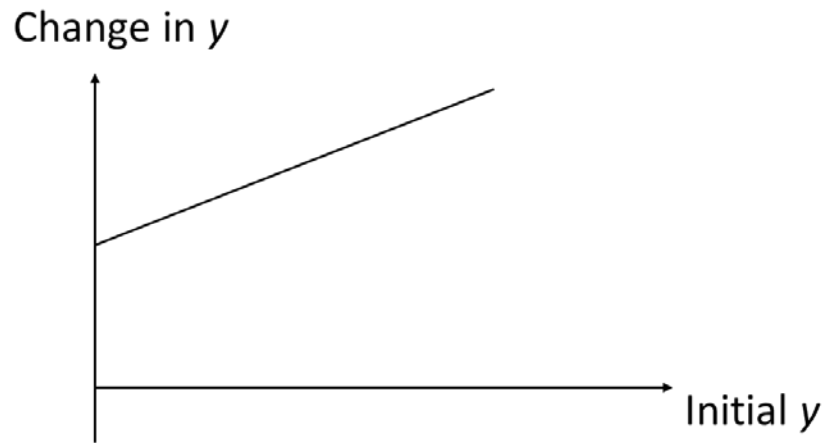
2. Divergent/Convergent Panel Income Changes
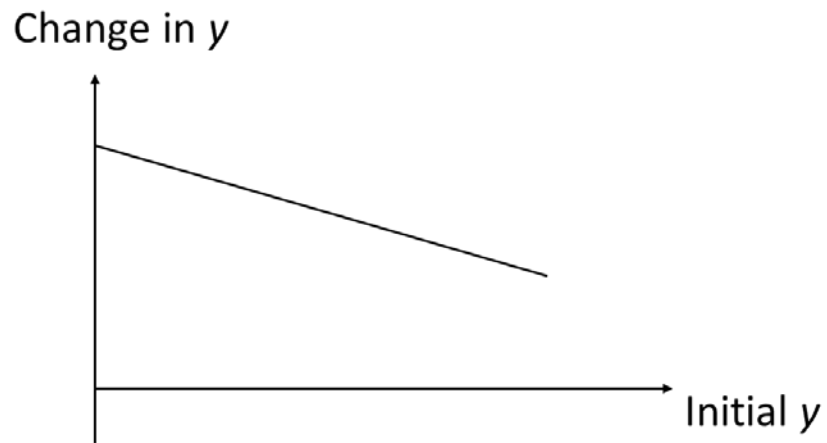
Mobility profiles or linear regression

May be dollar-based, log-dollar-based, share-based, or percentage-change-based. Use a generic income variable y.

Judge panel income changes to be divergent/convergent according to whether changes tend to increase/decrease with initial incomes:

Divergent panel income changes:

Convergent panel income changes:

Three Panel Regression Specifications:

Notation:
   y: A generic income variable which could be dollars (d), shares (s), log-dollars (log), or proportional changes (pch).

   1. A generic "final on initial regression":
      $$y_1 = \alpha_y + \beta_y\, y_0 + u_y.$$

   2. A generic "changes on initial regression":
      $$\Delta y = \gamma_y + \delta_y\, y_0 + u_{\Delta y}.$$

   3. "Exact proportional changes regression":
      $$\text{pch } d \equiv (d_1 - d_0)\, /\, d_0 = \varphi + \theta d_0 + u_{pch}.$$

Answering Our Three Questions

Q1: Theoretically, which combinations of rising/falling cross sectional inequality and divergent/convergent panel income changes can be proven to be possible?

A1: All of them are possible, if measured suitably:

	Falling Inequality	Rising Inequality
Convergent Panel Income Changes	√	√
Divergent Panel Income Changes	√	√

√: Possible in times of growth and decline.

Table 2: Matrix of Possibilities in Times of Economic Growth and Decline.

Final on Initial Regression: $y_1 = \alpha_y + \beta_y y_0 + u_y$

Changes Regression: $\Delta y_1 = \gamma_y + \delta_y y_0 + u_y$

Proportional Changes Regression: $\frac{d_1 - d_0}{d_0} = \phi + \theta d_0 + u_{pch}$

		Economic Growth Positive		Economic Growth Negative	
		Falling Relative Inequality	Rising Relative Inequality	Falling Relative Inequality	Rising Relative Inequality
Convergence/divergence	**Convergent** Share changes ($\beta_s < 1 \iff \delta_s < 0$)	$[5,20] \to [10,20]^{LD}$	$[5,20] \to [25,5]^{LD}$	$[5,25] \to [5,20]^{LD}$	$[7,23] \to [20,5]^{LD}$
	Dollar changes ($\beta_d < 1 \iff \delta_d < 0$)	$[5,20] \to [10,20]^{LD}$	$[5,20] \to [25,5]^{LD}$	$[5,25] \to [5,20]^{LD}$	$[7,23] \to [5,20]^{LD}$
	Proportional changes Log-dollar Approx. ($\beta_{\log} < 1 \iff \delta_{\log} < 0$)	$[5,20] \to [10,20]^{LD}$	$[1,1,1,1,1,1,1,1,6.1,8.89] \to [1,1,1,1,1,1,1,1,6,9]^{LD}$	$[5,25] \to [5,20]^{LD}$	$[1.1,407,418] \to [1,360,390]^{LD}$
	Exact Prop. changes ($\theta < 0$)	$[5,20] \to [10,20]^{LD}$	$[5,20] \to [25,5]^{LD}$	$[5,25] \to [5,20]^{LD}$	$[7,23] \to [20,5]^{LD}$
	Divergent Share changes ($\beta_s > 1 \iff \delta_s > 0$)	$[1,5,10] \to [2,4,25]^*$	$[5,20] \to [5,25]^{LD}$	$[60,320,1000] \to [54,150,876]^*$	$[10,20] \to [5,20]^{LD}$
	Dollar changes ($\beta_d > 1 \iff \delta_d > 0$)	$[5,20] \to [7,23]^{LD}$	$[5,20] \to [5,25]^{LD}$	$[20,90,180] \to [20,61,180]^*$	$[10,20] \to [5,20]^{LD}$
	Proportional changes Log-dollar Approx. ($\beta_{\log} > 1 \iff \delta_{\log} > 0$)	$[1,360,390] \to [1.1,407,418]^{LD}$	$[5,20] \to [5,25]^{LD}$	$[1,1,1,1,1,1,1,1,6,9] \to [1,1,1,1,1,1,1,1,6.1,8.89]^{LD}$	$[10,20] \to [5,20]^{LD}$
	Exact Prop. changes ($\theta > 0$)	$[1,5,10] \to [2,4,25]^*$	$[5,20] \to [5,25]^{LD}$	$[60,320,1000] \to [54,150,876]^*$	$[10,20] \to [5,20]^{LD}$

Notes: LD: Lorenz-Dominance

*: Possible when measure changing inequality by income share of the poorest tercile, because Lorenz curves cross. Lorenz-dominance is not possible in this cell.

Q2: Under what conditions might each combination arise?

The easy combinations:

    Rising inequality and divergent panel income changes
    Falling inequality and convergent panel income changes

Consider the other two combinations.

A. The Rising Relative Inequality/Convergent Panel Income Changes Quadrant

Result: All rows are possible.

	Rising Relative Inequality	
	Lorenz Criteria	Inequality Index
Type of Convergence		
Dollar changes	LW	√
Share changes	LW	√
Log-dollar changes	LW	√
Proportional changes	LW	√

Notes:

LW: Possible in some cases of Lorenz-worsening.

√: Possible for some Lorenz-consistent inequality measures.

Q: What Conditions for Certain Possibilities/Impossibilites?

Example of Derivation of Conditions for Lorenz Dominance and Convergent Share Changes:

Let $\Delta s = \gamma_s + \delta_s s_0 + u_s$ be a share changes regression.

Let s_c be the vector of final shares that would prevail if the shape of the income distribution changed, but everybody kept their initial position.

Define:

$$W = \frac{\sum (s_{ic} - s_{i0}) s_{i0}}{n} \text{ (term capturing "structural mobility").}$$

$$X = \frac{\sum (s_{i1} - s_{ic}) s_{i0}}{n} \text{ (term capturing "exchange mobility").}$$

We show that

$$sgn(\delta_s) = sgn\ (X + W).$$

A Lorenz-Improvement implies W<0.

A Lorenz-Worsening implies W>0.

X≤0 always.

Hence, if W>0 and X+W<0 there will be <u>both</u> convergence in shares and a Lorenz-worsening.

Note: If income changes are small enough that X=0 (i.e., no positional change), then Lorenz dominance will fully align with convergence/divergence. In this case, the anonymous rich/poor are the same people as the initial rich/poor.

Def. of β-divergence: Regress Δlog-income on initial log-income.

β-divergent if the regression coefficient is positive.

Def. of σ-convergence: In the cross-section, the variance of log-incomes is falling.

The F-W-Y result: β-divergence is incompatible with

σ-convergence.

Yet, we have claimed that divergent income changes and falling relative inequality can co-exist. How can this be?

Answer: Measure divergence and/or falling inequality differently from the way F-W-Y did and the two can co-exist.

Specifically: The variance of log-incomes is not Lorenz-consistent. Compare Lorenz curves or Lorenz-consistent inequality indices and the impossibility disappears.

Q3: Which combinations can be proven to be impossible?

- **Impossibility proven in previous work: Divergence in log-incomes cannot coexist with falling variance of logs (Furceri (2005) and Wodon and Yitzhaki (2006).**

- **Six new impossibilities are proven in our work. All involve "good" measures of falling relative inequality (Lorenz-improvement, Lorenz-consistent indices) and divergent panel income changes (in dollars, shares, and exact proportional changes).**

Summary of Results

The Big Questions Asked in This Line of Research

    Who gains how much from economic growth?

    Who is hurt how much by economic decline?

Two Ways Used to Answer These Questions

    Most common: analysis of cross-sectional changes

    Newer approach: analysis of panel income changes

General Finding: The two approaches can give opposite results. We have conditions for each.

Question for You: Which do you care most about: changes for anonymous income groups or for panel people? The answer to "who benefits from economic growth" hinges on the answer.