UNRISD
UNITED NATIONS RESEARCH INSTITUTE FOR SOCIAL DEVELOPMENT

DRAFT

# Inequality and Structural Change

Hyunsub Kum

prepared for the UNRISD project on

**UNRISD Flagship Report:**
**Combating Poverty and Inequality**

August 2008 ▪ Geneva

UNRISD was established in 1963 as an autonomous space within the UN system for the conduct of policy-relevant, cutting-edge research on social development that is pertinent to the work of the United Nations Secretariat; regional commissions and specialized agencies; and national institutions.

Our mission is to generate knowledge and articulate policy alternatives on contemporary development issues, thereby contributing to the broader goals of the UN system of reducing poverty and inequality, advancing well-being and rights, and creating more democratic and just societies.

UNRISD, Palais des Nations
1211 Geneva 10, Switzerland

Tel: +41 (0)22 9173020
Fax: +41 (0)22 9170650
info@unrisd.org
www.unrisd.org

**Inequality and Structural Change**

**Hyunsub Kum**[1]

## 1. Introduction

This paper presents an updated data set on inequality in structures of manufacturing pay for the years 1963 – 2002, using the standard methods of the University of Texas Inequality Project (http://utip.gov.utexas.edu). The paper then compares these measures with evidence on structural change, taken as changing shares of agriculture, manufacturing and services in total employment. A key finding is that low inequality is closely associated with low variability in inequality through time, and that movement out of agriculture is associated with high variability in the inequality of manufacturing pay. Thus the level of inequality is a reasonable index of underdevelopment, and the change of the UTIP inequality measure is an indicator of overall structural change in the process of development.

## 2. Data for the Measurement of Pay Inequality

Data on inequality for this study are derived from the Industrial Statistics Database of United Nations Industrial Development Organization (UNIDO),[2] which provides total payroll and annual average employment according to International Standard Industrial Code (ISIC) Revision 2 at the 3-digit level. This comprises 28 manufacturing industries for 155 countries in the 1963 – 2003 period. From this we compute 3,452 observations on pay inequality in manufacturing industry in somewhat consistent standardized format covering nearly forty years. These data have several merits for comparative analyses in cross-sections and time-series.

---

[1] Seoul National University and University of Texas Inequality Project. Prepared for UNRISD.

[2] This study uses the 2005 version of the UNIDO Industrial Statistics data set.

First, the data have been collected and managed in a consistent manner by UNIDO for a long time. All measures of pay and employment -- the necessary ingredients of the UTIP-UNIDO measure of inequality -- have been collected as a matter of official routine by each government following ISIC 3-digit framework in most countries around the world. Pay is defined as "wages and salaries paid to employees in a year" and employment is as "employees" or "persons engaged" by UNIDO criteria. This simplicity may minimize the noise associated with varying interpretations of the definition. Table 1 shows the detail of 3-digit ISIC industry classifications, which is used as the framework for aggregation.

Table 1. Manufacturing Sectors by 3-digit ISIC Code

| ISIC | Industry | ISIC | Industry |
|---|---|---|---|
| 311 | Food production | 354 | Misc. petroleum/coal production |
| 313 | Beverages | 355 | Rubber production |
| 314 | Tobacco | 356 | Plastic production |
| 321 | Textiles | 361 | Pottery/china/earthenware |
| 322 | Wearing apparel, w/o footwear | 362 | Glass/ production |
| 323 | Leather production | 369 | Other non-metallic mineral production |
| 324 | Footwear, w/o rubber or plastic | 371 | Iron/steel |
| 331 | Wood production, w/o furniture | 372 | Non-ferrous metals |
| 332 | Furniture, w/o metal | 381 | Fabricated metal production |
| 341 | Paper/ production | 382 | Machinery, w/o electrical |
| 342 | Printing/ publishing | 383 | Machinery electric |
| 351 | Industrial chemicals | 384 | Transport equipment |
| 352 | Other chemicals | 385 | Professional/Scientific equipment |
| 353 | Petroleum refineries | 390 | Other manufactured production |

Second, all values for pay and employment in this data are measured in annual terms. Of course, the annual *average* pay is a rough measure, which might be affected by changes in the length of work-time, in numbers of part-time workers, or change in the gender composition of the workforce. Also, there are still conceptual differences in annual pay or its calculation among different countries. This is because pay may include not only direct measures of "wages and salaries" but also several "auxiliary benefits paid to employees" (for instance social security, pension, insurance, or severance pay), which are different from country to country.[3]

However, when comparing the annual average pay from the UNIDO data with the average hourly compensation costs from the US. Bureau of Labor Statistics,[4] which are constructed for the assessment of international differences in employer labor costs, the correlation coefficients in the cases of OECD countries are above 0.95 except for France (0.82) and Mexico (0.72).[5] Thus, we can borrow some strength from the ICHCC to check the cross-country comparability of the annual average values in the UNIDO data. Further, the fact that most countries stick to their reporting conventions and statistical procedures over time allows us reasonably to expect the comparability of measures over time within a country. Berman's endorsement (2000) of the coverage and accuracy of the UNIDO compilation lends some weight to our confidence in the quality of this data set.

---

[3] Pay and salaries in terms of UNIDO's definition include "all payments in cash or in kind made to employees during the reference year in relation to work done for the establishment."

[4] This is the International Comparisons of Hourly Compensation Costs for Production Workers in Manufacturing (ICHCC) data, which provides average labor compensation costs for 28 countries in 1975-2000 at five year intervals. Rodrik (1999) took the same approach to check the quality of UNIDO data.

[5] Countries in this comparison include Australia, Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Greece, Hong Kong, Ireland, Israel, Italy, Japan, Korea, Sri Lanka, Luxembourg, Mexico, Netherlands, Norway, New Zealand, Portugal, Singapore, Taiwan, Sweden, the United Kingdom and the United States.

## 3. Theil's T Inequality Measure

The UTIP-UNIDO measure of inequality is the between-groups component of a Theil generalized entropy index of inequality, which has perfect decomposability into between-group ($T_B$) and within-group ($T_w$) components as shown below.[6] If we divide our subject pool into several groups, $T_w$ is a weighted average of the Theil index for each group, and $T_B$ is a weighted geometric mean of the wage relativities, using the share of aggregate pay as a weight.

<u>Theil Inequality Index and its Decomposition</u>

$$T_{total} \equiv T_B + \overline{T}_W$$

$$T_B = \sum_{i=1}^{n} \frac{w_i}{\sum_{i=1}^{n} w_i} \bullet \ln \left[ \frac{w_i \Big/ \sum_{i=1}^{n} w_i}{e_i \Big/ \sum_{i=1}^{n} e_i} \right]$$

$$T_w = \left( \frac{w_{ij}}{w_i} \right) \bullet \left[ \frac{w_{ij} / w_i}{e_{ij} / e_i} \right]$$

$$\overline{T}_w = \sum_{i=1}^{n} \frac{w_i}{w} \bullet T_w$$

We focus on the group-wise inequality or between-group inequality ($T_B$) component, which requires only group-wise measures (means of pay and employment) without any further information. With these, the calculation of the measure of inequality is straightforward as shown in the above formula. Also since this measure is a distance function showing divergence between wage shares and employment shares by groups, the changes of pay and employment are explicitly reflected in the calculations of change over time. The underlying grouping scheme can be just about anything -- gender, race,

---

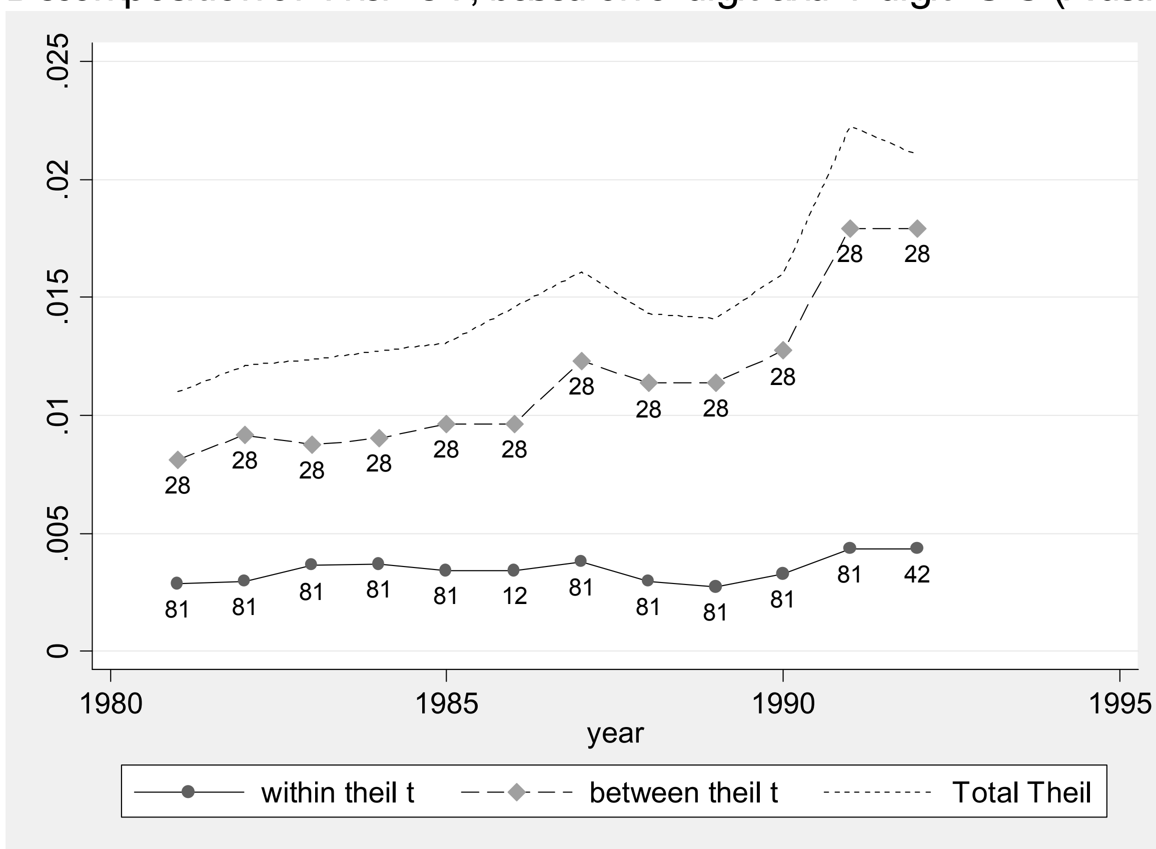
[6] The popular Gini inequality index also can be decomposed into between, within, and overlap components (Pyatt, 1976). However, in this case, the overlap component cannot be identified from aggregated measures alone, thus only an approximation of the between-groups component is available.

economic sector, or geographic region – so long as the groups are mutually exclusive and collectively exhaustive (MECE). In the UNIDO data, 3-digit ISIC (International Standard Industrial Classification) code for manufacturing industry meets this specification, and has the added virtue of placing wage and employment changes that reflect structural change in the economy into the between-group component of inequality where it can be directly observed; with other classification schemes, such as gender or region, it is possible that structural change would be reflected mainly in the within-group element of inequality, which is unobserved.

One may still ask whether omitting the within-industry component would make a significant difference to our understanding of the underlying economic processes. Without doubt, the degree of approximation of $T_B$ to $T_{total}$ may depend on the size of the within-industry component for each country and year. But Theil (1972) argued that an inequality measure computed from grouped data provides a *consistent lower-bound* estimate of inequality for the total population. And a series of empirical studies (Conceicao, Galbraith and Bradford, 2001) shows that $T_B$ is usually a good estimate of changes in the whole distribution when industrial sectorization is employed. Thus, it seems reasonable to assume that the movement of the between-industries component of Theil's T ($T_B$ ) approximates the movement of total inequality, especially for the secular trend rather than the absolute level.

To see this point clearly, we combine 3-digit and 4-digit industries data into a hierarchical structure and treat them as between-group (3-digit ISIC) and within-group (4-digit ISIC) components of a common classification. We then calculate the Theil index with the two components. Figure 1 shows the Australian case. When the Theil index is decomposed into $T_B$ and $T_W$ in this way, the relative magnitude of the latter is much smaller than that of the former, and the former very sufficiently represents the overall trend (Data labels show the number of categories available in each year.)

Figure 1. Decomposition of Theil's T, based on 3-digit and 4-digit ISIC (Australia)




Further disaggregation, carried out for the US by Conceicao, Galbraith and Bradford (2001) confirms that moving to finer levels of disaggregation yields diminishing returns in information about the movement of inequality: the fine classification schemes tend to have the same broad features as the coarse schemes, just as a low-resolution photograph captures the broad features of a landscape while a high-resolution picture merely adds detail. Thus it can be said that changes in the between-industry component do arguably provide a useful approximation of the changes in overall industrial pay inequality in the majority of countries and time periods covered in this study.

heil T inequality

tribution of our

: 2, and Figure 2