<center>**Equivalency Scales Supplemental Handout**</center>

I.   Concept & Purpose Behind Equivalency Scales

In order to generate poverty statistics, we need to be able to measure poverty. As in measuring anything in life, one must have a unit of measurement. The unit of observation for poverty is the individual, however, due to the nature of economics and spending, a few additional steps must be conducted to arrive at an individual unit of measurement.

In other social parameters of interest, it may be feasible to measure occurrences individually. For example, to measure the frequency of heart disease in a country, it may be possible to report 300, 000 heart disease cases among the total population during the year. When measuring poverty, however, this same logic does not apply. For example, how would one assess the income of infants who are incapable of generating income yet utilize financial resources? This predicament illustrates how the flow of income may also vary depending on income-earning individuals' household context. For example, a worker bringing home $50,000 a year to a family of five versus a worker only living with their spouse also earning $50, 000 will have different spending priorities and abilities. Consequently, depending on the age and gender demographics of the household and living standards, household economies of consumption will vary (Atkinson, Cantillon, Marlier, & Nolan, 2002).

This leads to the question of interest: what income levels cause financial constraints and bring households and its individuals to poverty? To answer accurately, one must be able to utilize household income data (as this is the most frequently reported form income) to assess the individual per-capita income and determine poverty levels for the entire household. To measure income as accurately and realistically as possible, equivalence scales are intended to measure this sharing of resources within households.

II.   Equivalence Scales

Per Capita Income

If we are interested in per-capita income, it is important to equalize measures into comparable units. For example, comparing 50 meters to 50 feet is quite meaningless, but 164 feet compared to 50 feet gives one a better idea of the magnitude and concepts in comparison. Similarly, the aim of equivalent scales is to convert household income measurements to individual per-capita measurements of income.

Equivalence scales are built upon the concept of disaggregation. We are attempting to convert the household cost of living into comparable individual units of measurement under the same standard of living by utilizing a reference point (in most cases, a single-member household) (Lewbel & Pendakur, 2006). Equivalence scales inform the weighting function used to arrive at this value for each household member. Before detailing the concepts of weighting, let's explore the basic concept and purposes behind utilizing equivalence scales with our guests, Family Chiba. Adult 1 is the head of household with an income of $30,000 followed by Adult 2 bringing home $8,000, giving Family Chiba a total income of $38,000 per year. Their children bring home $0 and are financially supported by Adult 1 and 2. In actuality, what would the children's equivalent income be? And how much of Adult 1 and 2's actual income is used?
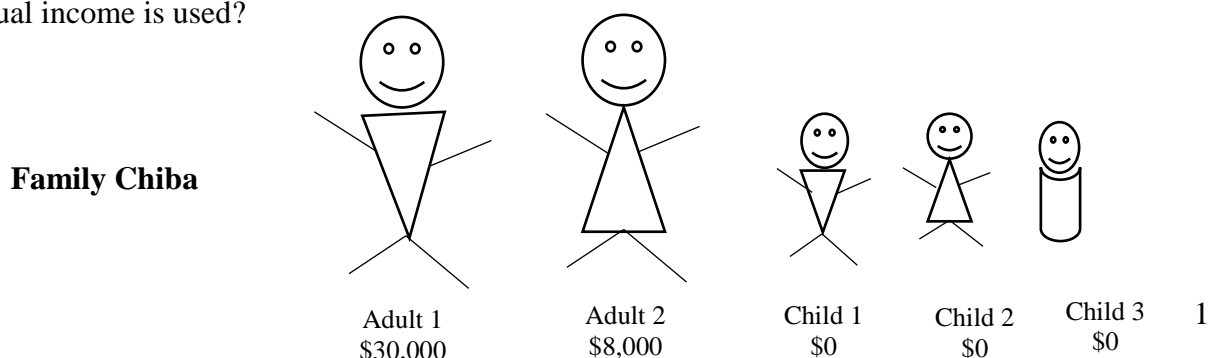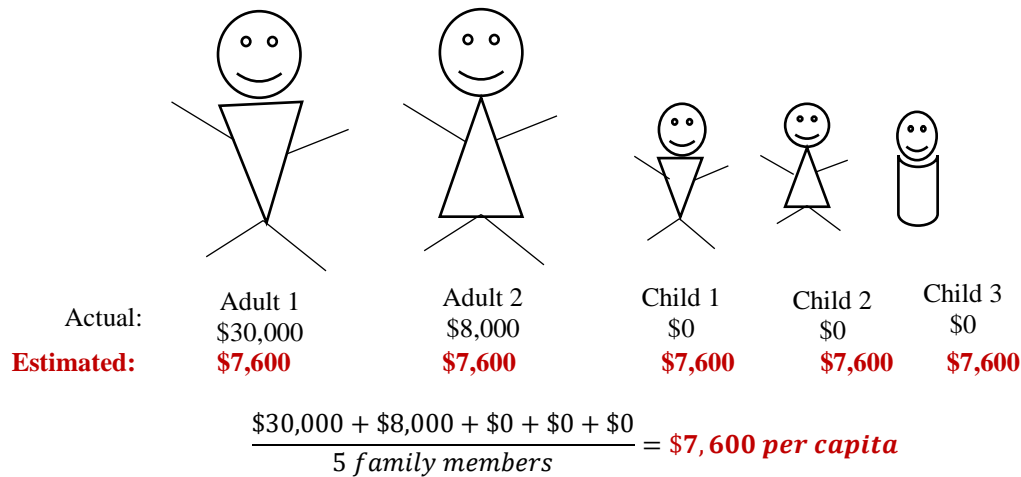
Family Chiba

Adult 1	Adult 2	Child 1	Child 2	Child 3
$30,000	$8,000	$0	$0	$0

Figure 1. Determining per-capita income (without equivalence scales) with Family Chiba.

Actual:	Adult 1 $30,000	Adult 2 $8,000	Child 1 $0	Child 2 $0	Child 3 $0
Estimated:	**$7,600**	**$7,600**	**$7,600**	**$7,600**	**$7,600**

$$\frac{\$30,000 + \$8,000 + \$0 + \$0 + \$0}{5 \; family \; members} = \$7,600 \; per \; capita$$

As shown in the calculations above, if the total family income, $38,000, were to be divided equally the each individual would have an income value of $7,6000. The next step would be to determine whether $7,600 per capita is considered to be under poverty. In this scenario, $7,600/365 days = $21.71, which is well above the current $1.90 poverty line. Consequently, children whose actual incomes are $0 (i.e., below the poverty line), would actually have a household expense of $21.71 and be classified above the poverty line (i.e., not experiencing poverty). It is important to note the reverse would also be true. If in another scenario, an individual has an actual income of $21.71, but after relevant adjustments daily income is $1.36 per day, then this individual should be classified under the poverty line.

The scenario above highlights one of the most common uses of equivalence scales – determining household income levels. The utility of equivalence scales are not limited to this sole measure. In assessing the distribution of income, individuals in most need of social support or food resources, for example, can be identified and thus a program corresponding to their needs can be developed.

For countries not having conducted investigations to determine the weights of each household member, this is the recommended approach for determining per capita income, as it is difficult to estimate the appropriate weights each individual without sufficient data.

Definition of Equivalence Scales
According to FAO, equivalence scales are:

> **"a tool to convert nominal incomes into a <<comparable>> measure of well-being in all those cases where heterogeneous populations must be handled for inequality and poverty purposes (Bellù & Liberati, 2005)."**

As one may observe from Figure 1 scenario above, a key limitation to determining per-capita income without equivalence scales is not taking into account economies of consumption. As individuals living in the household may have differing needs (i.e. a child may need more or less financial support), the amount of income allocated to each individual household may be different. In the example above, the expenses of having a child may not be $7,600 but rather $3,800, so the equivalent per capita income of each family member in this scenario may actually be different since a significant portion of the $7,600 per capita income may in fact be distributed elsewhere. This is the ultimate purpose of equivalence scales- to estimate the difference and adjust per-capita incomes accordingly. Essentially,

equivalence scales use household income data to establish a functional relationship between the actual, nominal income to comparable, per-capita income values (Bellù & Liberati, 2005).

Methodologies
Some commonly used methodologies are listed below with corresponding calculations in Table 1.

1. **Organisation for Economic Co-operation and Development (OECD)/ "Oxford" Equivalence Scale –** This was the original scale established by the OECD primarily used in the 1980's. This scale assigns 1 to the first household member, .7 to each additional adult, and .5 to each child (OECD, n.d.d).

2. **OECD-Modified Scale –** In 1994, Hagenaars, De Vos and Zaidi proposed the modified scale, arguing the original scale overestimated the economic cost of additional household members and children (Chanfreau & Burchardt, 2008). Based on the literature at the time and input from member states, the modified scale was introduced and has since been utilized as the standard scale for OECD countries without their proper equivalence scale (Chanfreau & Burchardt, 2008). The first household member has a value of 1, each additional adult a value of .5, and each child a value of .3.

3. **Square Root Scale –** Divides household income by the square root of the household size. This scale was derived in 1974 from analysis of the Boston Social Standards Survey (Chanfreau & Burchardt, 2008). Although this method does not scale the differences in individual's needs, squaring the household size was found to match household size growth in accordance to survey respondents' perception of income needed (Chanfreau & Burchardt, 2008). This scale is primarily utilized to conduct comparative research and is used institutions, organizations, and countries (Chanfreau & Burchardt, 2008).

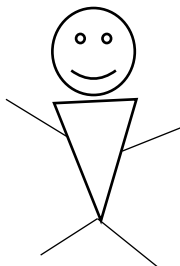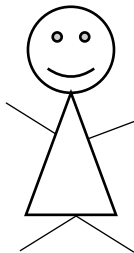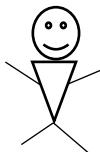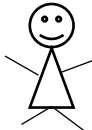**Table 1. Calculating individual income for the first household member.**

Household Size	Measure	Oxford/Old OECD Scale	OECD Modified Scale	Square Root Scale
1 Adult (Reference)	Scale	**1**	**1**	**√(1)**
	Unit	**$50,000**	**$50,000**	**$50,000**
2 Adults	Scale	1+.7 = **1.7**	1+.5 = **1.5**	√(2)
	Unit	50,000/1.7 = **$29, 412**	50,000/ 1.5 = **$35, 355**	50,000/ √(2) = **$35, 355**
1 Adult, 2 Kids	Scale	1 + .5 + .5 = **2**	1 + .3 + .3 = **1.6**	√(3)
	Unit	50,000/2 = **$25, 000**	50,000/1.6 = **$31, 250**	50,000/ √(3) = **$28, 868**
3 Adults, 4 Kids	Scale	1+.7+.7+.5+.5+.5+.5=**4.4**	1+.5+.5+.3+.3+.3+.3=**3.2**	√(7)
	Unit	50,000/ 4.4 = **$11, 364**	50,000/ 3.2 = **$15, 625**	50,000/ √(7) = **$18, 898**

Continuing the Example with Family Chiba
In the case of Family Chiba (2 adults, 3 kids), the calculations would appear like this:

Oxford Scale

$$\frac{\$30,000 + \$8,000 + \$0 + \$0 + \$0}{1 + .7 + .5 + .5 + .5 \; family \; members}$$
= $11,875 per capita

OECD Modified Scale

$$\frac{\$30,000 + \$8,000 + \$0 + \$0 + \$0}{1 + .5 + .3 + .3 + .3 \; family \; members}$$
= $15,833 per capita

Square Root Scale

$$\frac{\$30,000 + \$8,000 + \$0 + \$0 + \$0}{\sqrt{5} \; family \; members}$$
= $16,994

Table 2. Household equivalent income for each member of Family Chiba using equivalence scale.

Equivalence Scale	Adult 1	Adult 2	Child 1	Child 2	Child 3
Income	$30,000	$8,000	$0	$0	$0
No Equivalency scale	$7,600	$7,600	$7,600	$7,600	$7,600
Oxford/Old OECD Scale	$11,875	$8,312.5	$5,937.50	$5,937.50	$5,937.50
OECD-Modified	$15,833	$7,916.50	$4,749.90	$4,749.90	$4,749.90
Square Root Scale	$16,994	$16,994	$16,994	$16,994	$16,994

Utilizing an equivalence scale as compared to not will significantly influence the per-capita income reported. In our previous example, each member of Family Chiba had a per-capita income of $7,600 (as recorded on the "No Equivalency Scale" line). However, per principles on economies of scales of consumption, we know it is not reasonable to assume the expenses of each individual will be equal. Let's compare the income estimated utilizing the OECD/ "Oxford" scale to see the impact of weighting. If we were to determine the per-capita income, Adult 1 would have an income of $11,875 per year as compared to our previous estimates of $7,600. The use of an equivalence scale amounts to a $4,275 difference. This can mean very different things economically, and analytically when determining poverty classification. On this line of thinking, different equivalence scales will lead to different income estimates for the first adult, and thus for other household members as well. As is evident in Table 2, the per-capita income estimated for the first adult and subsequent family household members may be drastically different depending on the equivalence scale utilized.

Developing countries may not follow the weighting allocation preset for developed OECD countries. For this reason, it is important to clarify the rationale for using a different methodology than the equivalence scales proposed above.

Generating Poverty Statistics

III.   Data Sources

Now that we have reviewed the concept and computation of equivalence scales to generate per-capita income values, it is time to review how to how to apply these concepts to generate poverty statistics. Although sources such as United Kingdom Office for National Statistics (2015) highlight the strength of utilizing expenditure data to better measure standard of living, in practice it may be difficult to assess individual consumption. Thus, utilizing household income data and subsequently converting the data to individual estimates is the best option.

IV. Real Examples of the Utility of Equivalence Scales

Australia
In an attempt to relieve the need for children to enter the workforce and support family income, Australia identified low-income families with children between the ages of 13 and 15 to administer a Family Benefit program. In utilizing income data, Australia targeted families in most need of income assistance and support teen attendance in school (OECD, n.d.a). This program provides an excellent example of effective social investing, as supporting this demographic to attend school also increases future employment prospects, and thus quality of life (OECD, n.d.a).

Korea
Korea has a Employment Insurance System intended to support job security, professional capabilities and skill development. With this system in place, Korea responded to the 2009 unemployment crises in a targeted, efficient manner. By monitoring employment rate indicators, Korea identified the need to increase the employment retention subsidy in response to the 2009 crisis (OECD, n.d.b).

Mexico
Mexico established the program, *Oportunidades*, to target individuals living in extreme poverty. This program targets a specific audience for conditional cash transfer to improve their education, health, and nutrition prospects (OECD, n.d.c). Individuals eligible for the program are targeted by identifying specific family income, health, and educational needs.

V. Challenges/Limitations of Equivalence Scales

A few assumptions and limitations to keep in mind:
- Without utilizing scales, it is assumed resources are shared equally among household members
- In utilizing equivalence scales, we continue to make an assumption on the distribution of financial resources in the household and assume the distribution to reflect scale weights
- In cross-country comparisons, the manner in which income data is collected and reported may influence the comparability of data (Atkinson & Brandolini, 2001; Förster & d'Ercole, n.d.)

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