

## Per-capita income versus household-need adjusted income: a cross-country comparison

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We use data from the Luxembourg Income Study in order to quantify the economy-wide monetary gains achieved by Household-Size Economies, due to the within-household sharing of goods by individuals living in multi-member households. In most of the twenty countries we examine, we observe a decline in monetary gains achieved by Household-Size Economies over time. This decline is the result of a demographic trend towards smaller-sized household units, rather than a change in the shares of aggregate disposable income earned by household types of different size.

*Keywords:* equivalence scale, welfare, demographic change, Luxembourg Income Study, household size economies, income distribution, family economics

*JEL Codes:* D1, D13, D31, I31, J11

### Introduction

To assess a country's economy performance and the material living standard of its citizens, several monetary measures have been suggested. Perhaps the most frequently used is the Gross Domestic Product (GDP) per capita. GDP is the market value of all final goods and services produced within a nation's borders during a year and can be taken directly from national accounts, without a closer look at micro-level data.<sup>2</sup> GDP measures, however, what a nation produces rather than the

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living standard and consumption possibilities of a nation's individuals. Net or disposable income per capita is an income measure based on national accounts, which is closer to the possibility of individuals to consume.<sup>3</sup> Boarini, Johannson, and d'Ercole (2006) show that estimates derived from these different income concepts can vary widely.

Still, estimates of per-capita disposable income based on national accounts alone cannot capture Household-Size Economies (HSE) achieved in multi-member households, due to the fact that housing and other categories of within-household public goods can be shared among household members. In general, HSE may arise from intra-household public goods, a reduction of excess capacity concerning indivisible goods, increasing returns of household-production activities or quantity discounts (see Nelson, 1988). With household-level data on income and other socio-economic characteristics available, it is feasible to consider HSE in the analysis, through the use of equivalence scales. Equivalence scales can be seen as a type of deflator through which incomes of different household types can be converted to a needs-adjusted basis that is comparable across individuals who live in different household types. Usually, a single adult who lives alone (a one-member household) serves as the reference, and her equivalence scale is set to 1. Then an equivalence scale of 1.5 for a couple indicates that the couple needs 1.5 times the income of a one-member household to reach the same standard of living. Dividing the couple's household income by its equivalence scale gives the couple's welfare equivalent income in terms of the income of a one-member household: if each individual from a two-adult household is taken apart in order to form a one-member household, this welfare equivalent income reveals the income that must be given to each of the two newly formed households, in order that the two individuals have the same standard of living as they did before they were separated.

The central goal of this article is to use such micro-level data and equivalence scale measures in order to assess the importance of family-size economies for measuring average living standards at the country level. Using household-level data provided by the Luxembourg Income Study, we estimate two central statistics for a selected set of 20 member countries of the Organisation of Economic Co-operation and Development (OECD): mean equivalent disposable income versus mean per-capita disposable income. Dividing the former by the latter tells us about the importance of family-size economies at the country level.

We demonstrate that demographic trends do affect the prospects of material comfort economy wide. In particular, our study shows that, over time, the fraction of large-sized families has dropped and the share of one-member households has increased, while the shares of total disposable income of the differently-sized household types relative to population shares have remained rather constant. These household-size dynamics have led to a drop in the economy-wide benefits from within-household sharing. Aggregate income statistics derived from national ac-

counts neglect such changes.

To our knowledge, the possible loss in economy-wide HSE, implied by the demographic trend towards smaller-sized household units, does not appear to have been discussed in the literature, although its implication is obvious. If HSE drop over time economy wide, some positive rise in aggregate disposable income is required to compensate for the loss.

In the next section we introduce the database and methodological concepts underlying our empirical examination. In the following section we present our empirical results, while in a final section we make our concluding remarks.

### Database and statistical measures

Our empirical examination is based on data from the Luxembourg Income Study (LIS). For numerous countries and several years, the LIS provides representative micro-level data on household incomes and demographic characteristics (i.e., the number, age, and gender of each family member), with the first data wave (“Wave I”) being compiled around year 1980. For a selected set of countries, data from earlier years are also provided (“historical data”). While we use data from all available data waves, in order to keep our empirical analysis tractable, we restrict our attention to the data sets from 20 countries. Further details on our database (countries and years) are provided in Table 1.

The two key LIS variables underlying our empirical examination are the number of household members, “d4”, and the disposable household income, “dpi”. Only households with positive incomes are considered, and we use person weights - the number of household members times the LIS frequency weight (“hweight”) - when generating population-wide indicators. To make disposable household income comparable across household types, all incomes are adjusted by means of an equivalence scale. We apply a parametric Equivalence Scale (ES), suggested in Buhmann, Rainwater, Schmauss, and Smeeding (1988):  $ES(n_h, \theta) = n_h^\theta$ , where  $n_h$  denotes the number of persons living in household  $h$  and  $\theta$ , the level of household-size economies of scale, with  $0 \leq \theta \leq 1$ .

In the empirical part of our article, we distinguish two different levels of parameter  $\theta$ , the level of household-size economies of scale. In the first scenario, we employ the square-root equivalence scale, which is employed in numerous empirical studies and recommended by the OECD, i.e.,  $\theta=0.5$ . This implies that, for instance, a four-member household requires twice as much income as a one-member household to attain the same standard of living. In the second scenario, we assume that  $\theta=1.0$ . Hence, we compute disposable household incomes per capita, assuming that no HSE can be achieved.

For every country and each year examined, we use this household-level data to

**Table 1**  
**List of LIS data sets used in this study**

	Code	Historical	Wave I	Wave II	Wave III	Wave IV	Wave V	Wave VI
Australia	AU	—	1981	1985	1989	1995	2001	2003
Austria	AT	—	—	1987	—	1994/95/97	2000	—
Belgium	BE	—	—	1985	1988/92	1995/97	2000	—
Canada	CA	1971/75	1981	1987	1991	1994/97	1998/2000	2004
Denmark	DK	—	—	1987	1992	1995	2000	2004
Finland	FI	—	—	1987	1991	1995	2000	2004
France	FR	—	1979	1984B	1989	1994	2000	—
Germany	DE	1973/78	1981	1983/84	1989	1994	2000	—
Ireland	IE	—	—	1987	—	1994/95/96	2000	—
Israel	IL	—	1979	1986	1992	1997	2001	2005
Italy	IT	—	—	1986/87	1989/91	1993/95	1998/2000	—
Luxembourg	LU	—	—	1985	1991	1994/97	2000	2004
Mexico	MX	—	—	1984	1989/92	1994/96	1998/2000/02	—
Norway	NO	—	1979	1986	1991	1995	2000	2004
Poland	PL	—	—	1986	1992	1995	1999	2004
Spain	ES	—	1980	—	1990	1995	2000	—
Sweden	SE	1967/75	1981	1987	1992	1995	2000	2005
Taiwan	TW	—	1981	1986	1991	1995/97	2000	2005
United Kingdom	UK	1969/74	1979	1986	1991	1994/95	1999	2004
United States	US	1974	1979	1986	1991	1994/97	2000	2004

Note: All databases have been accessed in June 17, 2009.

compute two welfare indicators: 1) total population-wide equivalent income,

$$Y(\theta = 0.5) = \sum_{h=1}^H \left( y_h / (n_h)^{0.5} \right) \cdot n_h \cdot w_h, \quad (1a)$$

and 2) total population-wide per-capita income,

$$Y(\theta = 1.0) = \sum_{h=1}^H (y_h / n_h) \cdot n_h \cdot w_h, \quad (1b)$$

where  $y_h$  is the disposable household income of household  $h$ ,  $w_h$  denotes the  $h$ 's LIS household weight, and  $H$  denotes the total number of LIS household units.<sup>4</sup> The ratio,

$$\frac{Y(\theta = 0.5)}{Y(\theta = 1.0)} = \frac{\sum_{h=1}^H y_h \cdot (n_h)^{1-\theta} \cdot w_h}{\sum_{h=1}^H y_h \cdot w_h}, \quad (2)$$

reveals the extent to which the population-wide equivalent income,  $Y(\theta = 0.5)$ , differs from the population-wide per-capita income,  $Y(\theta = 1.0)$ . Hence, Equation 2 is a relative measure, capturing the economy-wide gain by HSE achieved, relative to a case where each and every person lives in a one-member household and has an income equal to  $1/n_h$ -th of the disposable household income,  $y_h$ .

Throughout, we refer to Equation 2 as the *HSE Index*, the indicator of HSE. Ceteris paribus, the *HSE Index* increases according to the extent to which a population benefits from HSE. HSE are higher, the larger the fraction of people living in multi-member households and also the larger the multi-member households. The *HSE Index* also increases, ceteris paribus, if the income share owned by multi-member households increases.

In sum, inter-temporal changes in the *HSE Index* can result from two interacting forces: 1) changes in household demographics and 2) changes in the income shares owned by different household types. To portray demographic change in a country, we calculate, by country and year, the number of persons living in a specific household type, relative to the whole population. Household types are classified according to the number of family members,  $m$ . Altogether, five household types are distinguished: one-, two-, three-, and four-member households, and households with five and more members. So, the fraction of people living in  $m$ -member households is:

$$f^m = \frac{\sum_i n_{m,i} \cdot w_{m,i}}{\sum_i \sum_m n_{m,i} \cdot w_{m,i}}, \quad (3)$$

with  $m \in \{1, 2, 3, 4, 5\}$  where  $m = 5$  identifies household types with five or more members. Again,  $w_{m,i}$  is the LIS weight for a household with  $m$  members which belongs to the  $i$ -th income category in the LIS database (see Note 4 above). The income share owned by a household type,  $m$ , is given by:

$$s^m = \frac{\sum_i y_{m,i} \cdot w_{m,i}}{\sum_i \sum_m y_{m,i} \cdot w_{m,i}}. \quad (4)$$

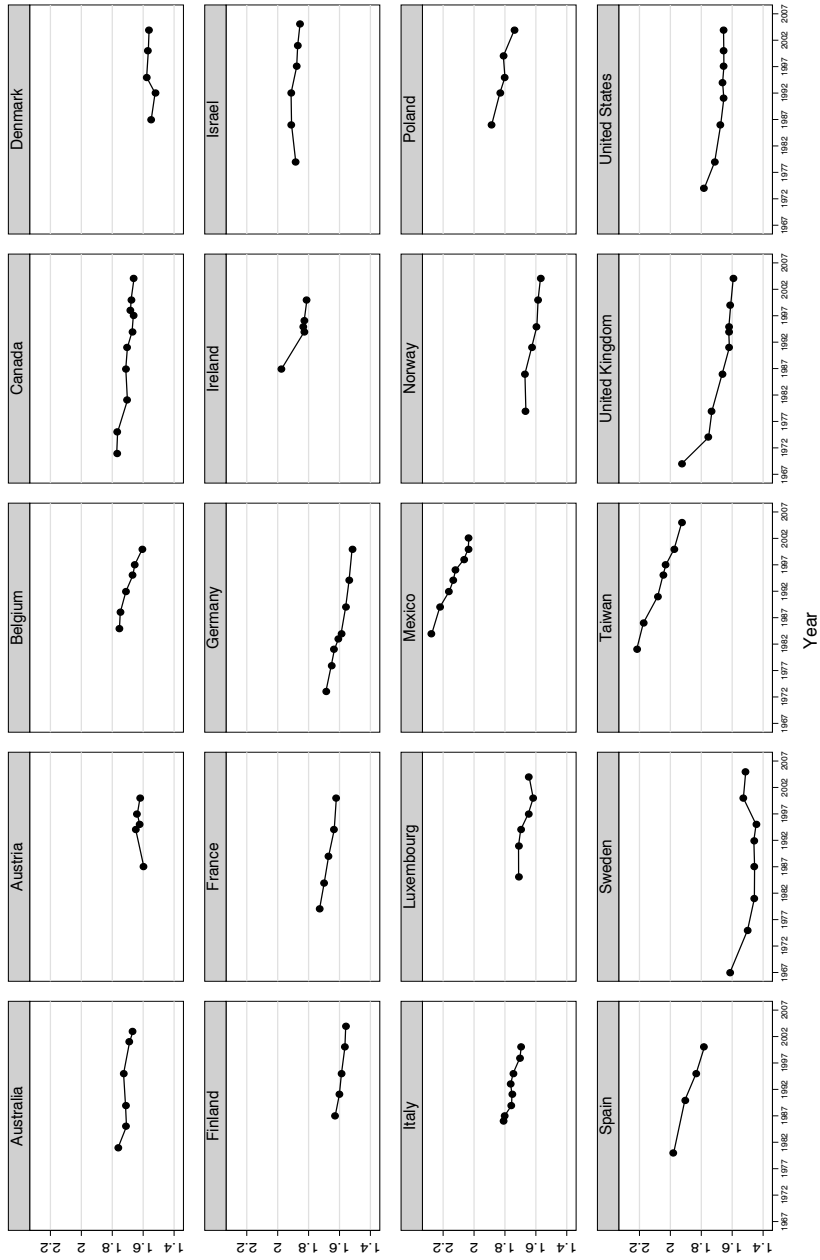
## Empirical results

### *Economy-wide Household-Size Economies over time and across countries*

Figure 1 summarizes our estimates of the *HSE Index*. For each of our 20 countries, estimates are summarized in a small panel, where year-specific point estimates are connected by a line. For example, consider the United Kingdom, with the value 1.927 in year 1969 and the value 1.594 in year 2004. This comparison indicates that aggregate weighted equivalent income exceeds aggregate weighted income per capita by 92.7 percent in year 1969 versus 59.4 percent in year 2004.

Two interesting insights are corroborated through the graphs in Figure 1. First, *HSE Indices* differ substantially across countries, ranging between 1.445 for Sweden in 1995 and 2.273 for Mexico in 1984. Apparently, the *HSE Index* is negatively related to a country's material prosperity (we can rely upon PPP-adjusted per-capita GDP for a first proxy of comparing material prosperity across countries). In rich societies, such as the Scandinavian and the central European countries, the

Figure 1  
One-member household equivalent average income divided by per-capita income



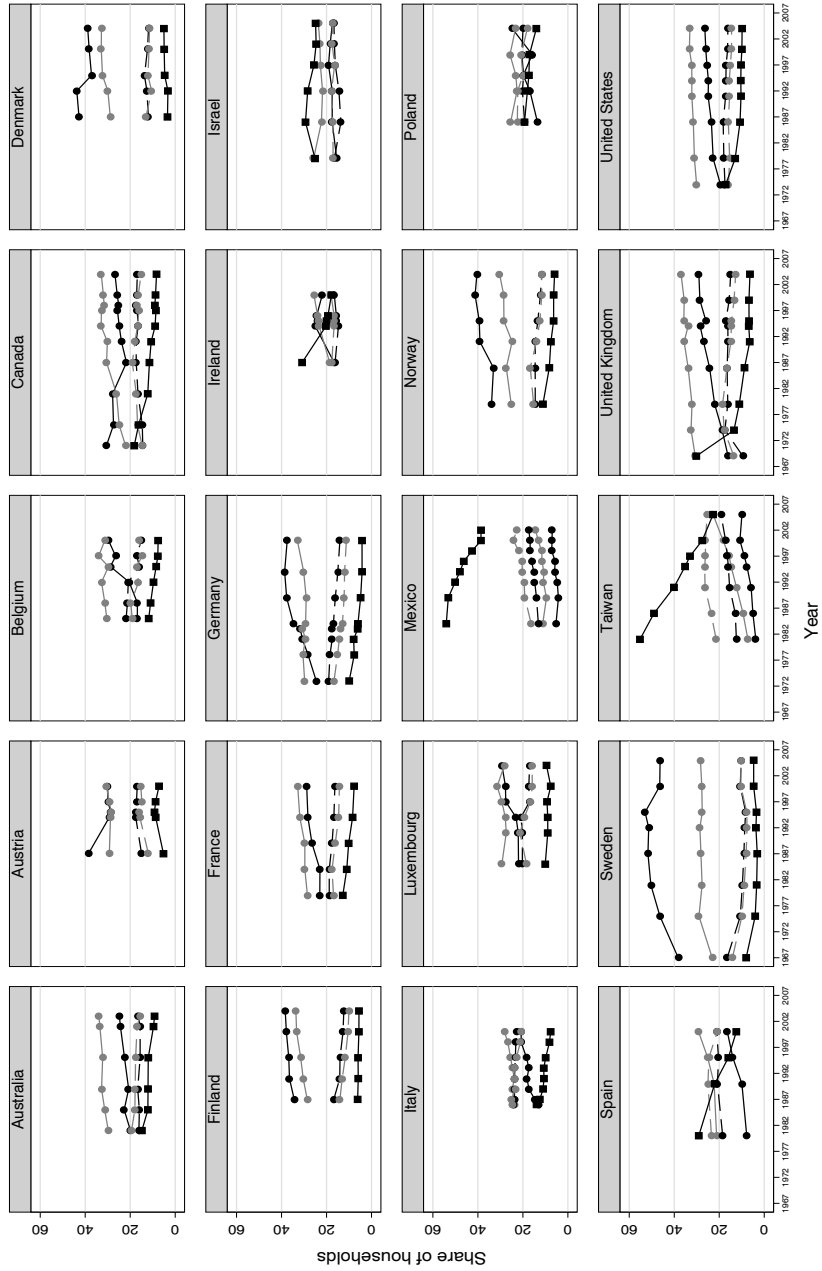
United Kingdom, and the United States, *HSE Indices* are distinctly smaller compared to countries with lower material prosperity (Mexico, Poland, and Taiwan). At the same time, socio-cultural differences, which again affect household formation, may contribute to the differences. For example, the *HSE Index* for Israel is remarkably high, given the country's material prosperity. Second, for the predominant number of countries, *HSE Indices* are decreasing over time. Comparing a country's *HSE Indices* in the first and the last observation period, most prominent are the downward-sloping trends over time for the following countries: Belgium (1.754 vs. 1.605), Germany (1.689 vs. 1.519), Mexico (2.273 vs. 2.031), Spain (1.979 vs. 1.780), Taiwan (2.218 vs. 1.926), and the United Kingdom (1.927 vs. 1.594). In the following section we further scrutinize the trend's driving sources.

#### *The drop in average household size over time*

Figure 2 summarizes population shares,  $f^m$ , by household types defined above. Again there is one panel per country. Within each graph, a line connects point estimates of population shares living in a specific household type. For example, consider the case of Germany (Spain). The fraction of the population living in households with five or more members declines from 9.944 percent in 1973 to 4.261 percent in 2000 (29.090 percent in 1980 to 12.430 percent in 2000 in Spain). Congruent with our previous results, we find that the share of the population living in small household units is negatively related to a country's economic prosperity. Indeed, there is a clear tendency that the fraction of the population living in one- or two-member household types is increasing over time at the expense of the population share of larger household types.

The decrease in average household size with economic prosperity may hint at the current preference to live in smaller household units, as compared to earlier periods. In many countries, it is only recently that people can afford to live in small household units and forego benefits from HSE. Indeed, the dominant hypothesis in the literature explains the decline in average household size by the improvement of peoples' economic situations (see Michael, Fuchs, and Scott, 1980; and Hughes and Gove, 1981, and related literature since then). The long-term fall in household size in the developed world is well documented. For example, in the United States, average household size has declined from 5.8 persons in year 1790 to 2.62 in 2000 (see US Census, 2005).<sup>5</sup> Whether the slowdown in recent years reflects convergence towards a new equilibrium is still open to debate (see Bianchi and Casper, 2000). Household size reductions have been documented in many societies, including the European countries (see Kuijsten, 1995 for an overview). Explanations for this trend comprise changes in (a) demographic variables - fertility and adoption,

**Figure 2**  
**Composition of family sizes: 1 member (solid black line with circle); 2 members (solid grey line with circle); 3 members (dashed black line with circle); 4 members (dashed grey line with circle); 5 members or above (squares)**





nuptiality and divorce, mortality and childbearing age (Burch, 1970, and Bongaarts, 1983), (b) economic variables - income and housing prices (Börsch-Supan, 1986, Di Salvo and Ermisch, 1997, and Haurin, Hendershott, and Kim, 1993) - and macro-economic conditions (Becker, Bentolila, Fernandes, and Ichino, 2005a;b, and Card and Lemieux, 1997), and (c) social norms - preferences and attitudes (Fernández, Fogli, and Olivetti, 2006, and Giuliano, 2007).

### *The change over time of income shares owned by household types*

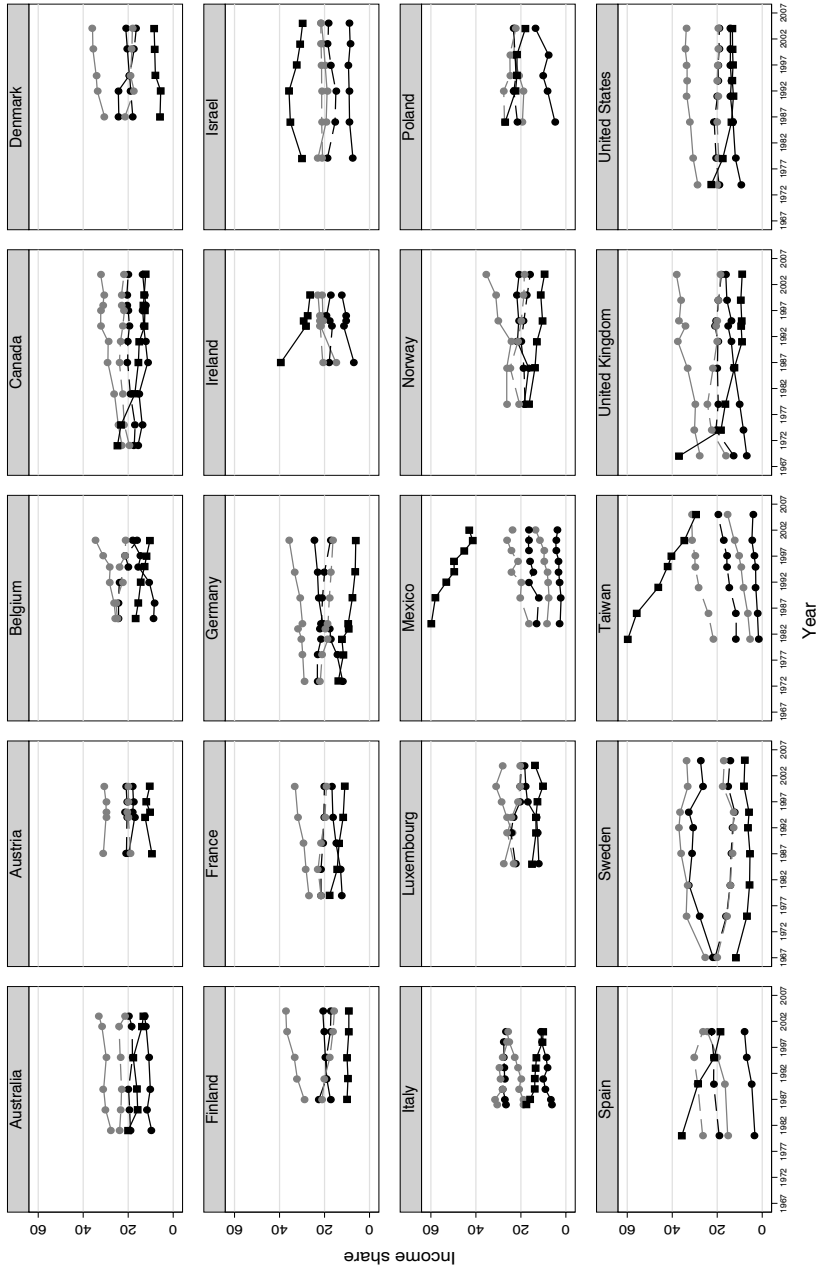
The trend toward smaller household units goes hand in hand with the changing of income shares,  $s^m$ , owned by the different household types. Estimates of  $s^m$  are provided in Figure 3. The structure of Figure 3 is equivalent to Figure 2. Relative to the population shares,  $f^m$ , it turns out that the income share tends to be particularly low for the one-member household type. This finding holds for all countries and years considered. On the other hand, income shares,  $s^m$ , relative to population shares,  $f^m$ , tend to rise with  $m$ . This can best be seen in Figure 4, which provides the ratios of  $s^m$  and  $f^m$ . If  $s^m/f^m > 1$  ( $s^m/f^m < 1$ ), the share of total disposable income assembled in the hands of households of type  $m$  exceeds (falls below) the same households' population share. For almost all countries and periods it is the case that the  $s^m/f^m$  ratio is higher, the higher the  $m$ . Moreover, ratios change only little over time. Hence, it is the demographic change towards smaller family units over time (the changes in the population shares,  $f^m$ ) rather than the changes in the income endowments of the family types, captured by  $s^m/f^m$  ratio, which is driving the inter-temporal decline of the *HSE Index*.

Both our findings, the positive relationship between household size and average position in the equivalent disposable income distribution, as well as the stability of household rankings, is supported by a recent work published by the OECD (2008).

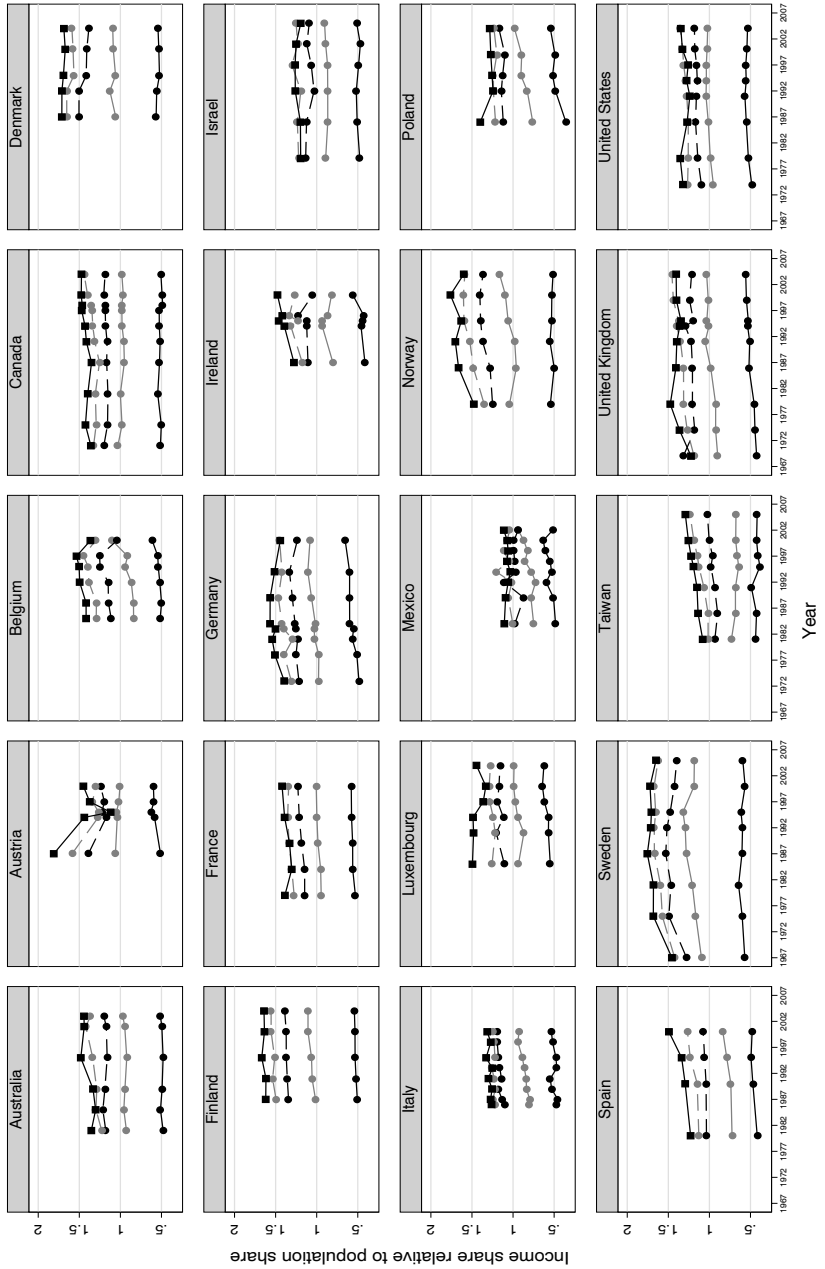
### **Concluding remarks**

The descriptive statistics provided in this article, in particular the drop in average household size over time and also the constancy of household-type specific income shares relative to population shares over time, underlie the inter-temporal decline in monetary gains countries achieve by Household-Size Economies. The micro-level phenomenon, that economically better-off people are willing/can cope better with a loss of Household-Size Economies and tend to live in smaller household units compared to previous decades, carries over to the macro-economic level. As a reduction in average household size increases, the material needs of the average citizen, a substantial part of the per-capita income growth over the decades, is required to offset the reduction in economy-wide Household-Size Economies.

**Figure 3**  
**Income percentages according to family size: 1 member (solid black line with circle); 2 members (solid grey line with circle); 3 members (dashed black line with circle); 4 members (dashed grey line with circle); 5 members or above (squares)**



**Figure 4**  
**Income share relative to population share by family size: 1 member (solid black line with circle); 2 members (solid grey line with circle); 3 members (dashed black line with circle); 4 members (dashed grey line with circle); 5 members or above (squares)**



## Notes

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<sup>2</sup> For cross-country comparisons, GDP estimates are Purchasing Power Parity (PPP) adjusted. Country rankings based on PPP adjusted per-capita GDP are provided, for example, by the International Monetary Fund, the World Bank, and also by the Central Intelligence Agency. For more information, see the World Economic Outlook Database of the International Monetary Fund, the World Development Indicators database of the World Bank, and the *World Factbook* of the Central Intelligence Agency for such country rankings.

<sup>3</sup> For an in-depth discussion of the suitability of the concept of GDP per capita and alternative measures, see the recent instructive overviews provided in Afssa et al. (2008) and Boarini, Johannsson, and d’Ercole (2006), and references cited therein.

<sup>4</sup> LIS household weights correct for sample bias and non-sampling errors; they are provided so as to inflate the result to reflect the total population. See the information provided at <http://www.lisproject.org/techdoc.htm> for details.

<sup>5</sup> For further details, see also Jiang and O’Neill (2007), Ermisch and Overton (1985) or Kobrin (1976). Extensive statistics for the developing world are provided in Bongaarts and Zimmer (2001) and Diallo and Wodon (2007).

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