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Christos Koulovatianos
Carsten Schröder
Ulrich Schmidt

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Properties of Equivalence Scales in Different Countries

Christos Koulovatianos[a,*], Carsten Schröder[b], Ulrich Schmidt[c]

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Abstract

Recent studies in high-income industrialized countries have shown that equivalence scales are income-dependent. We investigate whether this dependence also holds in poorer, services oriented countries, by considering the example of Cyprus. We also examine whether household economies of scale and relative children costs differ.

Keywords: household economies of scale, equivalence scales, survey method, independence of base

JEL Classification: C42, C90, D31, D63, I31

1. Introduction

Equivalence scales relate the incomes needed by different household types in order that all household types attain the same prespecified living standard. The identification of equivalence scales is crucial for applied inequality and poverty measurement as well as for the evaluation of social security.

Numerous studies have assumed that equivalence scales are constant at different income levels or living standards, '*independent of base.*' While this assumption is convenient for econometric analysis, recent work by Donaldson and Pendakur (2004) and Koulovatianos et al. (2005) reports evidence that equivalence scales are decreasing in income.[1] Both papers use data from high-income industrialized countries, i.e. from Canada in Donaldson and Pendakur (2004), and from Germany and France in Koulovatianos et al. (2005). Besides household size and composition, equivalence scales are influenced by many other characteristics, like relative prices and consumption patterns. So, their properties may differ substantially between richer and poorer countries. In order to investigate this issue, the present paper uses data from Cyprus, which is less industrialized and poorer than Canada, Germany, or France (for instance, the per-capita GDP of Cyprus is about 40% lower than in Germany). Apart from expenditure data, a popular way to derive equivalence scales is the use of survey data, see e.g. van Praag and Ferrer-i-Carbonell (2004) for an overview. The present analysis is based on survey data employing the method of Koulovatianos et al. (2005).

The paper is organized as follows. In the next section we briefly describe the survey method and our data set. Section 3 is devoted to the income dependence of equivalence scales and compares our scale values with those of previous studies. Properties of equivalence

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[1] Donaldson and Pendakur (2004) generalize a demand system to allow for variable equivalence scales for different welfare levels.

scales in different countries are compared in section 4. For this comparison we employ the model of Banks and Johnson (1994) in which equivalence scales are decomposed into relative costs of children and economies of scale in consumption. Finally, section 5 contains some concluding observations.

2.   Methodology and Data

Our survey method is based on eight hypothetical families of different size and composition.[2] We prespecify a reference income for the single childless-adult household, and leave gaps next to the remaining seven family types, i.e. single-parent families with one, two or three children, childless couples and couples with one, two, or three children. We ask our respondents to fill in the gaps, putting the after-tax *family* income (equivalent income) that brings these household types to the same living standard as the reference household. Dividing the equivalent income of a household type by the reference income gives the household type's equivalence scale. There are five tables with identical structure, each of them providing a different reference income for the single-adult (reference) household. Throughout the paper we index reference incomes by 1, 2.5, 4, 5.5 and 7, in order to show how many poverty lines each reference income is.

Our sample comes mainly from the Greek part of Nicosia and also from the cities of Larnaca and Limmasol. We conducted the study in June 2000 with 130 respondents.[3] The study by Koulovatianos et al. (2005) confirmed that our method is rather robust and not substantially biased by the personal characteristics of respondents.

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[2] We tell our respondents to assume that adults are of age between 35 and 55, and children between 7 and 11. For further details see Koulovatianos et al. (2005).
[3] Further details of our sample are stated in the appendix.

3. Average Equivalence Scales and Comparisons with Other Studies

Table 1 gives an overview of our data by stating mean equivalence scales of the seven household types for each reference income. The symbol "A" stands for one adult and "C" for one child in the household.[4] Underneath each of the sample means is the corresponding sample standard deviation, appearing in parentheses. Obviously, mean equivalence scales are decreasing with increasing reference income. In order to test the statistical significance of this pattern, we perform tests of differences of means for every two consecutive means for each household type. Because all values are reported by the same group of individuals, they are not independent. Therefore, the tests we perform are t-tests of differences of pairs of observations. For all household types, the decrease of equivalence scales is statistically significant at the 99% level. So, the results of Donaldson and Pendakur (2004) and of Koulovatianos et al. (2005) obtained for the G8 countries Canada, Germany, and France, are also confirmed for a comparatively poorer country, Cyprus.

In Table 2 we compare our average equivalence scales across reference incomes with the estimates of Lyssiotou (1997) who derived equivalence scales for Cyprus using expenditure data. We observe that our averages across reference incomes are similar for two-adult households, whereas for one-parent households our scale values are substantially higher. It is easily verified from Table 2 that, according to the scale values of Lyssiotou, the income needs of children in two-adult households are higher than in single-adult households. In our opinion, this is not very plausible, given the presence of household economies of scale and given the fact that there is more adult time in two-adult households for child care. The asymmetry between children costs of single- versus two-adult households in the data of Lyssiotou

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[4] So, for example, "ACC" means a household with one adult and two children.

(1997) might stem from the fact that single parents are typically poorer. Generally, in a consumer-expenditure analysis this clustering might lead to downwards biased estimators for single-adult equivalence scales.[5] For our scale values, the average children weights range between 0.28 and 0.32 for all family types. This is very close to the equivalence scales used by the OECD where each child always receives a weight of 0.3.

Table 2 also presents equivalence scales from Germany and France, taken from Koulovatianos et al. (2005). Apart from the childless two-adult household, average equivalence scales in Cyprus are always higher than in Germany and France which means that income needs of children are higher in Cyprus. This point is further analyzed in the next section.

4. Relative Children Costs and Economies of Scale in Consumption

In the previous section we saw that equivalence scale are decreasing with reference income. This decrease may stem from increasing economies of scale in consumption, or by decreasing relative costs of children, or by both. We use the structural analysis of Banks and Johnson (1994) in order to disentangle both effects. In Table 3 we present results from a regression of the form,

$$E_{i,k} = (A + \alpha C)^{\theta} + bPERSONAL_i + \varepsilon_{i,k} \ .$$

$E_{i,k}$ is the equivalence scale stated by respondent "i" and corresponding to reference income "k". Variable A is the number of adults and C is the number of children in the given household type. So, A and C define the household type, parameter α captures the relative cost of children, and parameter θ captures the extent of economies of scale in household consumption. A higher value of α corresponds to higher relative children costs whereas a

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[5] McClements (1978, p. 117) also notices this bias for another group of households who typically have lower incomes, pensioners.

higher value of θ implies lower economies of scale in consumption. PERSONAL_i is the vector of personal characteristics of each respondent i which were also surveyed in our questionnaire.

In all cases, most of the personal characteristics of our respondents were either insignificant or not robust with respect to alternative model specifications. Therefore, we only report the estimates $\hat{\alpha}$ and $\hat{\theta}$ in Table 3, for each reference income, k ($k = 1$, 2.5, 4, 5.5, 7). It is obvious that both $\hat{\alpha}$ and $\hat{\theta}$ decrease, i.e. both relative child costs decrease and economies of scale rise as living standards go up, which means that both effects are contributing to the decrease of equivalence scales.

We perform Wald tests to compare our estimators of $\hat{\alpha}$ and $\hat{\theta}$ for Cyprus with these of Germany and France.[6] The estimators for relative children costs, $\hat{\alpha}$, in Cyprus are always higher than these of both Germany and France at the 5% level which explains our observations from Table 2, that Cyprus always has higher equivalence scales in families with children. In contrast, Germany and Cyprus have similar economies of scale, captured by $\hat{\theta}$, and, with two exceptions (reference incomes 1 and 5.5), the $\hat{\theta}$'s of Cyprus are also similar to the French ones.

The varying relative costs of children across countries highlights the importance of cultural differences and differences in relative prices for the determination of equivalence scales. For instance, expensive private tutoring for primary-school pupils is rather common in Cyprus, which may be part of the higher children costs.

5. Conclusion

The goal of the present paper was to compare properties of equivalence scales between richer and poorer countries. As in Koulovatianos et al. (2005), equivalence scales are also decreasing in Cyprus, which implies that this property seems to be rather robust also for

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[6] In each case we compare the countries in pairs, e.g. Cyprus with Germany.

poorer countries. However, relative costs of children vary substantially across countries which means that cultural differences and/or differences in relative prices may have a significant effect on equivalence scale

We also compare our subjective equivalence scales of Cyprus, averaged across incomes, with these of Lyssiotou (1997) derived by an analysis of expenditure data. This comparison shows that both estimates are quite close for the two-adult households. Yet, single-adult equivalence scales in Lyssiotou (1997) are much lower than ours. This difference might stem from a systematic tendency to underestimate child costs of single-adult households in expenditure analyses because this family type is, in general, poorer.

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Table 1
Average equivalence scales for each demographic composition and income level.

Reference income	AC scale	ACC scale	ACCC scale	AA scale	AAC scale	AACC scale	AACCC scale
1.0	1.697 (0.343)	2.293 (0.592)	2.910 (0.929)	1.766 (0.327)	2.389 (0.511)	3.006 (0.805)	3.604 (1.053)
2.5	1.301 (0.181)	1.577 (0.319)	1.842 (0.454)	1.457 (0.318)	1.734 (0.356)	2.018 (0.481)	2.280 (0.589)
4.0	1.236 (0.163)	1.454 (0.278)	1.666 (0.403)	1.385 (0.278)	1.610 (0.364)	1.826 (0.463)	2.028 (0.563)
5.5	1.203 (0.173)	1.396 (0.303)	1.574 (0.424)	1.346 (0.261)	1.544 (0.358)	1.734 (0.459)	1.909 (0.558)
7.0	1.172 (0.275)	1.334 (0.275)	1.492 (0.381)	1.310 (0.266)	1.488 (0.359)	1.649 (0.446)	1.805 (0.525)

Standard errors in parentheses.

Table 2 Comparisons of averages with other studies

Household Type	Germany[a,c]	France[a,c]	Cyprus[b]	Cyprus[c] (this study)
AC	1.24 [1.11 - 1.57]	1.30 [1.20 - 1.58]	1.12 – 1.20	1.32 [1.17 – 1.70]
ACC	1.44 [1.21 - 2.02]	1.55 [1.34 - 2.06]	1.23 – 1.41	1.61 [1.33 – 2.29]
ACCC	1.64 [1.30 - 2.47]	1.77 [1.47 - 2.49]	1.30 – 1.60	1.90 [1.49 – 2.91]
AA	1.50 [1.39 - 1.75]	1.50 [1.40 - 1.73]	1.51	1.45 [1.31 – 1.77]
AAC	1.72 [1.49 - 2.27]	1.75 [1.55 - 2.22]	1.73 – 1.85	1.75 [1.49 – 2.39]
AACC	1.92 [1.59 - 2.72]	1.97 [1.68 – 2.67]	1.90 – 2.18	2.05 [1.65 – 3.01]
AACCC	2.12 [1.68 - 3.17]	2.18 [1.81 – 3.09]	2.01 – 2.48	2.33 [1.81 – 3.60]

Notes:
[a] Survey data taken from Koulovatianos et al. (2005). German data are from 1999 and French data are from 2002.
[b] Econometric estimates from consumer data, Lyssiotou (1997): the smaller number reported is the equivalence scale for children of age between 0-11 and the higher equivalence scale pertains children of age between 11-17
[c] Average equivalence scale among all income levels. In brackets: equivalence scales of the highest and lowest reference-income level.

Table 3 Children weights and economies of scale

	Cyprus		France		Germany	
Reference Income	$\hat{\alpha}$	$\hat{\theta}$	$\hat{\alpha}$	$\hat{\theta}$	$\hat{\alpha}$	$\hat{\theta}$
1	0.86	0.85	0.72[**]	0.76[**]	0.67[***]	0.83
	(0.05)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)
2.5	0.62	0.64	0.51[**]	0.61	0.42[***]	0.63
	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
4	0.58	0.56	0.47[**]	0.52	0.32[***]	0.58
	(0.04)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
5.5	0.55	0.52	0.42[**]	0.49[**]	0.27[***]	0.51
	(0.04)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
7	0.52	0.49	0.38[**]	0.49	0.23[***]	0.50
	(0.04)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)

Notes [***] Indicate significant difference at the 1 percent level. [**] at the 5 percent level.
Standard errors in parentheses.

Appendix (optional)

In Table A1 we present an outline of the personal characteristics that could be important in affecting people's perceptions about equivalence scales.

We present two categories of income classes. The first is the family "after-tax income class." The income level "P" is the poverty line for single-childless adults and the first after-tax income bracket is below 1.75×P. The poverty line was 200 Cypriot pounds in year 2000. We define each next class by adding an increment of 1.5×P. Within these five income intervals are our reference incomes in the questionnaire. The second category of income classes, the "adjusted after-tax income class," is constructed from our database so as to reflect our sample's distribution of living standards. We find each respondent's stated equivalent income for his/her own family type that is closest to his/her own family income. Then, we divide this income with the respondent's stated equivalence scale. In this way we convert each respondent's stated family income to their equivalent childless-single-adult household income.

Table A1

Breakdown of the sample

	N	%
Gender		
Female	57	43.8
Male	73	56.2
Partner in the household		
Yes	75	57.7
No	55	42.3
Number of children in the household		
None	82	63.1
One	18	13.8
Two	23	17.7
More than two	7	5.4
Living with parents		
Yes	37[*]	28.5
No	93	71.5
Family after-tax income class		
1 (Y<1.75P)	9	6.9
2 (1.75P≤Y<1.75P+1.5P)	25	19.2
3 (1.75P+1.5P≤Y<1.75P+3P)	24	18.5
4 (1.75P+3P≤Y<1.75P+4.5P)	31	23.8
5 (1.75P+4.5P≤Y)	41	31.6
Adjusted after-tax income class		
1 (Y<1.75P)	29	22.3
2 (1.75P≤Y<1.75P+1.5P)	40	30.8
3 (1.75P+1.5P≤Y<1.75P+3P)	31	23.8
4 (1.75P+3P≤Y<1.75P+4.5P)	24	18.5
5 (1.75P+4.5P≤Y)	6	4.6
Occupational group		
Welfare recipient	0	0.0
Unemployed	2	1.5
Blue-collar worker	2	1.5
White-collar worker	40	30.8
Pupil, student, trainee	30	23.1
Civil servant	40	30.8
Self-employed	13	10
Pensioner	0	0.0
Housewife, houseman	3	2.3
Education		
Below 9 years of education	4	3.1
Completed extended elementary school	8	6.2
Completed secondary school	65	50.0
Technical school and university degree	53[**]	40.7
Number of siblings during childhood		
None	9	7.0
One	34	26.2
Two	40	30.8
More than two	47	36.2

[*] One of the respondents who were living with their parents also had a partner and two children.

[**] 14 out of the 53 highly educated respondents in our sample had finished a technical school (3 years of higher education).