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Multidimensional Affluence in Income and Wealth in the Eurozone – A Cross Country Comparison Using the HFCS

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Abstract

This paper applies multidimensional affluence measures to a new dataset on income and wealth in 15 Eurozone countries. We start our analysis by examining the income and wealth distributions separately for each country, and extend it to a multidimensional setting by considering the joint distribution of income and wealth. The results indicate that the percentage of households affluent both in income and net wealth are less than 10% except in Cyprus, France, Italy and Slovenia. Investigating the joint distributions of income and net wealth yields that France demonstrates a more homogenous distribution of richness among affluent households compared to the other countries in the sample. Portugal demonstrates a higher concentration of richness in the hands of few compared to most of the other countries in the sample. The degree of countries' affluence rankings differs with respect to the measures of multidimensional affluence considered.

JEL Classifications: D31, D63, I31

Keywords: top incomes, multidimensional measurement, richness, wealth, inequality

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1. INTRODUCTION:

Inequality at the top of the distribution received a considerable interest both in the academic literature (see Atkinson et al. (2011) for an overview) as well as in public debate. So far, and in contrast to poverty[1], affluence has mostly been analyzed for a single dimension, typically income or – to a lesser extent – wealth.[2] Multidimensional analyses are relatively scarce.[3] An exception is Peichl and Pestel (2013a) who develop a measure of multidimensional affluence for the top fractiles of the distribution based on the uni-dimensional measures of Peichl, Schaefer and Scheicher (2010).[4]

In this study we apply Peichl and Pestel's (2013a) multidimensional affluence measures to a new dataset on income and wealth in 15 Eurozone countries – the Household Finance and Consumption Survey (HFCS).[5] The first wave of HFCS has become available only recently (Eurosystem Household Finance and Consumption Network, 2013a,b). Hence, the literature analyzing the income and wealth structure of the HFCS data is limited and mostly concerned with the wealth distribution. Fessler et al. (2014) studied the relationship between household structures and cross country differences in wealth distribution. Vermeulen (2014) combined HFCS and the US Survey of Consumer Finances (SCF) with the Forbes World's billionaires data to compare and contrast the structure of the top tail of the wealth distribution in the Eurozone and in the US. Arrondel et al. (2014) estimate the predictive power of a household's rank in the income distribution on its ranking in the wealth distribution. Therefore, our work is the first study that considers the joint distribution of income and wealth through

[1] See, e.g., Atkinson (2003), Bourguignon and Chakravarty (2003), Alkire and Foster (2011) Decancq and Ooghe (2010), Decancq and Lugo (2011a,b), among others.
[2] See, e.g., Atkinson (2005), Piketty (2005), Saez (2005), Piketty and Saez (2006), Atkinson and Piketty (2007), Roine and Waldenström (2008), Roine et al. (2009) and Roine and Waldenström (2011).
[3] See, e.g., Kopczuk and Saez (2004), Jenkins and Jäntti (2005) and Waldenström (2009).
[4] Peichl and Pestel (2013b) considered health and overall life satisfaction in addition to income while measuring the well-being at the top of the distribution in Germany.
[5] For the remainder of this paper, the 15 euro area countries included in the first wave of the HFCS are referred as the Eurozone.

multidimensional affluence measures for such a large range of European countries. As the HFCS includes harmonized variables across all countries in the sample, it increases the cross-country comparability for the Eurozone, eliminates the incompatibility issues and, therefore, provides an invaluable opportunity to compare and contrast the multidimensional affluence of Euro area countries in a multidimensional setting.

We find a weak correlation between income and net wealth and a less than perfect correlation between the rankings of households within the marginal distributions of both dimensions. The percentage of households being affluent both in income and net wealth distribution are less than 10% except in Cyprus, France, Italy and Slovenia. The degree of countries' affluence rankings differ with respect to convex and concave measures of multidimensional affluence, where the latter measures the homogeneity of distribution among the rich and the former measures the concentration of richness in the hands of few. Joint distributions of income and net wealth yield that France demonstrates a more homogenous distribution of richness among affluent households compared to the other countries in the sample. Portugal demonstrates a higher concentration of richness in the hands of few compared to most of the other countries in the sample.

The rest of the paper is organized as follows. In Section 2, we describe the dataset and the methodology. The dimensions, descriptive statistics and empirical results are presented in Section 3. Section 4 provides robustness checks and Section 5 concludes.

2. DATA and METHODOLOGY

2.1.DATA

We use the first wave of the Household Finance and Consumption Survey (HFCS) which was released in April 2013. The survey contains data on households' finances and consumption

for 62,500 households from 15 of the 18 euro area countries[6] with sample sizes ranging from 343 in Slovenia to 15,006 in France. The fieldwork was conducted in late 2010 and early 2011 period with few exceptions.[7]

Table 1. Population Shares

Country	Sampled Households	Number of Households in Population (weighted)	Household Population Shares
AT	2261	3,552,051	2.72
BE	2276	4,568,240	3.48
CY	1183	293,176	0.22
DE	3367	36,742,404	27.95
ES	6072	16,427,889	12.50
FI	10039	2,262,623	1.72
FR	14567	26,740,412	20.35
GR	2888	4,013,240	3.05
IT	7861	23,476,234	17.87
LU	920	178,939	0.14
MT	836	142,615	0.11
NL	1210	6,500,607	4.95
PT	4295	3,833,688	2.92
SI	334	759,306	0.58
SK	2009	1,889,090	1.44

Note: Households with negative income or net wealth are dropped from the sample.

HFCS applies a multiple imputation method for missing observations that enter the computation of total household income, consumption and wealth.[8] The households in the survey are weighted such that the sum of the weights over all sampled households of a country approximates the total number of households in the population of that country. The sampling weights are equal to the inverse of the probability of being sampled. In this study,

[6] Estonia, Ireland and Latvia did not participate in the first wave of the survey.
[7] The fieldwork period is 2008-2009 for Spain, late 2009-early 2010 for France and 2009 for Greece. The differences in the field work and reference periods are listed in Table A.1 in the Appendix.
[8] Multiple imputation method avoids inefficiencies in estimation imposed by singly-imputed data and allows for using standard techniques for complete data. Because there are very few number of missing observations for Italy and no non-response items for Finland, multiple imputation procedure is not applied to these countries.

we use the weights for all empirical analyses. The number of sampled households and total number of households in the population are reported in Table 1. Households in Germany constitute 28% of the total number of households in the Eurozone. Germany is followed by France, Italy and Spain. The population shares of households in Cyprus, Slovenia, Luxembourg and Malta are less than 1%.

*2.2.*METHODOLOGY

We use the dual cut-off method proposed by Peichl and Pestel (2013a) to measure the multidimensional well-being at the top of the joint income and wealth distribution in the Eurozone countries. The initial cut-off is set to identify the dimension-specific well-off households. The households whose achievements in a specific dimension exceed the dimension specific threshold set by the first cut-off are considered as affluent with respect to that dimension. The second cut-off is set to define the minimum number of dimensions in which a household must be well-off in order to be considered as multidimensional affluent.

More specifically, we measure the multidimensional affluence of a population with n households and d ≥ 2 dimensions. The achievement of household $i \in \{1, \dots, n\}$ in dimension $j \in \{1, \dots, d\}$ is denoted by y_{ij}. Households, whose achievements in dimension j exceed the dimension specific initial cut-off value (γ_j), are recorded by an indicator function θ_{ij}. The indicator function takes the value one if $y_{ij} > \gamma_{ij}$ and zero if otherwise. The total number of dimensions in which household i is well-off is denoted as $c_i = \sum_j \theta_{ij}$. If we denote the second cut-off as an integer $k \in \{1, \dots, d\}$, the multidimensional affluent households can be recorded by an indicator function $\varphi_i(k)$. The indicator function takes the value 1 for households who are well-off in at least k dimensions (i.e. $c_i \geq k$) and 0 if otherwise.

The total number of affluent households in the population is$s(k) = \sum_i \varphi_i(k)$. The focus axiom suggests that a measure of richness should disregard the achievements of households

who are not well-off in at least k dimensions. Hence, for households who cannot attain affluence in at least k dimensions, $c_i(k)$ is set to zero. Formally,

$$c_i(k) = \begin{cases} c_i \; if \; \varphi_i(k) = 1 \\ 0 \; if \; \varphi_i(k) = 0 \end{cases} \tag{1}$$

Based on these definitions, Peichl and Pestel (2013a) define several measures of multidimensional affluence. The fraction of affluent households in the total population, i.e., the headcount ratio is given by:

$$HR(k) = \frac{s(k)}{n} \tag{2}$$

The average affluence share is the ratio of affluence counts to the maximum number of affluence counts that would be observed when all affluent households were affluent in all dimensions:

$$AAS(k) = \frac{\sum_i c_i(k)}{s(k) \cdot d} \tag{3}$$

However, the headcount ratio does not satisfy the property of dimensional monotonicity, as the value of $HR(k)$ does not change when a multidimensionally affluent household becomes (or is no longer) affluent in some dimension. Therefore, a dimension-adjusted headcount ratio that is sensitive to the changes in households' affluence counts can be defined by multiplying $HR(k)$ and $AAS(k)$:

$$R_{HR}^{M}(k) = HR(k) \cdot AAS(k) = \frac{\sum_i c_i(k)}{n \cdot d} \tag{4}$$

The dimension-adjusted headcount ratio is the proportion of the total number of affluence counts to the maximum number of affluence counts attainable when every individual would be affluent in every dimension.

The dimension-adjusted headcount ratio, however, does not satisfy the monotonicity condition. It is a measure of multidimensional affluence which is unaffected by an increase or a decrease in y_{ij} – the achievement of individual i in dimension j. Therefore, following Peichl and Pestel (2013), we construct dimension-adjusted multivariate affluence measures that take the intensity of affluence into account. In order to set up the dimension adjusted multivariate affluence measures, we first need to measure the intensity of affluence in each dimension. The convex and concave transfer axioms[9] suggest that the intensity of affluence can be measured as follows:

$$\Theta^{\alpha} = \left[\left(\frac{y_{ij}-\gamma_j}{\gamma_j}\right)_{+}^{\alpha}\right]_{n\times d} \text{ for } \alpha \geq 1 \tag{5}$$

$$\Theta^{\beta} = \left[\left(1-\left(\frac{\gamma_j}{y_{ij}}\right)^{\beta}\right)_{+}\right]_{n\times d} \text{ for } \beta > 0 \tag{6}$$

Here, Θ^{α} and Θ^{β} are matrices that contain convex and concave measures of intensity of affluence associated with each dimension, respectively. The entries of the matrices must be non-negative as indicated by the '+' subscript. As the value of the convex sensitivity parameter α increases, more weight is put on more concentrated affluence. For the concave measure of intensity, on the other hand, the smaller value of parameter β puts more weight on more intense affluence.

As mentioned before, the focus axiom suggests that these matrices should contain only the information on affluent individuals. Therefore, the rows that correspond to non-affluent individuals are replaced with zero whenever it holds that $\varphi_i(k) = 0$.

Hence, the dimension adjusted multivariate affluence measure reads

[9] The concave measurement approach is in line with the "polarization view", and thus, concerned with the homogeneity of the distribution among rich, while the convex measure focuses on the concentration of richness in the hands of few as suggested by the "inequality view" (Peichl et. al., 2010).

$$R_l^M(k) = HR(k) \cdot AAS(k).\frac{\sum_{j=1}^{d}\left|\theta_j^l(k)\right|}{\sum_i c_i(k)} = \frac{\sum_{j=1}^{d}\left|\theta_j^l(k)\right|}{n \cdot d} \text{ for } l \in \{\alpha, \beta\}. \quad (7)$$

$\left|\theta_j^l(k)\right|$ represents the sum of concave and convex intensity measures across all individuals within each dimension. The proportional contribution of each dimension to the dimension adjusted multivariate affluence measure, then, can be represented as follows:

$$\pi_j^l(k) = \frac{\left|\theta_j^l(k)\right|}{\sum_{j=1}^{d}\left|\theta_j^l(k)\right|}$$

3. EMPIRICAL RESULTS

3.1.DIMENSIONS and DESCRIPTIVES

In our calculations we use HFCS' aggregations of total household gross income from various sources and net wealth. The latter is defined as the difference between the aggregate household assets excluding public and occupational pension wealth and the total outstanding household liabilities.[10]

Cut-offs. Following Peichl and Pestel (2013a), in order to identify the well-off subpopulation, we set the initial cut-off, the one dimensional richness line, at the 80% quantile of each distribution.[11] Table 2 presents descriptive statistics of income and wealth dimensions and their corresponding cut-off levels. The mean income is ranging between 13,000 Euros in Slovakia to 85,000 Euros in Luxembourg. For both income and wealth in each country the median is lower than the mean which indicates inequality.

[10] In HFCS' derived statistics, pensions are considered as a source of income and therefore, included in income definition rather than wealth. However, there might be important differences across countries in terms of (Public) pension wealth.

[11] The results for top 90% and top 99% quantiles are presented in tables A.2 through A.8 in the Appendix.

Table 2: Descriptive Statistics and Cut-offs

Country	Dimension	Mean	Median	Cut-off (*)
AT	Income	44,655	32,808	61,235
	Net Wealth	281,743	92,500	323,169
BE	Income	48,950	33,900	70,400
	Net Wealth	348,351	215,750	491,500
CY	Income	43,439	32,500	60,500
	Net Wealth	691,973	282,254	799,091
DE	Income	44,982	33,640	63,020
	Net Wealth	211,978	66,150	274,850
ES	Income	314,55	24,800	43,000
	Net Wealth	302,816	188,318	395,006
FI	Income	45,984	36,534	66,232
	Net Wealth	182,867	109,122	283,866
FR	Income	37,375	29,469	49,611
	Net Wealth	242,984	127,553	338,162
GR	Income	27,763	22,100	39,672
	Net Wealth	151,921	104,800	224,200
IT	Income	34,569	26,444	48,651
	Net Wealth	279,314	177,983	380,001
LU	Income	85,188	66,000	117,000
	Net Wealth	739,638	416,553	905,768
MT	Income	26,482	21,641	39,413
	Net Wealth	369,044	218,406	457,634
NL	Income	46,068	40,182	64,352
	Net Wealth	198,558	130,985	325,334
PT	Income	20,450	14,700	28,420
	Net Wealth	157,241	78,000	192,369
SI	Income	22,573	18,213	34,076
	Net Wealth	149,538	102,167	240,457
SK	Income	13,515	11,200	18,478
	Net Wealth	80,641	61,903	108,500
Eurozone	Income	38,291	28,963	53,400
	Net Wealth	243,436	122,200	331,746

Source: HFCS, authors' own calculations.
Note: Households with negative net wealth or income are dropped from the sample.
(*) The cut-off values for the top 90% and 99% quantiles as well as for the PPP adjusted income and net wealth are presented in Appendix A.2.

Considering mean net wealth, we observe that Slovakia has, again, the lowest value in the sample while Luxembourg has the highest. The most skewed net wealth distribution is

observed in Austria and Germany, where the mean net wealth is equal to more than the triple of the median net wealth.

3.2 WELL-OFF COUNTS

Considering the cut-off values presented in Table 2, the distribution of the number of affluent households across the Eurozone countries is presented in Table 3. The first column lists the percentage of households who are affluent in one or both dimensions whereas the second column lists those who are affluent in exactly one dimension among the population of the corresponding country. The first column shows that about 70% of the population in each country is not well-off in any dimension. Similarly, the third column presents the percentage of households affluent in both dimensions. Only in Cyprus, France, Italy and Slovenia (slightly) more than 10% of the households are affluent in both dimensions. This value is lowest in the Netherlands suggesting the weakest correlation between income and wealth.

Table 3. Headcount ratios:

Country	*Well-off in at least 1 dimension*	*Well-off in exactly one dimension*	*Well-off in both dimensions*
AT	30.62	21.25	9.37
BE	32.68	25.42	7.26
CY	29.83	19.80	10.03
DE	30.12	20.26	9.86
ES	30.52	21.19	9.33
FI	30.90	21.83	9.08
FR	29.51	19.03	10.48
GR	31.05	22.13	8.92
IT	29.74	19.49	10.24
LU	30.22	20.48	9.74
MT	32.61	25.53	7.08
NL	33.08	26.23	6.85
PT	30.44	20.90	9.55
SI	29.51	19.13	10.38
SK	32.17	24.35	7.82

Source: HFCS, authors' own calculations

3.3 ONE DIMENSIONAL AFFLUENCE

In this section we present our results for one dimensional measures of well-being (i.e. $d = 1$) by considering the income and wealth distributions separately (following Peichl et al., 2010). Table 4 presents the values of dimension-adjusted univariate well-being measures for income, and Table 5 presents the results of that for wealth. The left blocks in Tables 4 and 5 display the results for convex univariate affluence measure (with sensitivity parameter α ranging from 1 to 3) whereas the right blocks display the results for concave univariate affluence measure for different values of sensitivity parameter β. Note that when $\alpha = 1$, the convex measure of dimension adjusted *univariate* affluence can be interpreted as, by definition, the population average of the percentage deviation of affluent households' achievements from the top 80% quantile cut-off. When $\beta = 1$, on the other hand, the concave measure of dimension adjusted *univariate* affluence gives the population average of affluent households' achievements above the dimension- specific threshold as a fraction of their own achievement.

Note that because our definition of rich corresponds to the top 20% of income and wealth distribution in each country, the headcount ratio (percentage of rich people) is equal to 20% in the univariate case for all countries in the sample.

Income. Considering the dimension adjusted *univariate* affluence measures with respect to income (reported in Table 4 and visualized in Figure 1), the highest convex univariate measure is observed for Portugal (0.161) and the lowest for Netherlands (0.077) when α is equal to 1. That stems from affluent households in Portugal earning on average 16% more than the cut-off value while in the Netherlands the average percentage deviation of income from the threshold value is approximately 8%. While the differences between the countries are rather moderate when $\alpha = 1$, the convex measure of univariate affluence increases as the sensitivity parameter α increases except for Netherlands. The most significant jump in

affluence measure is observed in Spain and France for higher values of α. Moreover, these two countries have the highest convex dimension adjusted univariate affluence measures when $\alpha > 1$.

Table 4. One Dimensional Affluence Measures: Income

	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	0.148	0.455	3.039	0.059	0.091	0.111
BE	0.152	0.524	3.559	0.057	0.087	0.106
CY	0.148	0.486	3.554	0.060	0.094	0.115
DE	0.138	0.291	1.448	0.062	0.097	0.118
ES	0.141	0.878	71.467	0.058	0.091	0.112
FI	0.104	0.189	1.105	0.053	0.085	0.106
FR	0.137	0.616	14.869	0.057	0.089	0.109
GR	0.116	0.190	1.087	0.058	0.092	0.113
IT	0.122	0.203	0.610	0.058	0.090	0.111
LU	0.142	0.413	2.704	0.059	0.091	0.111
MT	0.083	0.083	0.145	0.048	0.078	0.098
NL	0.077	0.058	0.065	0.047	0.079	0.100
PT	0.161	0.450	3.560	0.067	0.102	0.123
SI	0.126	0.169	0.379	0.064	0.101	0.124
SK	0.107	0.221	1.342	0.053	0.085	0.106

Source: HFCS, authors' own calculations.
Note: The results for top 90% and top 99% quantiles are presented in Tables A.3 and A.4 in the Appendix.

The difference between the countries are more moderate regarding the concave dimension adjusted *univariate* affluence measure of income for all values of sensitivity parameter β. For $\beta = 1$, the highest value of the concave measure of dimension adjusted *univariate* affluence with respect to income is again observed for Portugal (0.067) and the lowest for Netherlands (0.047). We do not observe a big leap in the value of the concave affluence measure as β increases. For $\beta > 1$, the highest values of concave measure are observed for Portugal and Slovenia and lowest for Malta and Netherlands.

Figure 1. Comparison of One Dimensional Measures of Affluence for Income

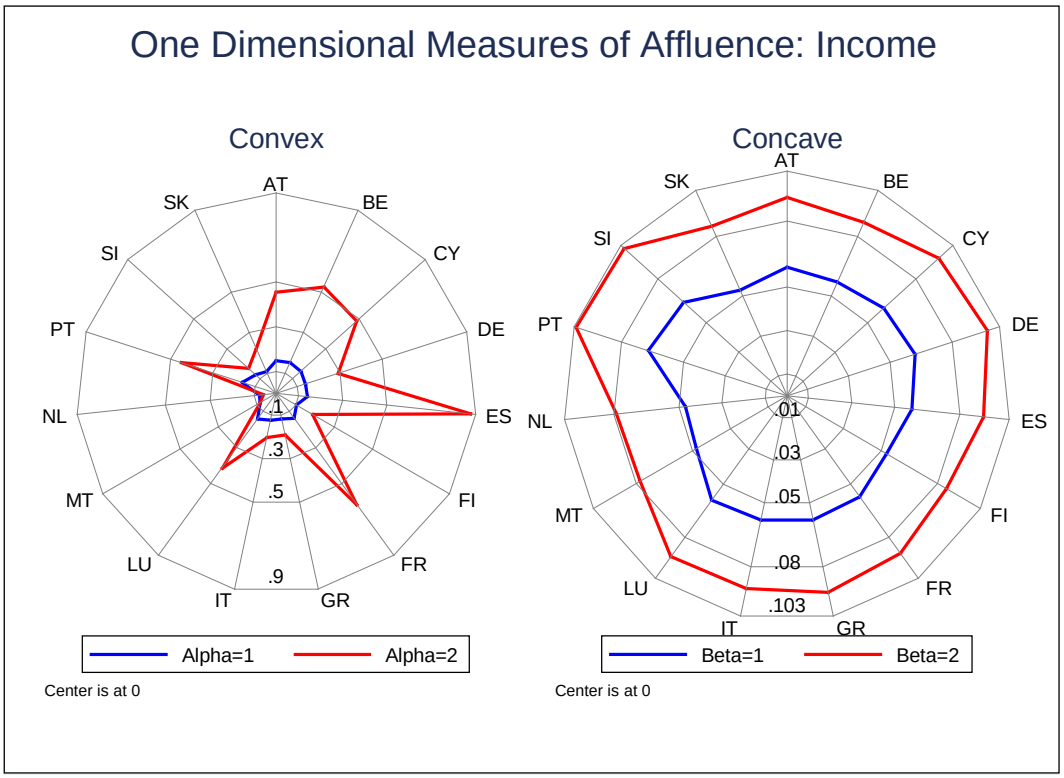
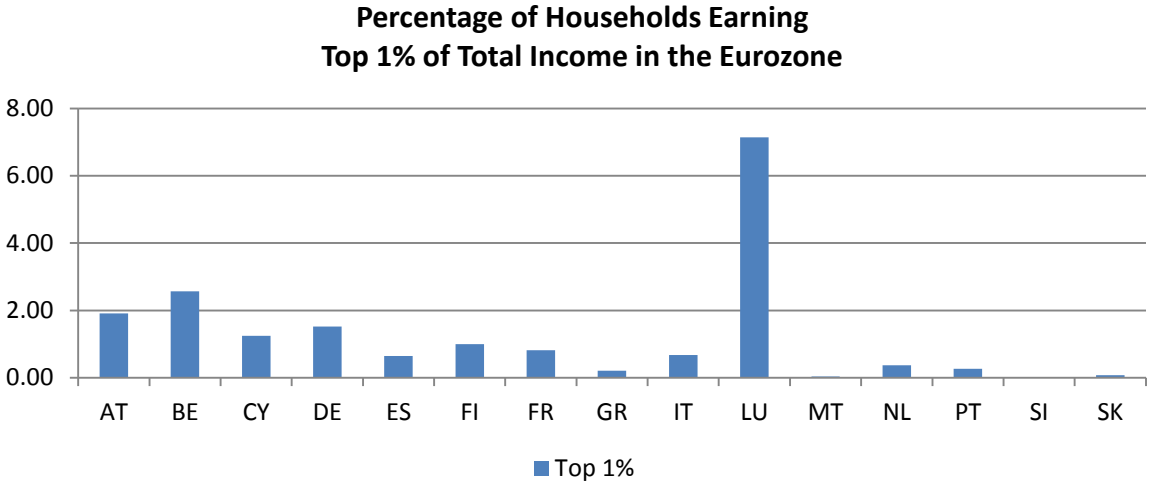


Figure 2. Percentage of Households Earning the Top 1% of Total Income in the Eurozone[12]



Note: Each bar represents the percentage of households in the corresponding country earning the top 1% of Total Income. Approximately 7% of households in Luxembourg earn the top 1% of the Eurozone income distribution. Or in other words, 7% of households in Luxembourg are in the top 1% of Eurozone income distribution.

[12] Figure A.1 in the Appendix demonstrates an analogous chart for PPP adjusted income values. The PPP adjusted income is calculated by scaling the net wealth values by the ratio of average income in Austria to the average income of the corresponding country. The share of households earning the top 1% PPP adjusted income is highest in Belgium (approximately 2%),and Luxembourg is observed to be no longer an outlier with 1% of its households earning the top 1% total income in the Eurozone.

That is, even though the top of the income distribution is equally populated for all countries, the pairwise comparison of countries' convex and concave measures for $\alpha, \beta > 1$ demonstrates the nature of the income distribution of the rich in each country. For instance, higher values of concave affluence in Portugal and Slovenia indicate that income is more homogenously distributed among the rich in these countries whereas in Spain and France the highest incomes are concentrated mostly in the hands of few as suggested by the convex intensity of richness. This can also be observed from Figure 2: in Portugal and Slovenia a lower portion of households earn the top 1% of the Eurozone income compared to Spain and France. Even though there are many other countries in the sample with higher percentage of households earning the top 1% of the Eurozone income compared to that of Spain and France, their convex intensity of richness ($R^M_{\alpha>1}$), and, in turn, the inequality among the rich is much lower. For instance, 7.1% of households in Luxembourg earn the top 1% of the Eurozone income. However, the convex measure of affluence ($R^M_{\alpha>1}$) in Luxembourg is much lower than in Spain while the concave measure is equal in both countries ($R^M_{\beta>1}$). This result is driven by the few very rich households in Spain.

Wealth. Relying on wealth as a measure of affluence (reported in Table 5 and visualized in Figure 3) yields that, for $\alpha = 1$, the top three highest average dispersion of wealth from the richness line are observed in Austria (45%), Cyprus (42%) and Germany (37%). For Slovenia and Netherlands, the convex measure of affluence is the lowest when $\alpha = 1$. That is because wealth owned by the wealthiest households in Slovenia and Netherlands deviates from the cut-off value set for the top 20% of wealth distribution by approximately 13% on average. As in the case of income, the most significant jump in the convex measure of wealth affluence is observed in Spain and France as the sensitivity parameter α increases.

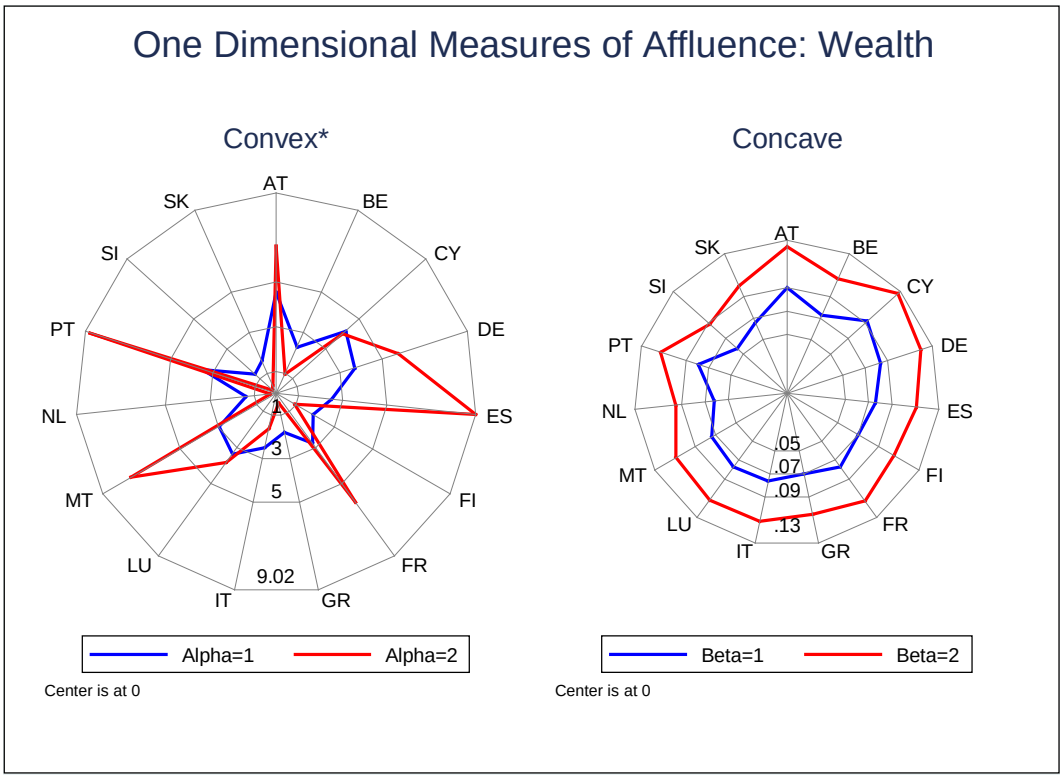
Table 5. One Dimensional Measures for Wealth

	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	0.456	6.610	231.355	0.090	0.125	0.143
BE	0.228	0.960	7.517	0.073	0.107	0.127
CY	0.420	4.013	100.975	0.092	0.127	0.145
DE	0.370	5.767	310.549	0.084	0.120	0.140
ES	0.250	9.015	6048.235	0.076	0.111	0.132
FI	0.190	0.963	20.985	0.070	0.105	0.126
FR	0.276	6.034	981.323	0.077	0.113	0.133
GR	0.179	0.438	2.343	0.070	0.105	0.125
IT	0.250	1.604	32.921	0.076	0.111	0.130
LU	0.336	3.832	89.226	0.077	0.112	0.131
MT	0.298	7.538	461.672	0.074	0.109	0.129
NL	0.136	0.268	1.237	0.062	0.095	0.116
PT	0.349	8.811	873.427	0.079	0.113	0.132
SI	0.130	0.249	0.813	0.057	0.088	0.107
SK	0.161	0.392	1.744	0.066	0.100	0.121

Source: HFCS, authors' own calculations
Note: The results for top 90% and top 99% quantiles are presented in Tables A.5 and A.6 the Appendix

Considering the concave measure of affluence, the highest (lowest) values of concave affluence measure is observed for Cyprus and Austria (Slovenia) for all levels of concave sensitivity parameter, β. Indicated by the concave affluence measure when β is equal to 1, the excess wealth owned by wealthiest households in Austria and Cyprus above the richness line approximates 9% of the wealth of the rich, on average, whereas this excess wealth above the richness line constitutes 6% of wealth holdings of the rich in Slovenia and Netherlands. For higher values of β, the concave measure of dimension adjusted wealth affluence increases for the Eurozone countries but not significantly.

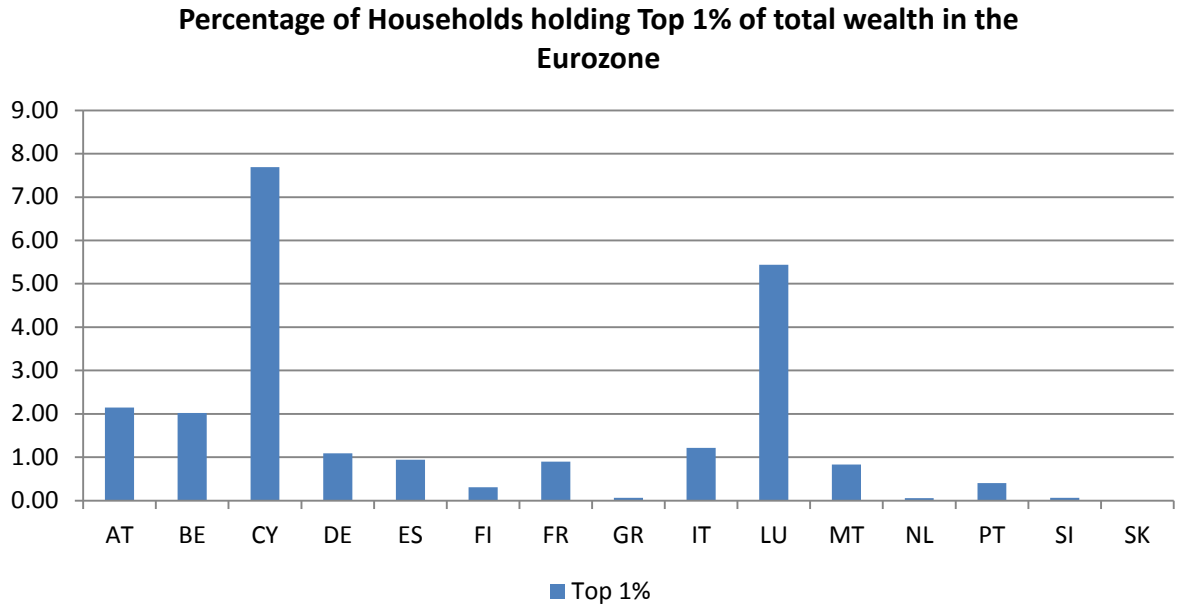
Figure 3. Comparison of One Dimensional Measures of Affluence for Wealth



Note: (*) Values of convex affluence measures for $\alpha = 1$ are scaled up by a multiple of 10 for visibility purposes.

We observe differences in the ranking of countries by comparing the convex and concave univariate measures of affluence for wealth. For instance, Figure 4 shows that almost 8% of households in Cyprus have wealth above the top 1% wealth threshold in the Eurozone. As mentioned before, Cyprus has higher measure of concave affluence compared to the rest of the Eurozone countries. However, it is Spain that is ranked first with respect to convex measure of affluence (i.e. $R^{M}_{\alpha>1}$). One explanation for this finding could be that very high level of wealth is concentrated in the hands of very few in Spain while the distribution of wealth is more homogenous in Cyprus.

Figure 4. Percentage of households in each country holding top 1% of Eurozone wealth[13]



Note: (1) Each bar represents the percentage of households in the corresponding country holding the top 1% of Total net wealth in the Eurozone. For instance, more than 7.5% of households in Cyprus are in the top 1% of Eurozone wealth distribution.

3.4 JOINT ANALYSIS OF INCOME AND WEALTH

3.4.1 RANK CORRELATIONS:

Table 6 reports the correlations between income and net wealth. The first block presents the correlation coefficients between dimensions whereas the second block presents the spearman rank correlations. The first columns of each block display the results when population weights are employed and the second columns display the correlations when the population weights are not employed in the calculations.

The weighted correlation coefficients are lower than weighted Spearman rank correlations for most of the countries except for Finland, Netherlands, Portugal and Slovenia. That is because

[13] Figure A.2 in the Appendix demonstrates an analogous chart for PPP adjusted net wealth values. The PPP adjusted net wealth is calculated by scaling the net wealth values by the ratio of average wealth in Austria to the average wealth of the corresponding country. The share of households earning the top 1% PPP adjusted wealth is again highest in Cyprus, however, this share is approximately 2%.

for the majority of countries the correlation between the income and wealth dimensions is weaker than the correlation between the rankings of households in each dimension. Considering the Spearman correlations, Germany exhibits the highest and Netherlands exhibits the lowest rank correlations. Therefore, the likelihood of high-income households to be ranked as high-wealth owners in Germany is higher compared to the rest of the countries in the sample and the association between households' income and wealth rankings is the lowest in Netherlands.

Table 6. Correlations between dimensions

		CORRELATIONS		**SPEARMAN RANK CORRELATIONS**	
		(weighted)	(unweighted)	(weighted)	(unweighted)
Country	Dimension	Net Wealth	Net Wealth	Net Wealth	Net Wealth
AT	Income	0.239	0.238	0.506	0.500
BE	Income	0.252	0.291	0.423	0.450
CY	Income	0.429	0.337	0.518	0.532
DE	Income	0.359	0.461	0.561	0.594
ES	Income	0.246	0.229	0.455	0.590
FI	Income	0.607	0.609	0.504	0.514
FR	Income	0.446	0.521	0.555	0.635
GR	Income	0.424	0.768	0.435	0.424
IT	Income	0.478	0.529	0.514	0.519
LU	Income	0.471	0.442	0.531	0.553
MT	Income	0.187	0.203	0.379	0.389
NL	Income	0.299	0.322	0.282	0.303
PT	Income	0.478	0.480	0.415	0.433
SI	Income	0.425	0.413	0.363	0.383
SK	Income	0.283	0.333	0.342	0.340

Source: HFCS, authors' calculations.
Note: (*) Spearman Rank Correlations represent the rank correlation for the entire population in the corresponding country.

3.4.2 MULTIDIMENSIONAL AFFLUENCE MEASURES

Table 7 presents the values of multidimensional well-being measures for different cut-off thresholds, k, and for different values of sensitivity parameters, α and β. The results are also visualized in Figure 5. When the second cut-off is set to 1 ($k = 1$), i.e. a household is

considered as multidimensionally affluent when the household is affluent in at least one dimension,, the headcount ratio gives the percentage of households affluent in at least one dimension as presented in Table 3. Whereas, when it is necessary to be well-off in both dimensions (i.e. k=2) to be considered as multidimensionally affluent, the headcount ratio is identical to the value of the well-off counts in both dimensions in Table 3.

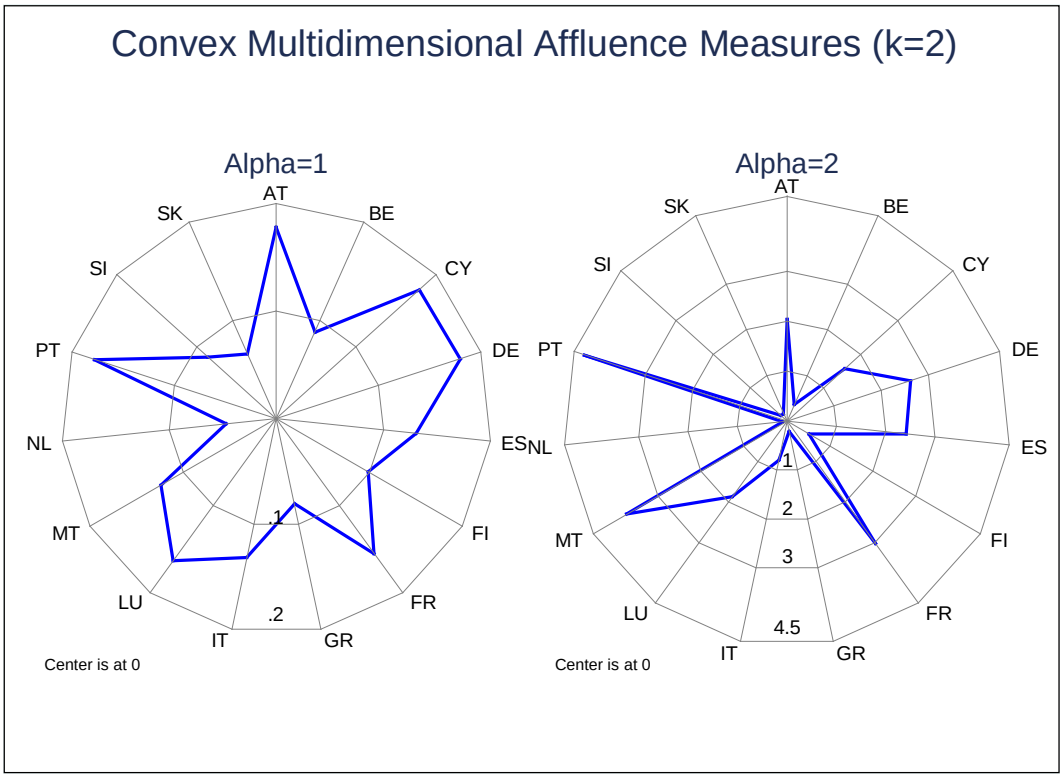
Table 7. Multidimensional Measures of Affluence

Country	*Second cut-off*	***HR(k)***	***AAS(k)***	$R^M_{HR}(k)$	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	k=1	0.306	0.653	0.200	0.302	3.532	117.197	0.074	0.108	0.127
	k=2	0.094	1	0.094	0.178	2.037	61.689	0.040	0.056	0.064
BE	k=1	0.327	0.611	0.200	0.190	0.742	5.538	0.065	0.097	0.116
	k=2	0.073	1	0.073	0.088	0.367	2.768	0.028	0.041	0.048
CY	k=1	0.298	0.668	0.199	0.284	2.250	52.264	0.076	0.110	0.130
	k=2	0.100	1	0.100	0.179	1.565	28.728	0.042	0.059	0.068
DE	k=1	0.301	0.664	0.200	0.254	3.029	155.998	0.073	0.108	0.129
	k=2	0.099	1	0.099	0.180	2.624	142.581	0.042	0.060	0.070
ES	k=1	0.305	0.653	0.199	0.196	4.947	3059.851	0.067	0.101	0.122
	k=2	0.093	1	0.093	0.131	2.410	694.365	0.037	0.054	0.064
FI	k=1	0.309	0.647	0.200	0.147	0.576	11.045	0.061	0.095	0.116
	k=2	0.091	1	0.091	0.099	0.519	10.904	0.035	0.051	0.061
FR	k=1	0.295	0.678	0.200	0.206	3.325	498.096	0.067	0.101	0.121
	k=2	0.105	1	0.105	0.155	3.027	467.379	0.043	0.062	0.073
GR	k=1	0.310	0.644	0.200	0.147	0.314	1.715	0.064	0.099	0.119
	k=2	0.089	1	0.089	0.081	0.204	1.384	0.033	0.049	0.058
IT	k=1	0.297	0.672	0.200	0.186	0.904	16.766	0.067	0.100	0.121
	k=2	0.102	1	0.102	0.132	0.797	16.262	0.041	0.060	0.070
LU	k=1	0.302	0.661	0.200	0.239	2.123	45.965	0.068	0.101	0.121
	k=2	0.097	1	0.097	0.163	1.861	43.960	0.038	0.055	0.065
MT	k=1	0.326	0.609	0.198	0.191	3.811	230.908	0.061	0.093	0.113
	k=2	0.071	1	0.071	0.124	3.717	230.661	0.026	0.039	0.046
NL	k=1	0.331	0.604	0.200	0.106	0.163	0.651	0.055	0.087	0.108
	k=2	0.069	1	0.069	0.047	0.090	0.399	0.022	0.034	0.041
PT	k=1	0.304	0.657	0.200	0.255	4.631	438.493	0.073	0.107	0.127
	k=2	0.095	1	0.095	0.178	4.279	429.586	0.041	0.059	0.068
SI	k=1	0.295	0.676	0.199	0.128	0.209	0.596	0.061	0.095	0.116
	k=2	0.104	1	0.104	0.086	0.170	0.538	0.037	0.055	0.067
SK	k=1	0.322	0.621	0.200	0.134	0.307	1.543	0.059	0.092	0.113
	k=2	0.078	1	0.078	0.066	0.162	0.724	0.027	0.041	0.049
EA	k=1	0.306	0.653	0.200	0.422	5.257	1574.483	0.138	0.207	0.248
	k=2	0.094	1	0.094	0.284	3.737	342.095	0.076	0.110	0.129

Source: HFCS, authors' calculations

As we set the initial cut-off for income and wealth distributions to top 80% quantile, the dimension adjusted headcount ratio, $R_{HR}^{M}(k)$, equals to 0.2 for all countries when $k = 1$. The multidimensional headcount ratio is much lower for $k = 2$ and it represents the total affluence counts. Note that, because we set the second cut-off threshold equally to the total number of dimensions (i.e. $k = 2$), dimension adjusted headcount ratio is identical to the headcount ratio ($R_{HR}^{M}(2) = HR(2)$).

Figure 5. Comparison of Convex Multidimensional Measures for k=2



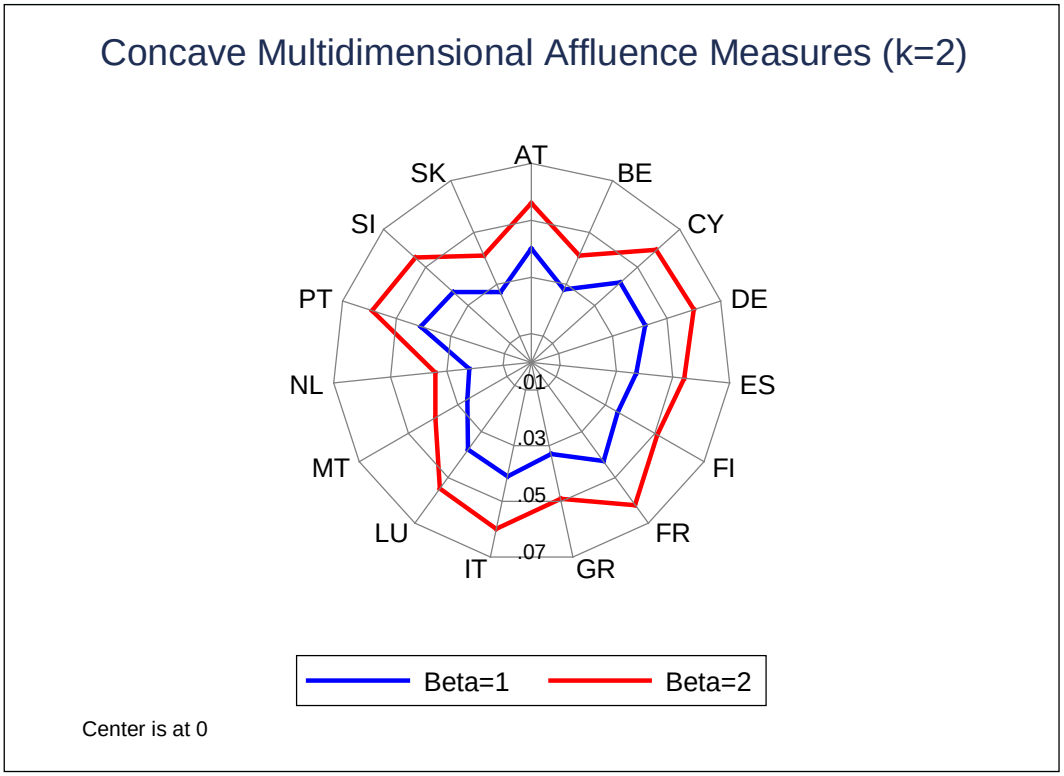
Note: A figure that displays the comparison of convex multidimensional affluence measures when k=1 is included in Appendix A.9.

The convex multidimensional affluence measures indicates that Germany, Cyprus, Portugal and Austria have higher affluence measures compared to the rest of the Eurozone countries in the sample when $\alpha = 1$ and households are well-off in both dimensions (ie. $k = 2$). The dispersion of convex multivariate affluence measure across the Eurozone countries is much higher for higher values of α. The largest value of convex multidimensional affluence

measure is observed for Portugal (4.28) when $\alpha = 2$. Malta (3.72), France (3.03) and Germany (2.62) follow Portugal.

Regarding the concave multidimensional affluence measures (see Figure 6), France always has the highest value for all levels of the second cut-off threshold. We find that Germany and Italy have the second highest values of concave measure of richness $\boldsymbol{R^{M}_{\beta=2}}$ with 6%, and Cyprus and Portugal (5.9%) follow them closely.

Figure 6. Comparison of Convex Multidimensional Measures for k=2



Note: A figure that displays the comparison of concave multidimensional affluence measures when k=1 is included in Appendix A.10.

Therefore, for $k = 2$ and $\alpha, \beta \geq 1$, the pairwise comparison of countries with the highest values of convex and concave affluence measures indicates that France has the highest percentage of households affluent in both dimensions ($R^{M}_{HR}(2) = 10.5\%$) and maintains its lead in concave affluence measures (see $R^{M}_{\beta \geq 1}$), however, regarding the convex measure $R^{M}_{\alpha=2}(2)$**,** Portugal is ranked first**.** This indicates that richness is mostly concentrated in the

hands of few in Portugal while the distribution of richness among affluent households is more homogenous in France. Comparing Germany and Portugal also leads to a similar conclusion that the group of rich households is more populated in Germany and the richness is distributed more evenly among the rich households. For Germany and Italy, we observe an equal concave intensity of richness ($R^{M}_{\beta>1}$) whereas the convex measure of affluence is larger for Germany.

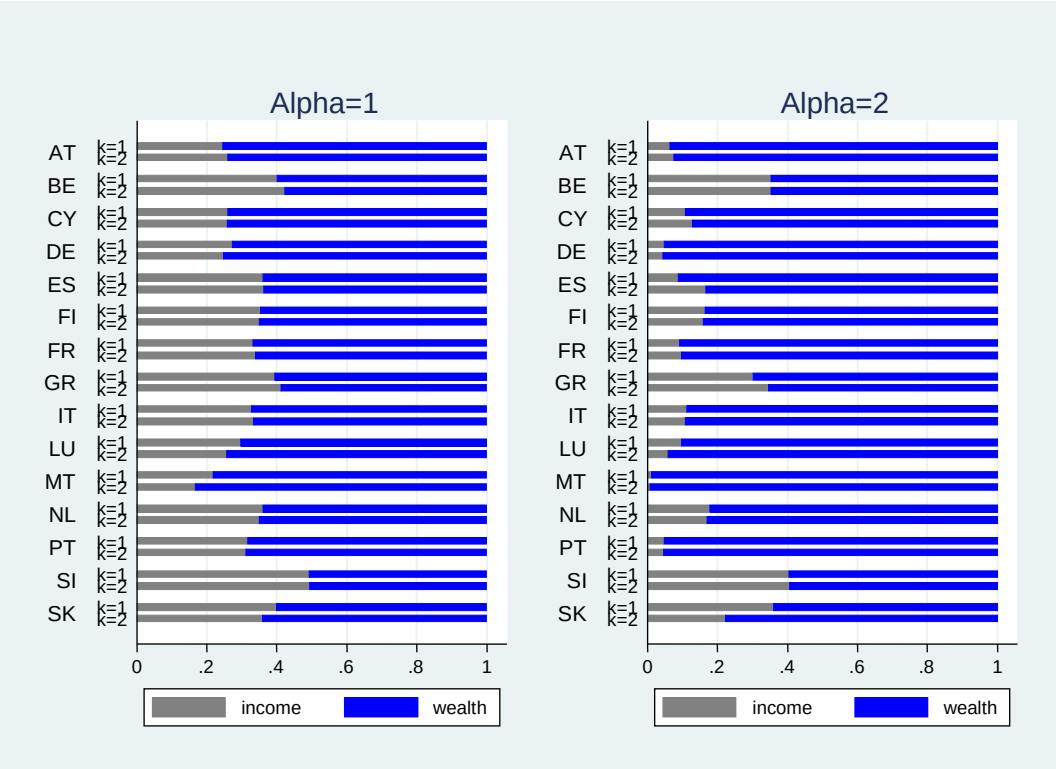
Considering that Germany has a slightly more populated group of affluent households and the homogeneity of the distribution of richness among the rich households is equal in both countries, the richest of the rich households in Germany are earning more than Italian households. A further comparison is also possible for Germany by considering the analysis in Peichl and Pestel (2013a). They measured the multidimensional affluence for the rich in Germany and the US for the year 2007. The analysis for Germany is based on the German Socio-Economic Panel Study (SOEP). The comparison of the dimension adjusted headcount ratios for $k = 2$ reveals that the percentage of households affluent in both income and wealth increased is slightly higher in our data (9.9% vs. 8.1%). Our analysis also yields significantly higher values of convex and concave measures of affluence for Germany compared to those reported for the year 2007 in Peichl and Pestel (2013a). While these differences may partly be due to different sources of data used in both studies, the increases in measures of affluence might also indicate that the economic conditions of the top of the joint distribution in Germany improved during the global financial crisis.

3.4.3. CONTRIBUTIONS TO MULTIDIMENSIONAL AFFLUENCE:

This section displays the contribution of income and wealth dimensions to the affluence measures for each country. The percentage contribution of dimensions to the convex affluence measure is demonstrated by Figure 3 whereas Figure 4 displays the contribution of income

and wealth dimensions to the concave affluence measure. It can be seen that countries differ substantially regarding the affluence contribution of each dimension.

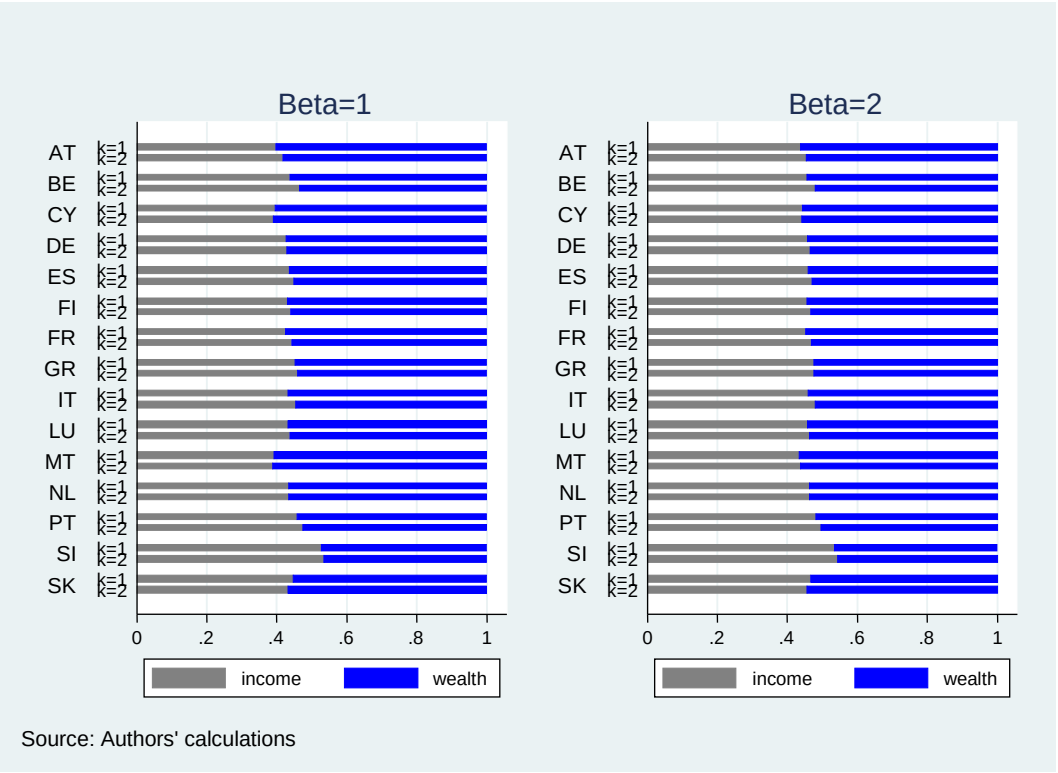
Figure 7. Percentage Dimension Contribution to Convex Affluence measure:



Source: HFCS, authors' own calculations

For the convex affluence measure, when $\alpha = 1$, wealth is relatively more important dimension than income except for Slovenia. The relative importance of wealth shrinks, if not stays, the same when the second stage cut-off raises from 1 to 2, with the exceptions of Germany, Luxemburg, Malta, Netherlands, and Slovakia. The relative importance of wealth slightly increases in these countries when the second stage cut-off is set at its maximum (k=2). For $\alpha = 2$, wealth is relatively more important dimension than income. For Cyprus, Spain, and Greece: The relative importance of wealth shrinks whereas for Luxembourg, Netherlands, and Slovakia the relative importance of wealth increases when the second stage cut-off increases from 1 to 2.

Figure 8. Percentage Dimension Contribution to Concave Affluence measure:



Source: Authors' calculations

For the concave measure, the relative importance of wealth and income is almost equal for all countries. For both values of the sensitivity parameter β, the relative importance of wealth shrinks when the affluence threshold is raised to 2 except for Slovakia.

4. ROBUSTNESS CHECK

The results presented in this paper measures the affluence for the top 80 of the income and wealth distribution in 15 Eurozone countries. In order to assess the both multidimensional and unidimensional well-being of the very rich, we also calculated the affluence measures for top 90% and top 99% quantile of the income and wealth distribution. Table A.2 in the Appendix shows that the income cut-off values for the top 90% (99%) quantile ranges from 156,300 (385,200) Euros in Luxembourg to 24,500 (47,735) Euros in Slovakia while the wealth cut-off values ranges from 1,524,441 (7,491,000) Euros in Cyprus to 152,800 (454,084) Euros in Slovakia. Table A.2 also presents the cut-off values for purchasing power parity adjusted income and the net wealth for the top 80% quantile.[14] The PPP

[14] The purchasing power parity is calculated by scaling the income (net wealth) values by the ratio of average income (net wealth) in Austria to the average income (net wealth) of the corresponding country.

adjusted income values indicate that the income cut-off values range from 67,411 Euros in Slovenia to 59,274 Euros in France. The PPP adjusted net wealth cut-offs ranges between 461,631 Euros in Netherlands to 323,169 in Austria.

The one-dimensional affluence measures for the top 90% and top 99% quantile indicates that rankings of the countries are very similar to the top 80% quintile as indicated by tables A.3 through A.6 in the Appendix. Multidimensional affluence measures are presented in tables A.7 and A.8 for the top 90% and 99% quantiles. Considering the households who are well-off in both dimensions (i.e. $k = 2$), there are very few changes in the rankings of the countries regarding the joint distribution of income and wealth for the top 90% quintile compared to the top 80%. For the top 99% quantile of the joint distribution of income and wealth, however, the story is different: the highest convex affluence measure is observed for France for all levels of α and we observe Greece and Slovakia with the highest concave measures of affluence when $\beta = 2$.

5. CONCLUSIONS

Using the first wave of the HFCS which was recently published, this paper examines the joint distribution of income and net wealth at the top of the distribution in 15 Eurozone countries. We employ convex and concave measures of affluence proposed by Peichl and Pestel (2013a) to measure the inequality among the rich. Before examining the joint distribution of income and wealth, we start our analysis with one- dimensional measures of affluence by considering income and wealth distributions separately. The ranking of countries according to the income distribution among the rich indicates that, with respect to the convex affluence measures, Spain and France are more affluent than the rest of the countries in the sample. Considering the concave affluence measures, on the other hand, Portugal and Slovenia are the top two affluent countries. Regardless of the measure of affluence, Netherlands is the least affluent country in the sample. Referring to the distribution of net wealth as the dimension of affluence, the ranking of countries also changes depending on the choice of affluence

measures. Spain is ranked as the most affluent country according to convex measure while Cyprus has the highest concave affluence measure in the sample. Therefore, we can conclude that households' rankings within marginal distributions of income and net wealth are not perfectly correlated. This result is also confirmed by the Spearman correlation coefficients in Table 7.

To demonstrate the distribution of affluence better, we considered the joint distribution of income and net wealth. The pairwise comparison of countries' multidimensional affluence measures indicates that: France has the highest concave affluence measure in the sample for all values of sensitivity parameter β , indicating a more homogenous distribution of richness among affluent households compared to the other countries in the sample. Portugal is ranked first regarding the convex measure when $\alpha = 2$ and among the top three countries for $\alpha = 3$**.** This indicates that richness is mostly concentrated in the hands of few in Portugal. Comparing Germany and Portugal, we also found a similar result that the group of rich households is more populated in Germany and the richness is distributed more evenly among the rich households.

Lastly, comparing the contribution of each dimension to the multidimensional well-being, we found that net wealth is a relatively more important dimension for the convex affluence measure except for Slovenia. Regarding the concave affluence measure, contribution of net wealth and income to the multidimensional well-being is almost equal for all countries.

APPENDIX

A.1 Reference and Fieldwork Periods for Wealth and Income:

Table A.1.

Country	Net Wealth	Income	Fieldwork period
Belgium	Time of interview	2009	04/10 – 10/10
Germany	Time of interview	2009	09/10 – 07/11
Greece	Time of interview	Last 12 months	6/09 – 9/09
Spain	Time of interview	2007	11/08 – 07/09
France	Time of interview	2009	10/09 – 02/10
Italy	31.12.2010	2010	01/11 – 08/11
Cyprus	Time of interview	2009	04/10 – 01/11
Luxembourg	Time of interview	2009	09/10 – 04/11
Malta	Time of interview	Last 12 months	10/10 – 02/11
Netherlands	31.12.2009	2009	04/10 – 12/10
Austria	Time of interview	2009	09/10 – 05/11
Portugal	Time of interview	2009	04/10 – 07/10
Slovenia	Time of interview	2009	10/10 – 12/10
Slovakia	Time of interview	Last 12 months	09/10 – 10/10
Finland	31.12.2009	2009	01/10 – 05/10

Source: HFCS Country Surveys Metadata Information Wave I, Doc.UDB5, ECB, 2013

A.2. Cut-offs:

Table A.2.

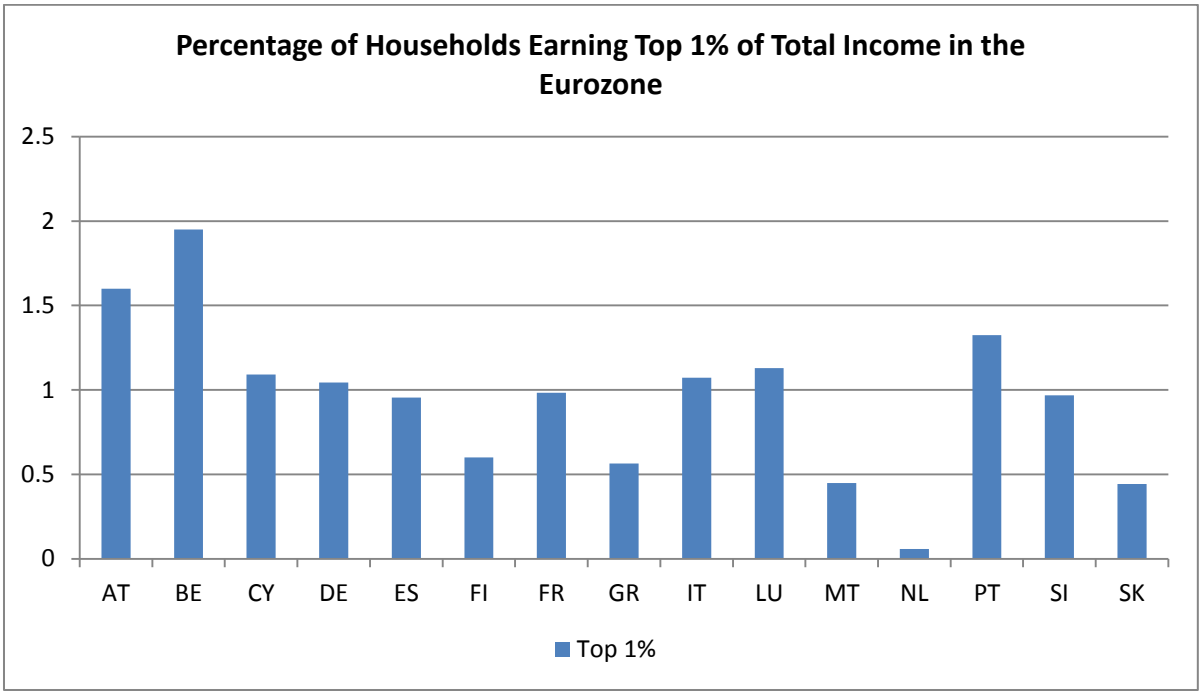
Country	Dimension	Cut-off* (PPP adjusted)	Cut-off (top 99% quantile)	Cut-off (top 90% quantile)
AT	Income	61,235	239,478	81,323
	Net Wealth	323,169	3,194,239	564,836
BE	Income	64,222	305,031	90,000
	Net Wealth	397,520	2,900,500	718,052
CY	Income	62,194	204,880	83,800
	Net Wealth	325,357	7,491,000	1,524,441
DE	Income	62,561	204,100	87,300
	Net Wealth	365,307	2,012,500	461,300
ES	Income	61,044	132,010	58,711
	Net Wealth	367,517	1,889,156	622,048
FI	Income	64,317	174,366	85,943
	Net Wealth	437,351	1,151,924	420,331
FR	Income	59,274	164,481	65,336
	Net Wealth	392,102	1,813,483	525,708
GR	Income	63,810	111,000	53,497
	Net Wealth	415,786	919,000	335,000
IT	Income	62,845	156,124	65,272
	Net Wealth	383,305	2,199,900	583,000
LU	Income	61,331	385,200	156,230
	Net Wealth	345,025	6,329,426	1,407,448
MT	Income	66,459	87,224	51,000
	Net Wealth	349,375	1,868,125	701,643
NL	Income	62,379	135,242	82,658
	Net Wealth	461,631	1,094,786	448,135
PT	Income	62,057	100,710	40,150
	Net Wealth	344,685	1,267,000	302,090
SI	Income	67,411	96,529	50,000
	Net Wealth	453,043	862,506	313,313
SK	Income	61,052	47,735	24,500
	Net Wealth	379,076	454,084	152,800

*Source:*HFCS, authors' calculations

(*) The purchasing power parity adjusted cut-off values of income (net wealth) are calculated by scaling the income (netwealth) values by the ratio of average income (net wealth) in Austria to the average income (net wealth) of the corresponding country.

A.3. Percentage of Households Earning the Top 1% of Total Income in the Eurozone (PPP adjusted)

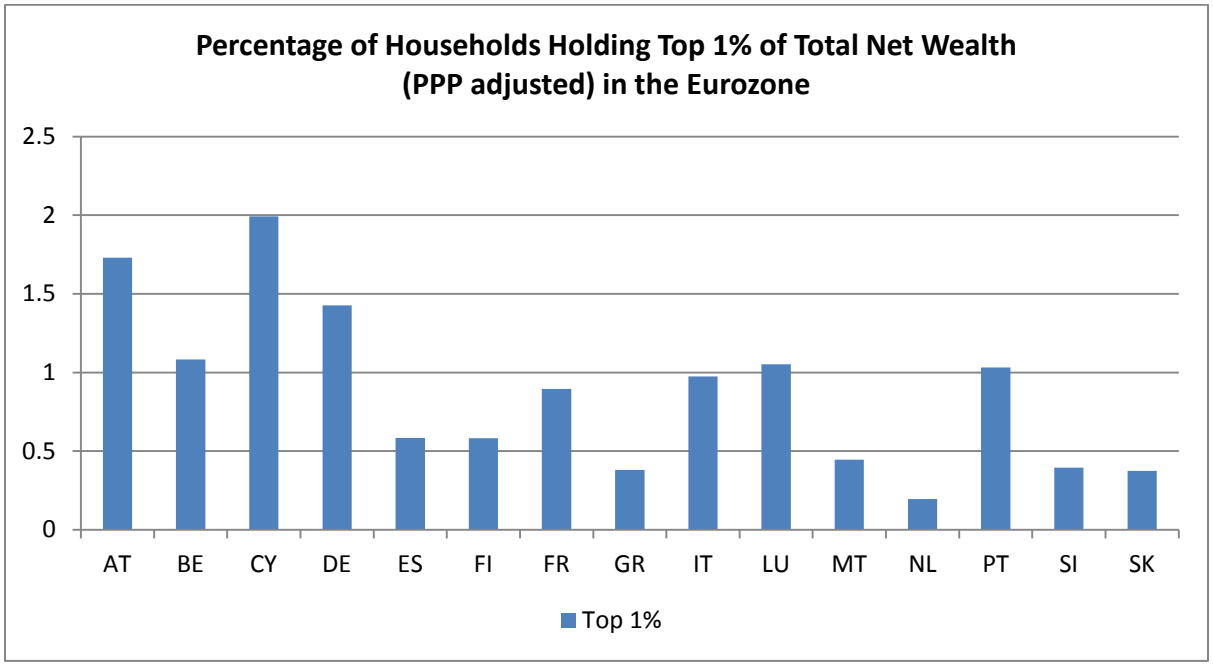
Figure A.1.



(*) The purchasing power parity adjusted values of income are calculated by scaling the income values by the ratio of average income in Austria to the average income of the corresponding country.

A.4. Percentage of households in each country holding top 1% of Eurozone wealth (PPP adjusted)

Figure A.2.



(*) The purchasing power parity adjusted cut-off values of net wealth are calculated by scaling the net wealth values by the ratio of average net wealth in Austria to the average net wealth of the corresponding country.

A.5. One Dimensional Affluence Measures for top 90% quantile: Income

Table A.3.

	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	0.076296	0.212418	1.124513	0.03	0.045607	0.055224
BE	0.088014	0.276425	1.509005	0.031699	0.047327	0.056742
CY	0.067539	0.206292	1.14694	0.026539	0.040997	0.050298
DE	0.059604	0.108834	0.4373	0.028572	0.045004	0.055533
ES	0.065609	0.426904	27.71803	0.025848	0.040738	0.050737
FI	0.047147	0.084005	0.439282	0.024409	0.039448	0.04963
FR	0.069321	0.314171	6.269109	0.028142	0.043807	0.053881
GR	0.048447	0.07087	0.376515	0.025802	0.041608	0.052151
IT	0.05427	0.077153	0.181187	0.026993	0.042559	0.052566
LU	0.070674	0.188199	0.978509	0.028895	0.044259	0.053753
MT	0.032694	0.028221	0.04126	0.019831	0.03305	0.042478
NL	0.0279	0.01636	0.014622	0.018704	0.031918	0.041665
PT	0.071559	0.17254	1.089896	0.03165	0.048951	0.059624
SI	0.039328	0.040047	0.065653	0.022554	0.037141	0.047413
SK	0.046315	0.095264	0.495228	0.02329	0.037812	0.047838

Source: HFCS, authors' own calculations. The initial cut-off is top 90% quantile

A.6. One Dimensional Affluence Measures for top 90% quantile: Wealth

Table A.4.

	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	0.200419	1.969132	40.68458	0.044179	0.06157	0.070735
BE	0.110914	0.367344	2.02622	0.037562	0.054929	0.064781
CY	0.154987	0.927497	13.10187	0.042262	0.059925	0.069498
DE	0.162762	1.895161	63.29948	0.037823	0.054319	0.063779
ES	0.107318	3.540416	1544.777	0.033429	0.050526	0.060914
FI	0.081938	0.372598	6.070592	0.031616	0.048356	0.058664
FR	0.126361	2.390369	258.5745	0.036489	0.054041	0.064282
GR	0.073151	0.13437	0.540739	0.032873	0.050397	0.060986
IT	0.113301	0.587479	8.45656	0.036358	0.053682	0.063796
LU	0.16559	1.453072	22.15948	0.037141	0.052649	0.061379
MT	0.145864	3.090548	124.8152	0.034586	0.051887	0.062084
NL	0.059201	0.099186	0.376103	0.028707	0.045002	0.055284
PT	0.171243	3.432189	221.7265	0.040049	0.057169	0.066467
SI	0.067351	0.108707	0.279352	0.03146	0.048826	0.059662
SK	0.07213	0.145223	0.477134	0.031056	0.047596	0.057795

Source: HFCS, authors' own calculations. The initial cut-off is top 90% quantile

A.7. One Dimensional Affluence Measures for top 99% quantile: Income

Table A.5.

	$R^M_{\alpha=1}$	$R^M_{\alpha=2}$	$R^M_{\alpha=3}$	$R^M_{\beta=1}$	$R^M_{\beta=2}$	$R^M_{\beta=3}$
AT	0.006	0.008	0.015	0.003	0.004	0.005
BE	0.005	0.007	0.010	0.003	0.004	0.005
CY	0.010	0.017	0.036	0.004	0.006	0.007
DE	0.005	0.007	0.014	0.002	0.004	0.005
ES	0.011	0.066	2.316	0.004	0.006	0.007
FI	0.005	0.009	0.032	0.002	0.004	0.005
FR	0.008	0.032	0.322	0.003	0.005	0.006
GR	0.004	0.006	0.027	0.002	0.003	0.004
IT	0.003	0.002	0.002	0.002	0.003	0.004
LU	0.008	0.013	0.029	0.003	0.005	0.006
MT	0.004	0.002	0.002	0.002	0.004	0.005
NL	0.002	0.001	0.000	0.002	0.003	0.004
PT	0.006	0.012	0.038	0.003	0.004	0.005
SI	0.004	0.002	0.001	0.003	0.004	0.005
SK	0.007	0.013	0.041	0.003	0.004	0.005

Source: HFCS, authors' own calculations. The initial cut-off is top 99% quantile

A.8. One Dimensional Affluence Measures for top 99% quantile: Wealth

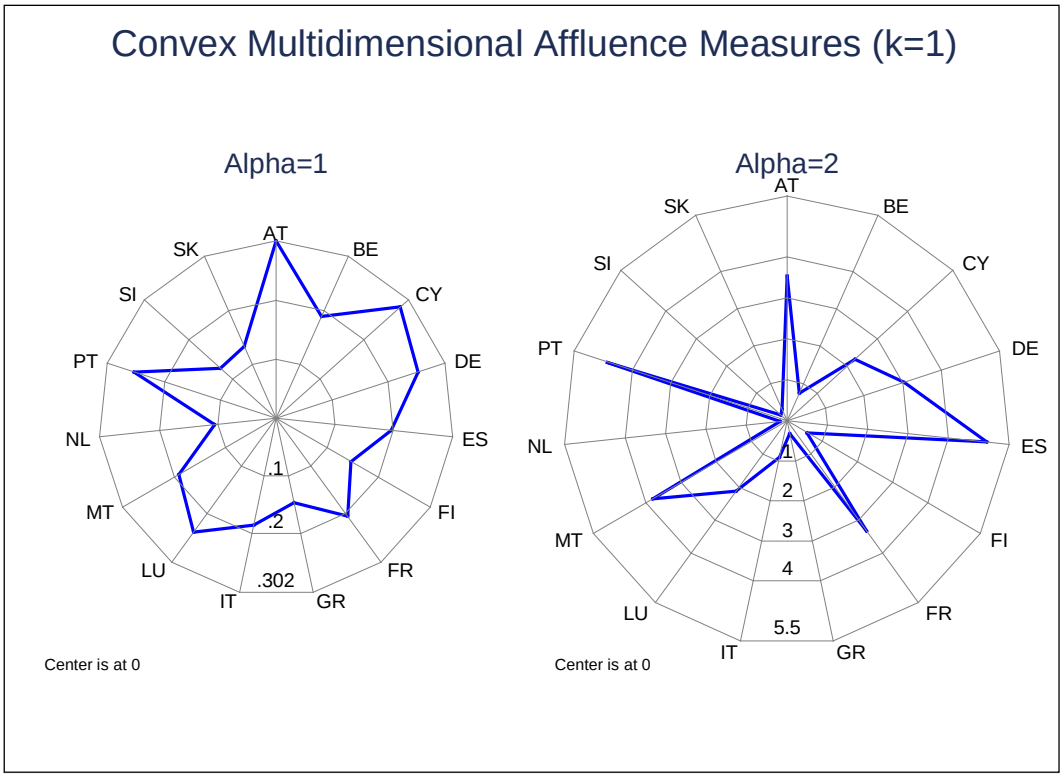
Table A.6.

	$R^{M}_{\alpha=1}$	$R^{M}_{\alpha=2}$	$R^{M}_{\alpha=3}$	$R^{M}_{\beta=1}$	$R^{M}_{\beta=2}$	$R^{M}_{\beta=3}$
AT	0.011	0.031	0.118	0.004	0.005	0.006
BE	0.005	0.005	0.006	0.003	0.004	0.005
CY	0.006	0.015	0.054	0.002	0.004	0.004
DE	0.015	0.065	0.577	0.004	0.006	0.007
ES	0.014	0.357	54.408	0.003	0.005	0.006
FI	0.008	0.030	0.223	0.003	0.005	0.006
FR	0.014	0.171	5.908	0.004	0.005	0.006
GR	0.004	0.004	0.010	0.002	0.004	0.005
IT	0.008	0.019	0.096	0.003	0.005	0.006
LU	0.015	0.038	0.122	0.005	0.006	0.007
MT	0.030	0.388	5.846	0.004	0.005	0.006
NL	0.004	0.005	0.010	0.002	0.003	0.004
PT	0.016	0.158	2.608	0.004	0.005	0.006
SI	0.003	0.002	0.002	0.002	0.003	0.004
SK	0.004	0.003	0.003	0.002	0.004	0.005

Source: HFCS, authors' own calculations. The initial cut-off is top 99% quantile

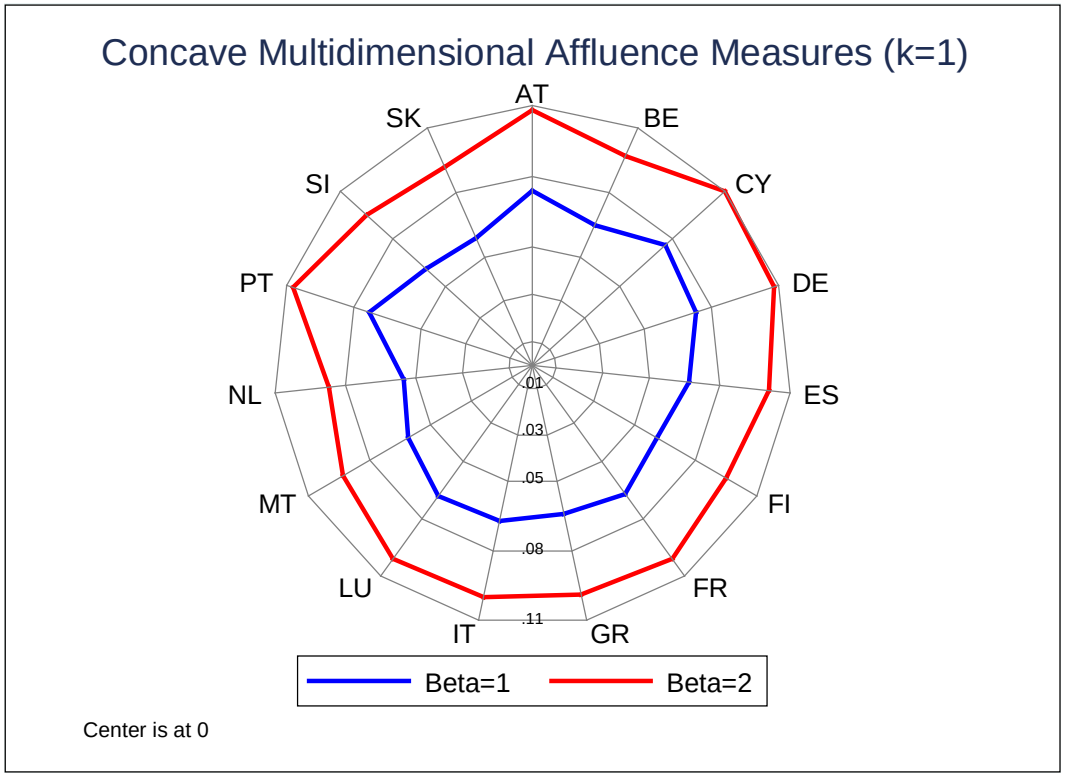
A.9. Comparison of Convex Multidimensional Affluence Measures for k=1

Figure A.3.



A.10. Comparison of Concave Multidimensional Affluence Measures for k=1

Figure A.4.



A.11. Multidimensional Affluence Measures for top 90% quantile:

Table A.7.

Country	*Second cut-off*	***HR(k)***	***AAS(k)***	$R^{M}_{HR}(k)$	$R^{M}_{\alpha=1}$	$R^{M}_{\alpha=2}$	$R^{M}_{\alpha=3}$	$R^{M}_{\beta=1}$	$R^{M}_{\beta=2}$	$R^{M}_{\beta=3}$
	k=1	0.165	0.606	0.100	0.138	0.037	1.091	0.054	20.905	0.063
AT	k=2	0.035	1	0.035	0.067	0.016	0.497	0.022	8.233	0.026
	k=1	0.170	0.583	0.099	0.099	0.035	0.322	0.051	1.768	0.061
BE	k=2	0.028	1	0.028	0.036	0.011	0.127	0.016	0.722	0.019
	k=1	0.166	0.596	0.099	0.111	0.034	0.567	0.050	7.124	0.060
CY	k=2	0.032	1	0.032	0.056	0.013	0.354	0.018	3.702	0.021
	k=1	0.159	0.628	0.100	0.111	0.033	1.002	0.050	31.868	0.060
DE	k=2	0.041	1	0.041	0.063	0.016	0.602	0.024	21.771	0.028
	k=1	0.160	0.623	0.100	0.086	0.030	1.984	0.046	786.248	0.056
ES	k=2	0.040	1	0.040	0.055	0.015	0.695	0.022	46.850	0.026
	k=1	0.158	0.633	0.100	0.065	0.028	0.228	0.044	3.255	0.054
FI	k=2	0.042	1	0.042	0.043	0.015	0.207	0.023	3.213	0.027
	k=1	0.154	0.651	0.100	0.098	0.032	1.352	0.049	132.422	0.059
FR	k=2	0.046	1	0.046	0.071	0.019	1.216	0.027	123.804	0.032
	k=1	0.166	0.601	0.100	0.061	0.029	0.103	0.046	0.459	0.057
GR	k=2	0.034	1	0.034	0.027	0.012	0.061	0.018	0.370	0.022
	k=1	0.155	0.643	0.100	0.084	0.032	0.332	0.048	4.319	0.058
IT	k=2	0.044	1	0.044	0.055	0.018	0.281	0.026	4.096	0.030
	k=1	0.163	0.610	0.100	0.118	0.033	0.821	0.048	11.569	0.058
LU	k=2	0.036	1	0.036	0.067	0.014	0.642	0.020	10.399	0.023
	k=1	0.168	0.584	0.098	0.089	0.027	1.559	0.042	62.428	0.052
MT	k=2	0.028	1	0.028	0.058	0.010	1.528	0.015	62.377	0.017
	k=1	0.175	0.568	0.100	0.044	0.024	0.058	0.038	0.195	0.048
NL	k=2	0.024	1	0.024	0.015	0.007	0.028	0.011	0.114	0.014
	k=1	0.160	0.625	0.100	0.121	0.036	1.802	0.053	111.408	0.063
PT	k=2	0.040	1	0.040	0.077	0.017	1.634	0.025	108.571	0.029
	k=1	0.167	0.589	0.098	0.053	0.027	0.074	0.043	0.173	0.054
SI	k=2	0.030	1	0.030	0.026	0.011	0.050	0.016	0.140	0.019
	k=1	0.171	0.581	0.099	0.059	0.027	0.120	0.043	0.486	0.053
SK	k=2	0.028	1	0.028	0.022	0.010	0.046	0.015	0.154	0.018

A.12. Multidimensional Affluence Measures for top 99% quantile.

Table A.8

Country	*Second cut-off*	***HR(k)***	***AAS(k)***	$R^{M}_{HR}(k)$	$R^{M}_{\alpha=1}$	$R^{M}_{\alpha=2}$	$R^{M}_{\alpha=3}$	$R^{M}_{\beta=1}$	$R^{M}_{\beta=2}$	$R^{M}_{\beta=3}$
AT	k=1	0.019	0.518	0.010	0.008	0.003	0.019	0.005	0.067	0.006
	k=2	0.001	1	0.001	0.000	0.000	0.000	0.045	0.001	0.000
BE	k=1	0.019	0.523	0.010	0.005	0.003	0.006	0.004	0.008	0.005
	k=2	0.001	1	0.001	0.000	0.000	0.000	0.424	0.000	0.000
CY	k=1	0.016	0.566	0.009	0.008	0.003	0.016	0.005	0.045	0.005
	k=2	0.002	1	0.002	0.003	0.001	0.002	0.134	0.010	0.002
DE	k=1	0.018	0.563	0.010	0.010	0.003	0.036	0.005	0.296	0.006
	k=2	0.002	1	0.002	0.003	0.001	0.001	0.117	0.165	0.002
ES	k=1	0.017	0.599	0.010	0.012	0.004	0.211	0.005	28.362	0.006
	k=2	0.003	1	0.003	0.007	0.002	0.002	0.444	2.165	0.002
FI	k=1	0.016	0.619	0.010	0.007	0.003	0.020	0.004	0.127	0.005
	k=2	0.004	1	0.004	0.005	0.001	0.002	0.223	0.125	0.003
FR	k=1	0.016	0.630	0.010	0.011	0.003	0.102	0.005	3.115	0.006
	k=2	0.004	1	0.004	0.008	0.002	0.003	0.163	2.908	0.003
GR	k=1	0.019	0.531	0.010	0.004	0.002	0.005	0.003	0.018	0.004
	k=2	0.001	1	0.001	0.001	0.000	0.001	0.880	0.014	0.001
IT	k=1	0.017	0.582	0.010	0.006	0.003	0.011	0.004	0.049	0.005
	k=2	0.003	1	0.003	0.002	0.001	0.001	0.101	0.034	0.002
LU	k=1	0.017	0.585	0.010	0.011	0.004	0.026	0.006	0.076	0.007
	k=2	0.003	1	0.003	0.004	0.001	0.002	0.188	0.045	0.002
MT	k=1	0.017	0.593	0.010	0.017	0.003	0.195	0.005	2.924	0.006
	k=2	0.003	1	0.003	0.003	0.001	0.002	0.120	0.009	0.002
NL	k=1	0.019	0.534	0.010	0.003	0.002	0.003	0.003	0.005	0.004
	k=2	0.001	1	0.001	0.001	0.000	0.001	0.142	0.003	0.001
PT	k=1	0.017	0.575	0.010	0.011	0.003	0.085	0.005	1.323	0.006
	k=2	0.003	1	0.003	0.006	0.001	0.002	0.050	1.266	0.002
SI	k=1	0.019	0.517	0.010	0.003	0.002	0.002	0.004	0.002	0.005
	k=2	0.001	1	0.001	0.000	0.000	0.000	0.003	0.001	0.000
SK	k=1	0.019	0.531	0.010	0.005	0.003	0.008	0.004	0.022	0.005
	k=2	0.001	1	0.001	0.001	0.000	0.001	0.584	0.001	0.001

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