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EUROSISTEMA

Energy poverty in Italy*

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** The views expressed are those of the authors and do not involve the responsibility of the Bank of Italy*

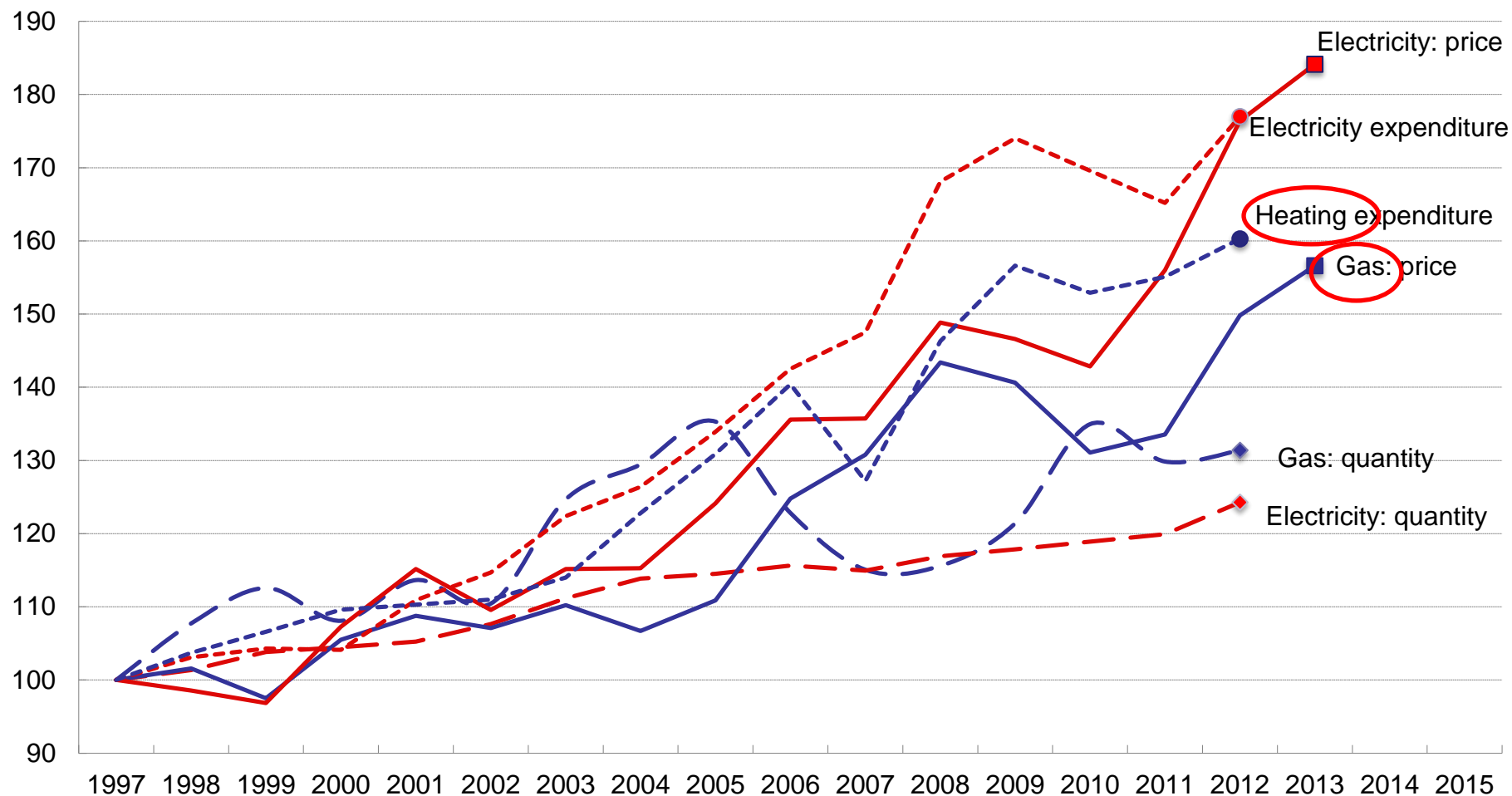
Outline of the presentation

1. Evidence of households' (HHs) “energy stress”
2. Issues in measuring Households' (Energy) Poverty (EP)
3. Comparison among different EP measures
4. Are “energy bonus” an effective tool to fight against EP?
5. Conclusions and the way forward



Some evidence on HHs «energy stress»

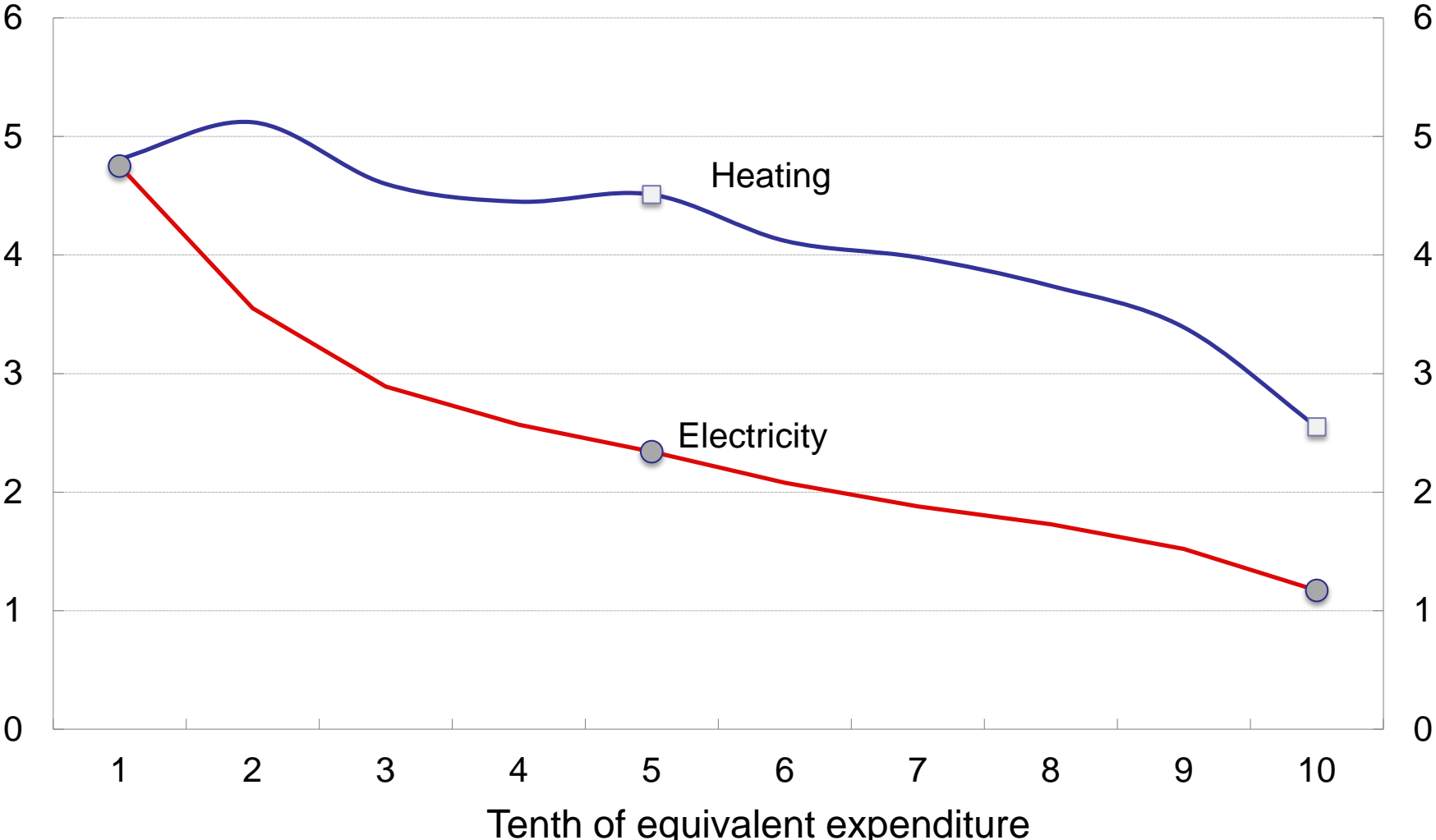
Prices, quantities and expenditure for electricity and gas: households (1997=100)



Source: our computation on MiSE, Eurostat, AEEGSI and HBS data

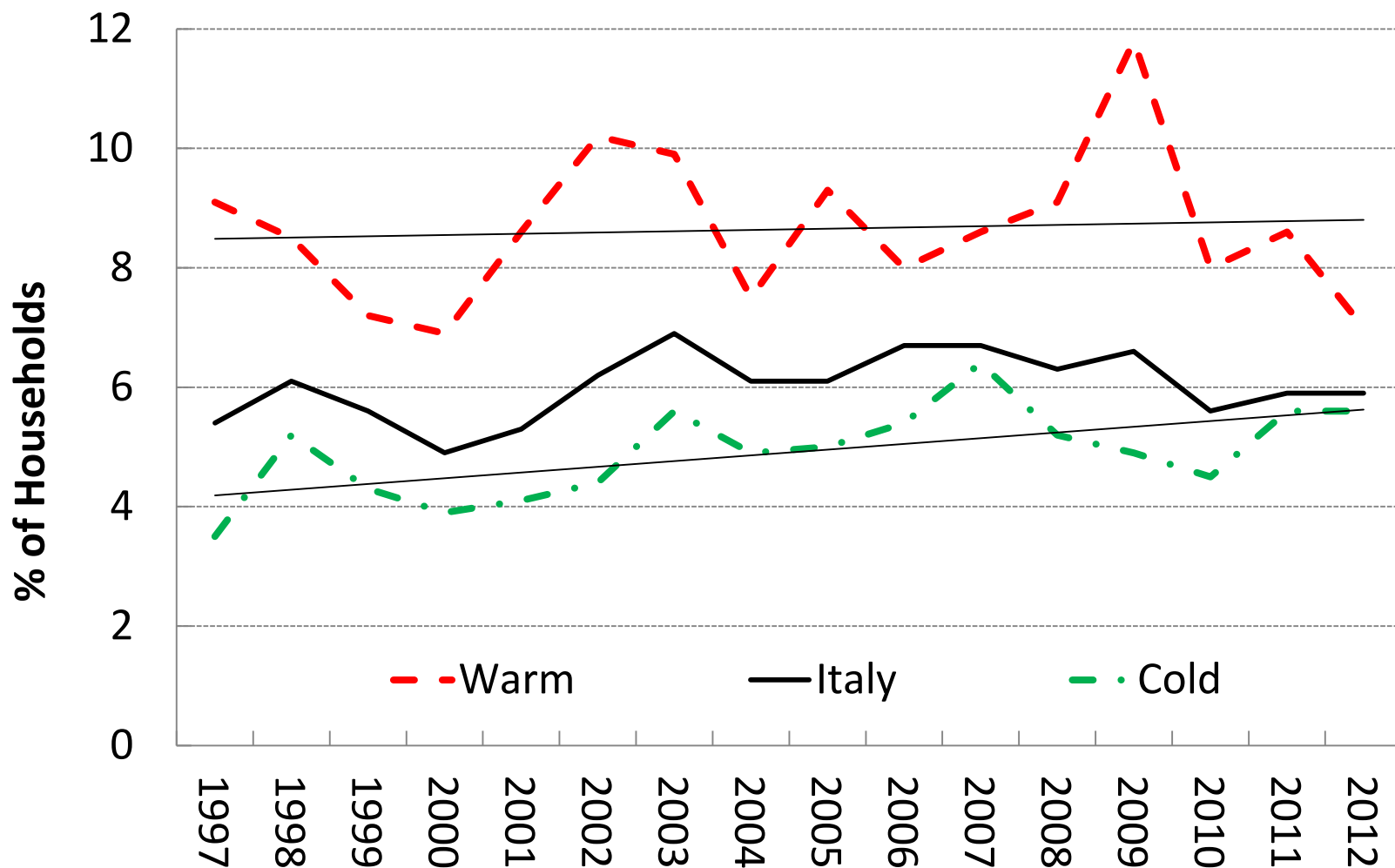
Energy expenditure and welfare: 2012

(percentage points of total expenditure)



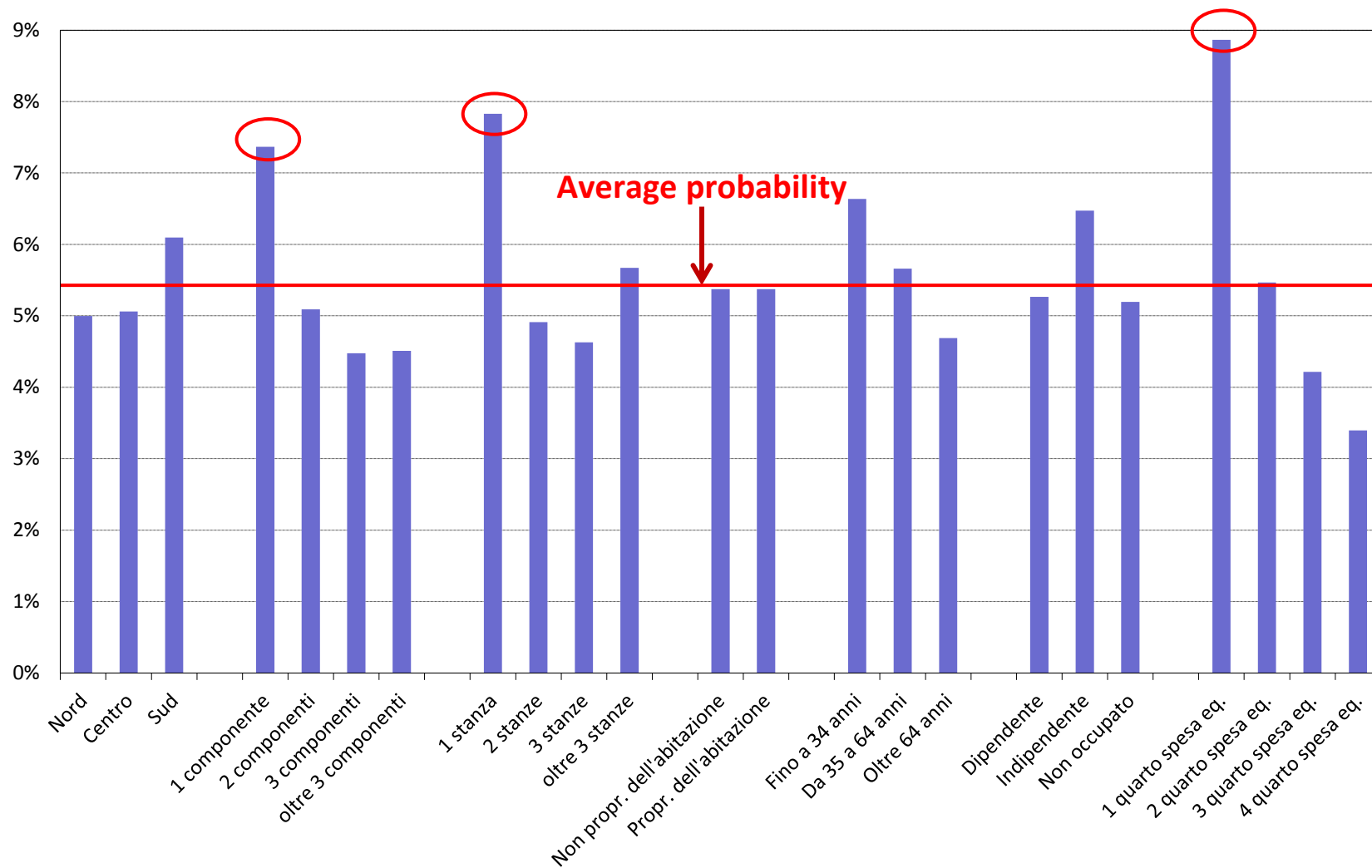
Source: our computation on HBS data

EP and HHs with no heating expenditure



Source: our computation on HBS data

Who are the HHs with no heating expenditure?



Source: our computation on HBS data

Literature review

UK 

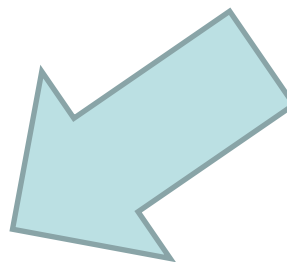
- Boardman (1991, 2010)
- Hills (2011)

EU 

- EPEE Project
- Commissione europea (2010)

ITA 

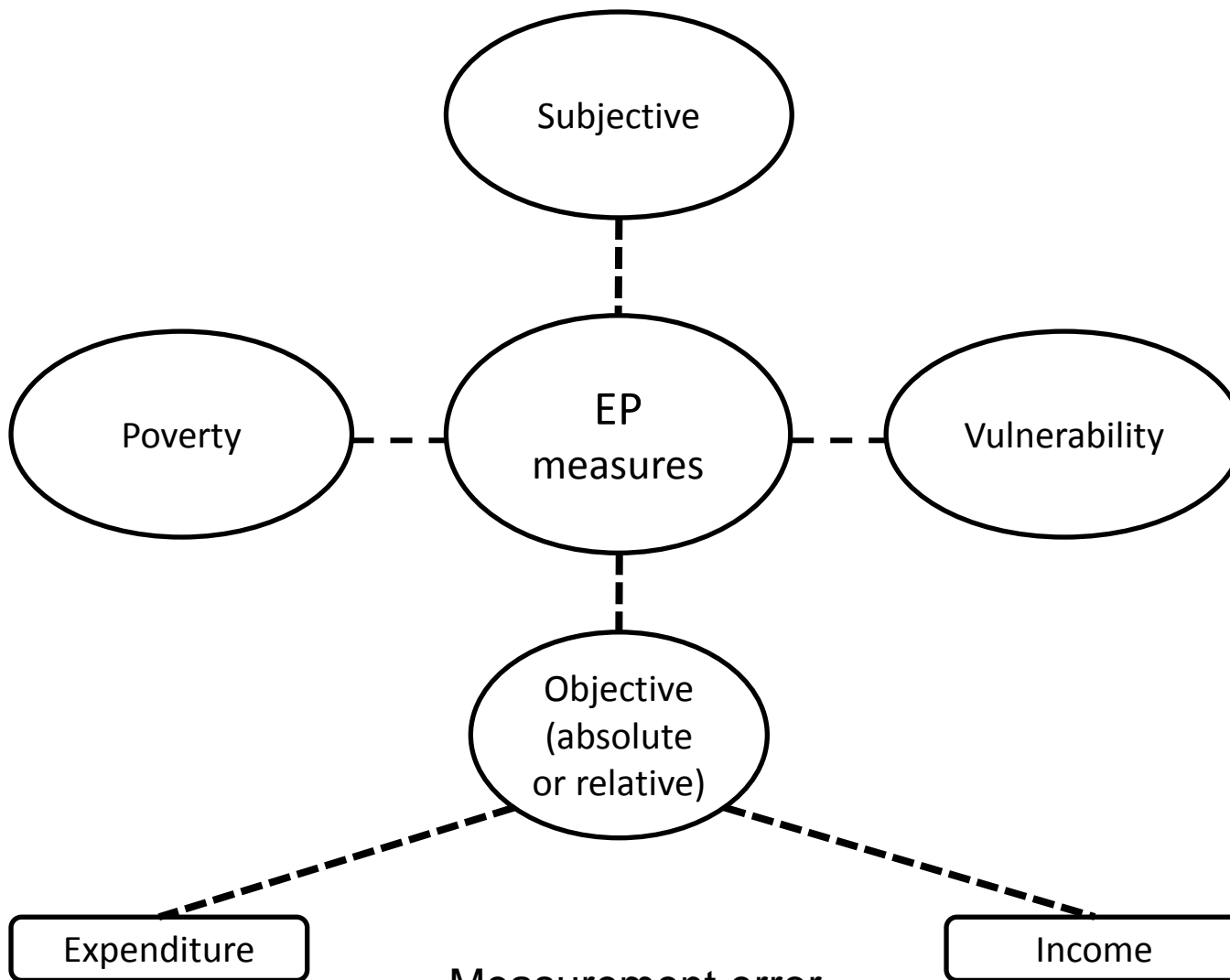
- Miniaci et al. (2008, **2014**)
- AEEGSI (**2014**)





Issues in measuring EP

A taxonomy of EP measures (headcounts)



Measurement error
Headcount vs poverty intensity

Datasets and Symbols

Datasets (survey microdata)

SILC Survey on income and living conditions (Istat)

HBS Household budget survey (Istat)

SHIW Survey on household income and wealth (Bank of Italy)

Symbols (all at the household level)

y = disposable income

S = expenditure

S^{eq} = equivalent expenditure ($S_i/\sqrt{n_i}$)

s_e = energy expenditure (heating and electricity)

s^e = electricity expenditure

s^r = heating expenditure

w = survey weight

$I()$ = indicator function: $I(true)=1$; $I(false)=0$

1st measure - γ_1 – energy expenditure greater than 10% of disposable income

Class: objective, income-based

Dataset: SILC

Previously adopted? Yes, UK (Boardman, 1991)

$$\gamma_1 = \frac{1}{n} \sum_{i=1}^n w_i I \left(\frac{s_{ie}}{y_i} > 0.1 \right)$$

1st measure bis - γ_{1a} – electricity expenditure greater than 5% of disposable income and heating expenditure greater than 10% of disposable income

Class: objective, income-based

Dataset: SILC

Previously adopted? Yes, Miniaci et al. (2008, 2014); AEGGSI (2014)

$$\gamma_{1a} = \frac{1}{n} \sum_{i=1}^n w_i I \left(\left\{ \frac{s_i^e}{y_i} > 0.05 \right\} \cup \left\{ \frac{s_i^r}{y_i} > 0.1 \right\} \right)$$

2nd measure - γ_2 - energy expenditure greater than 10% of total expenditure

Class: objective, expenditure-based

Dataset: HBS

Previously adopted? No

$$\gamma_2 = \frac{1}{n} \sum_{i=1}^n w_i I \left(\frac{S_{ie}}{S_i} > 0.1 \right)$$

3rd measure – γ_3 - energy expenditure greater than twice the average

Class: objective, expenditure-based

Dataset: HBS

Previously adopted? Yes, EC (2010)

$$\gamma_3 = \frac{1}{n} \sum_{i=1}^n w_i I \left[\frac{S_{ie}^{eq}}{S_i^{eq}} > 2 * \left(\frac{\sum_{i=1}^n S_{ie}^{eq}}{\sum_{i=1}^n S_i^{eq}} \right) \right]$$

4th measure – γ_4 - energy expenditure greater than twice the conditional median

Class: objective-relative, expenditure-based

Dataset: HBS

Previously adopted? No

$$\gamma_4 = \frac{1}{n} \sum_{i=1}^n w_i I \left[\left(q_i^e + q_i^r \right) > 2 \left(\hat{q}_j^e + \hat{q}_j^r \right) \right]$$

Covariates: climate zone (4), family type (12),

5th measure - θ - absolute energy poverty

Class: objective-absolute, expenditure-based

Dataset: HBS

Previously adopted? No

$$\theta = \frac{1}{n} \sum_{i=1}^n w_i I \left[\left(s^e_i + s^r_i \right) < \left(\tilde{s}^e_h + \tilde{s}^r_j \right) \right]$$

6th measure – δ_1 - subjective energy poverty

Class: subjective

Dataset: SILC

Previously adopted? EPEE

Question HH050 - «Could you afford to adequately heat the house in which you live?»

7th measure – δ_2 - subjective energy poverty

Class: subjective

Dataset: SILC

Previously adopted? EPEE

Question HS020 – «In the last 12 months, there have been periods in which you were in arrears with the payment of bills, for example, those for the gas or the electricity? »

8th measure – δ_3 - subjective energy poverty

Class: subjective

Dataset: SILC

Previously adopted? EPEE

Question HH040 – «Leaking roof, damp walls/floors/foundation, or rot in window frame or floor»

9th measure – η_1 - Low Income High Costs (LIHC) – ver UK

Class: objective, relative, composite, income-based

Dataset: SILC

Previously adopted? Yes: UK from 2013 (proposed in Hills, 2011)

$$\eta_1 = \frac{1}{n} \sum_{i=1}^n w_i \left\{ I \left[s_{ie}^{eq} > P50_t \left(s_{ie}^{eq} \right) \right] * I \left[\left(y_i^{eq} - s_{ie}^{eq} \right) < y_J^* \right] \right\}$$

10th measure – η_2 - Low Expenditure High Costs (LEHC)

Class: objective, relative, composite, income-based

Dataset: HBS

Previously adopted? No.

$$\eta_2 = \frac{1}{n} \sum_{i=1}^n w_i \left\{ I \left[\frac{S_{ie}^{eq}}{S_i^{eq}} > 2 * \frac{\left(\sum_{i=1}^n S_{ie}^{eq} \right)}{\sum_{i=1}^n S_i^{eq}} \right] * I \left[(s_i - s_{ie}) < s_J^* \right] \right\}$$

11th measure – η_3 - LEHC+low expenditure No heating

Class: objective, relative, composite, income-based

Dataset: HBS

Previously adopted? No.

$$\eta_3 = \frac{1}{n} \sum_{i=1}^n w_i \left\{ \begin{array}{l} I \left[\frac{s_{ie}^{eq}}{s_i^{eq}} > 2 * \left(\frac{\sum_{i=1}^n s_{ie}^{eq}}{\sum_{i=1}^n s_i^{eq}} \right) \right] * I \left[(s_i - s_{ie}) < s_J^* \right] \cup \\ \left[I(s_i^r = 0) * I(s_i^{eq} < P50_t(s_i^{eq})) \right] \end{array} \right\}$$

Summing up

12 measures:

3 subjective ($\delta_1, \delta_2, \delta_3$)

9 objective

2 relative (γ_3, γ_4), 3 «quasi» relative
($\gamma_1, \gamma_{2a}, \gamma_2$)

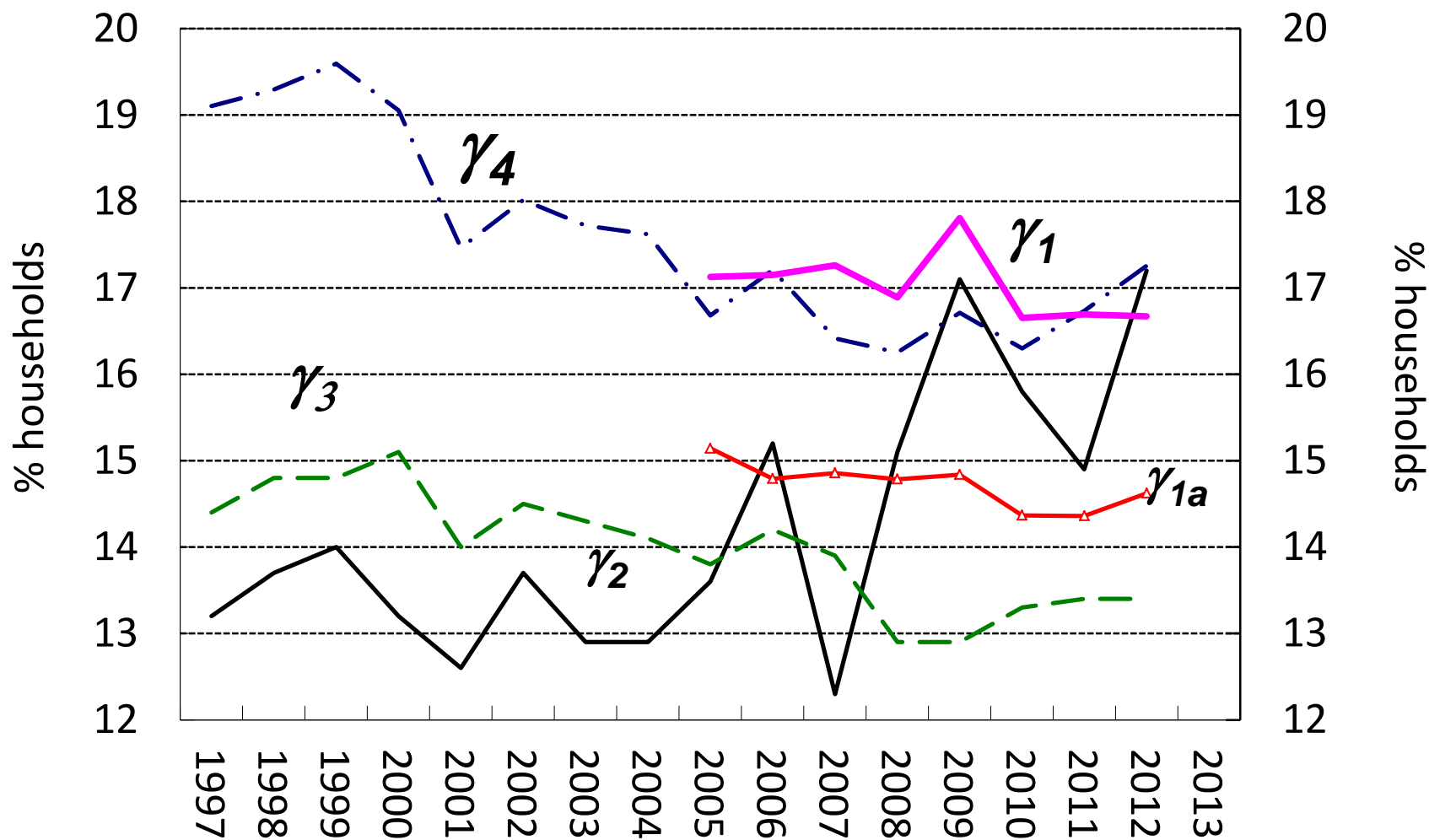
1 absolute (θ)

3 «composite» (η_1, η_2, η_3)

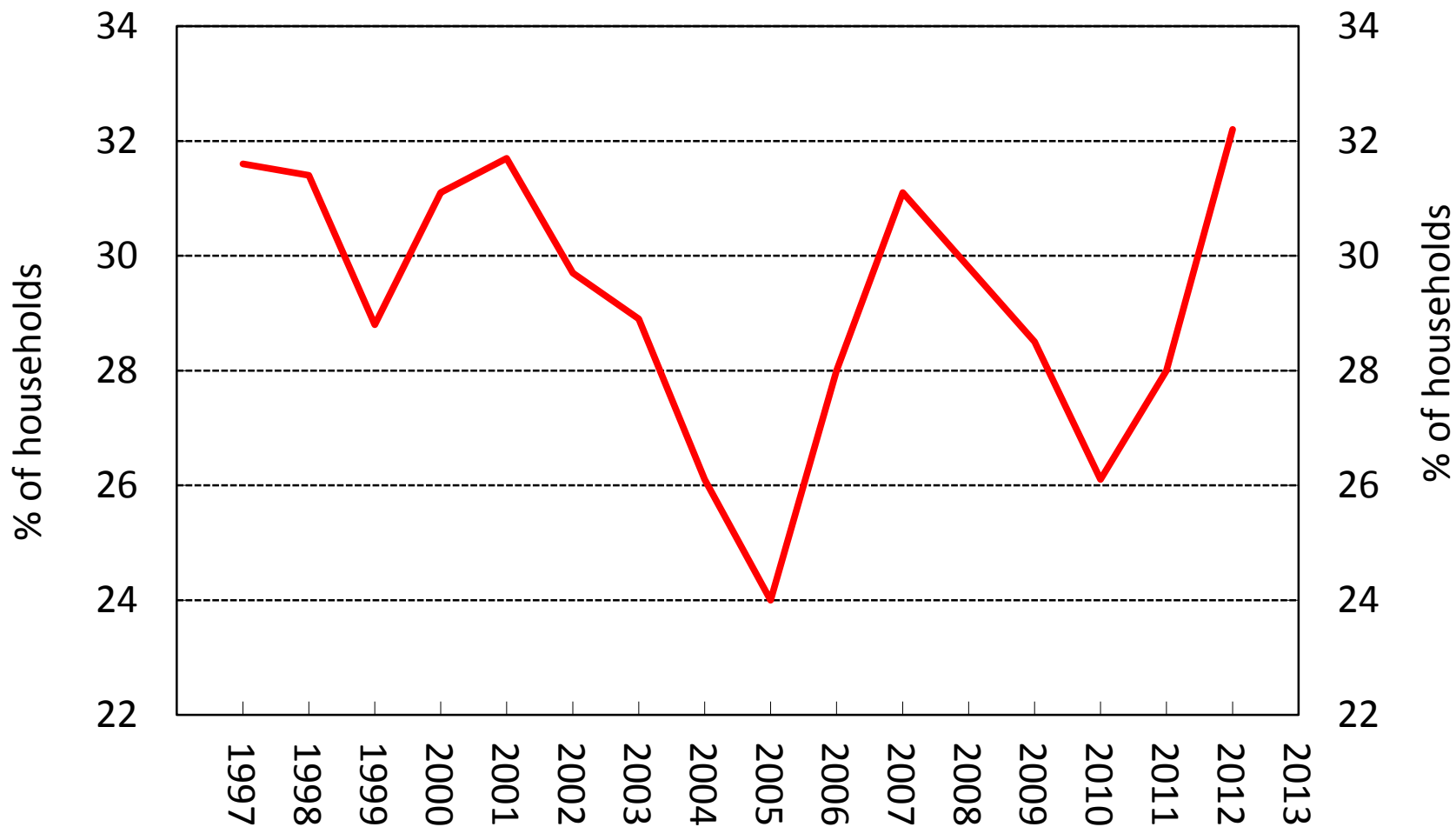


Comparison across different indicators

Relative and «quasi relative» measures

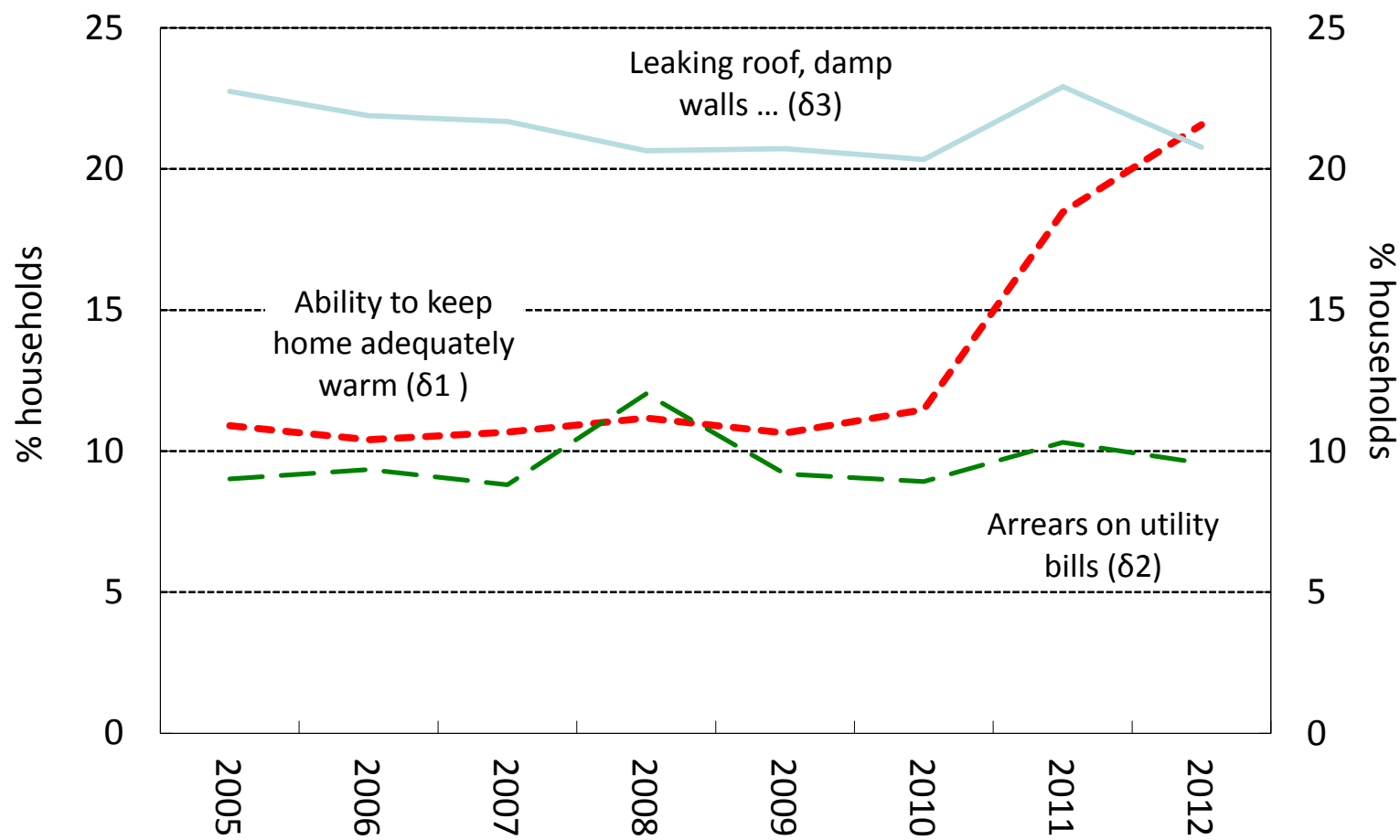


Absolute measure



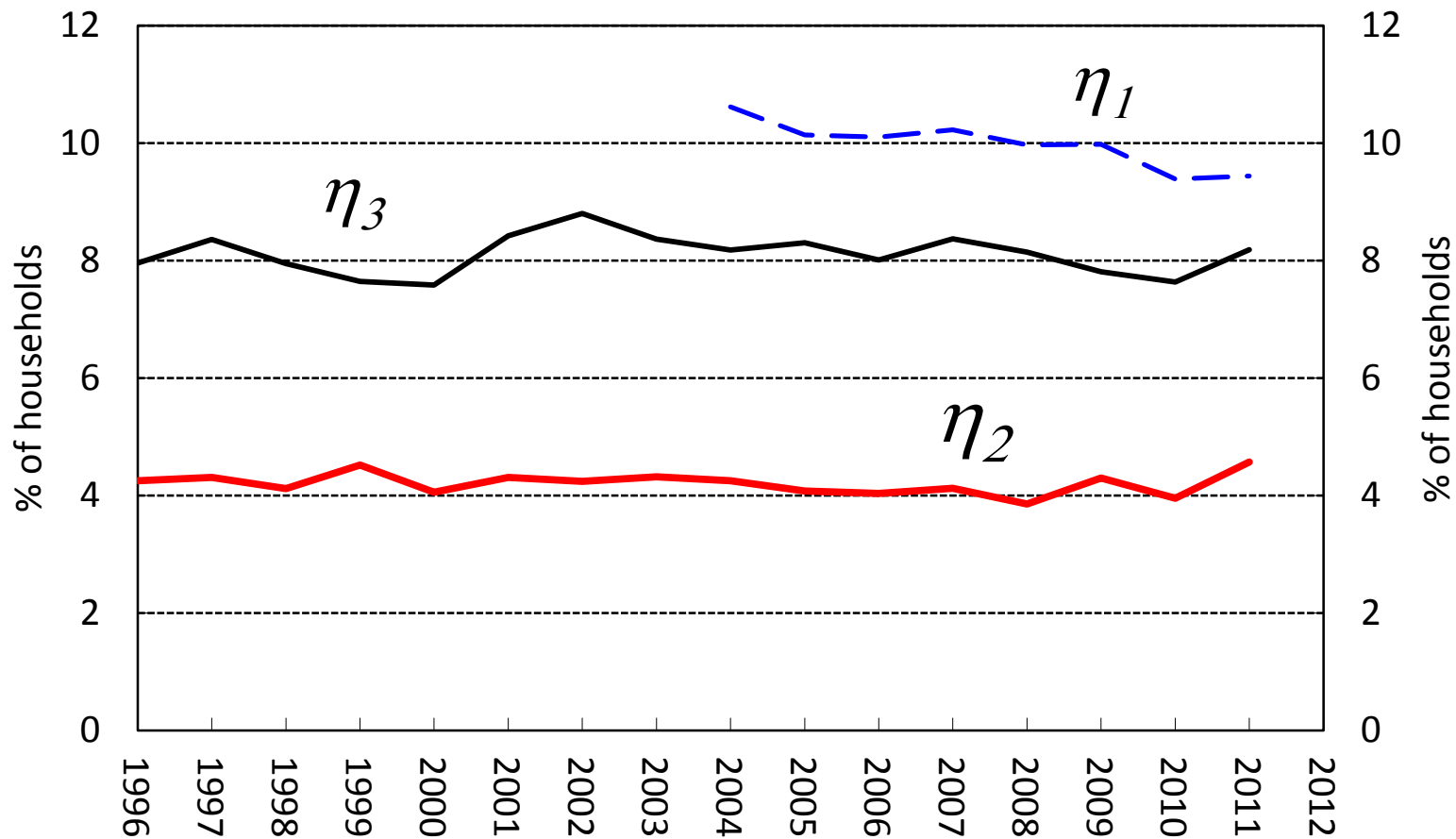
Source: our computation on HBS data

Subjective measures



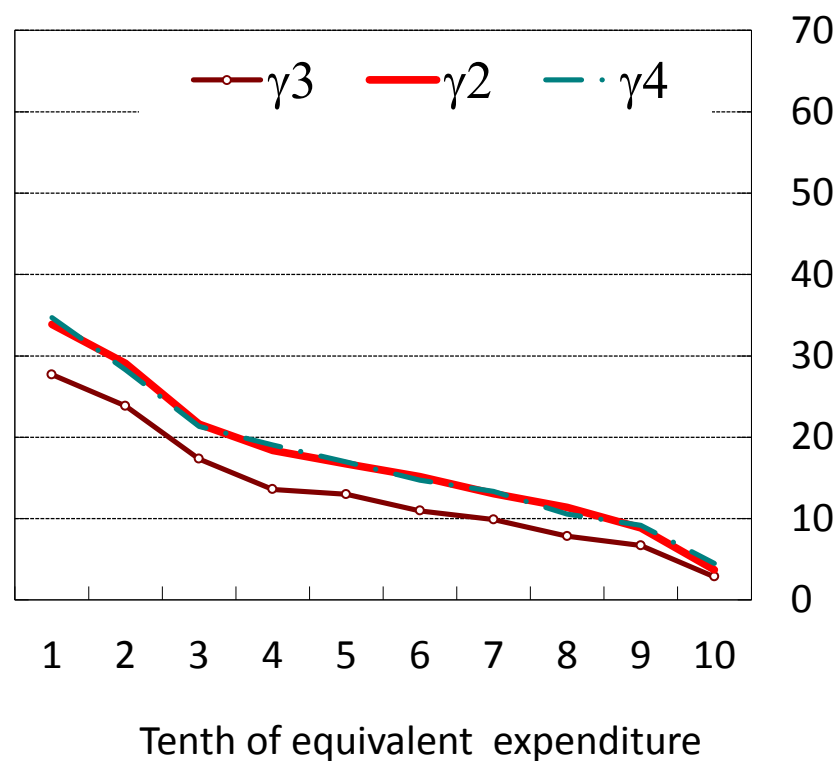
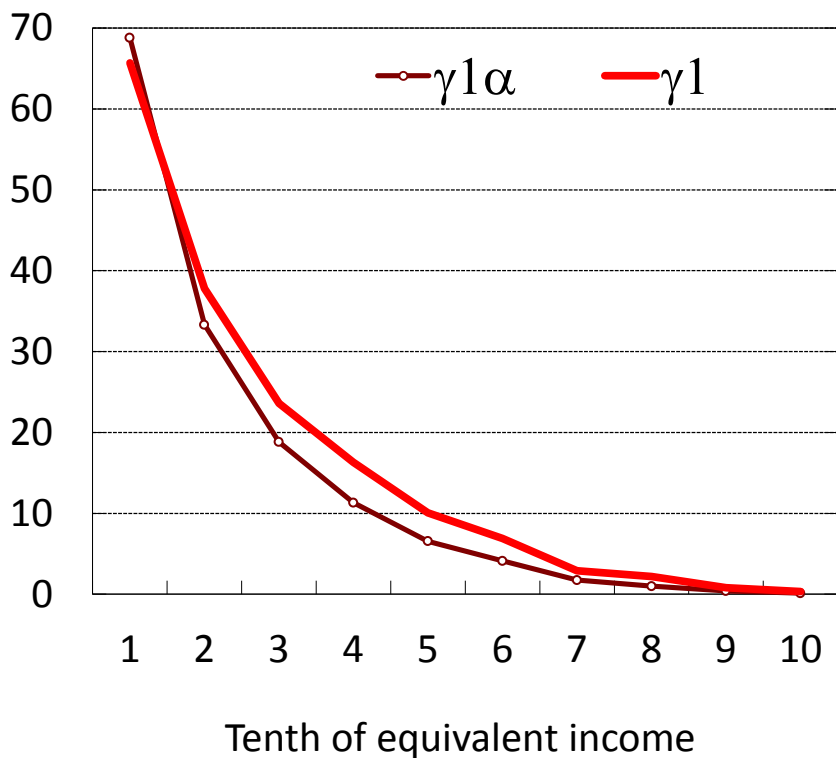
Source: our computation on SILC data

Composite measures

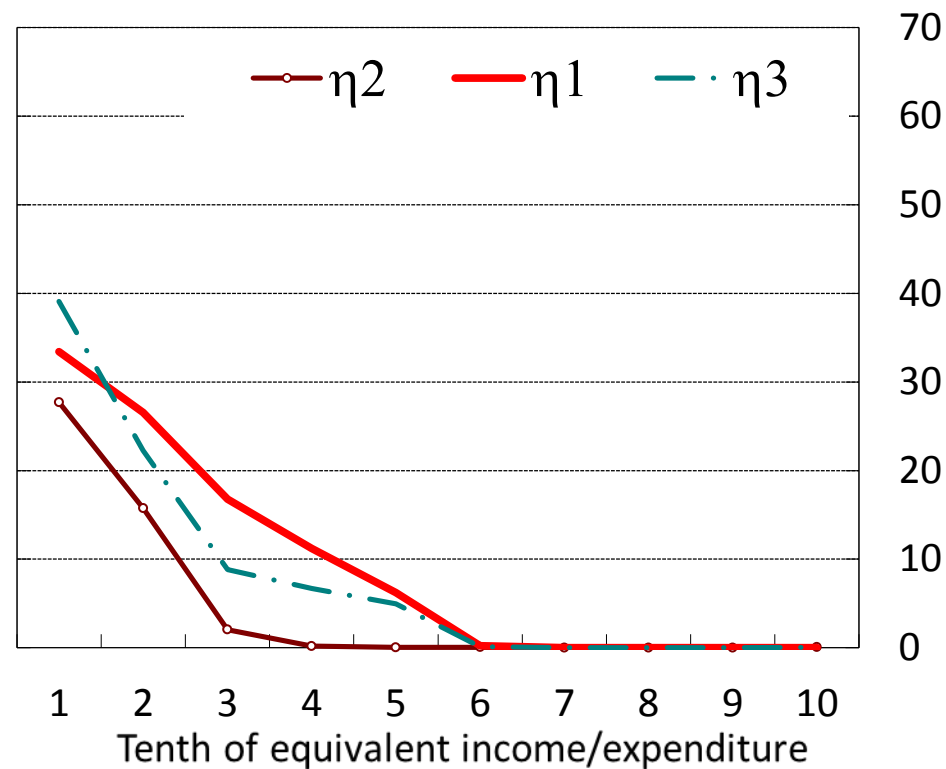
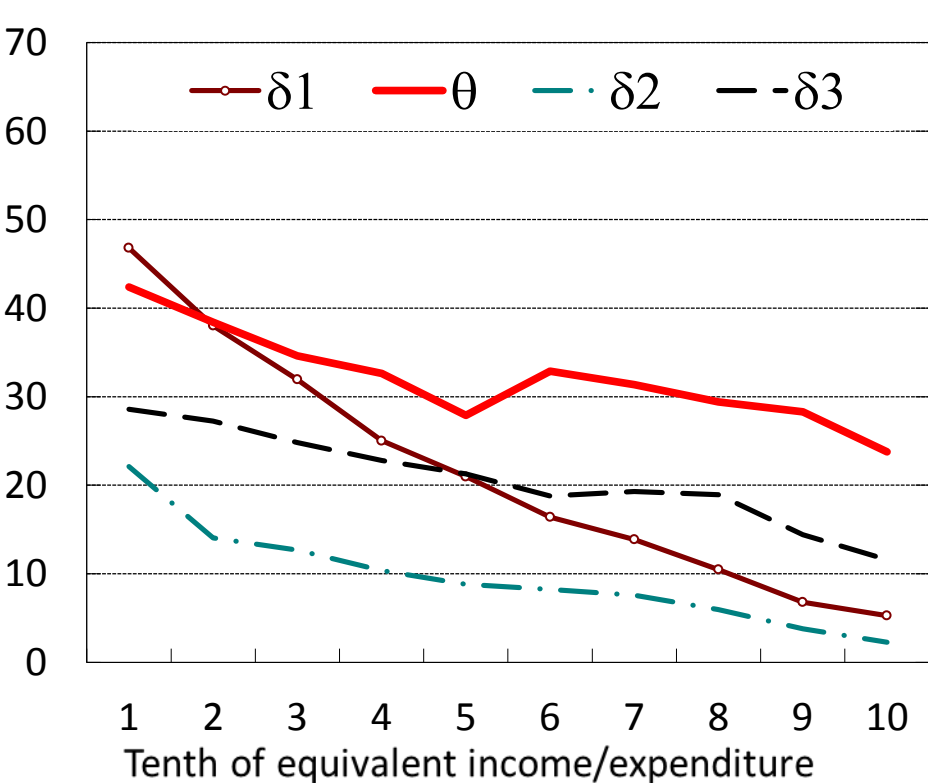


Source: our computation on SILC and HBS data

EP indicators in the welfare distribution



EP indicators in the welfare distribution





Pros and cons of the EP measures

EP Indicator	Communication Efficacy	Conveyed information	Quality of the estimator	Data Quality	Length of the series	Cross-country comparability	Synthesis
$\gamma_1, \gamma_{1\alpha}$	😊	😐	😞	😞	😞	😞	😞😞😞
γ_2	😊	😞	😞	😊	😊	😞	😐
γ_3	😊	😐	😊	😊	😊	😞	😊😊😊
γ_4	😞	😊	😊	😊	😊	😞	😊😊
δ_1	😊	😞	😞	😞	😞	😊	😞😞
δ_2	😊	😞	😞	😞	😞	😊	😞😞
δ_3	😊	😞	😞	😞	😞	😊	😞😞
θ	😊	😐	😞	😊	😊	😞	😊
η_1	😐	😊	😊	😞	😞	😞	😞
η_2	😐	😊	😊	😊	😊	😞	😊😊😊
η_3	😐	😊😊	😊	😊	😊	😞	😊😊😊😊



We select η_3

Traits of the EP households

	η_3		
	1997	2005	2012
Geographical area			
North	5,4	5,8	6,1
Center	5,2	5,9	5,2
South	12,8	13,1	13,1
Household size			
1 member	10,3	10,1	7,8
2 members	8,3	8,1	7,5
3 members	6,2	6,0	8,8
more than 3 members	7,2	7,9	9,0
Dwelling size			
1 room	13,6	19,8	6,7
2 rooms	10,7	13,2	10,6
3 rooms	10,3	10,7	9,0
more than 3 rooms	7,0	6,9	7,6
Homeowner			
No	10,5	11,6	12,2
Yes	6,8	6,9	6,6
Age (Reference person - RP)			
Up to 34	5,5	6,7	9,6
35-64	6,5	6,2	7,3
64+	11,7	11,8	9,3
Job status of the RP			
Employee	5,5	5,4	6,4
Self-employed	5,5	5,4	6,3
Unemployed – Out of the labour force	10,7	11,1	10,1
Fourths of equivalent expenditure			
1°	25,4	26,5	26,6
2°	6,4	6,2	6,1
3°	0,0	0,0	0,0
4°	0,0	0,0	0,0
Total	8,0	8,2	8,2



Do policies aimed at reducing households energy bill alleviate energy poverty?

Policies aimed at reducing households energy bill

1975 Provision in favor of families with low energy consumption

2003 Proposal of the Authority for Electricity and Gas (AEEGSI) of a preferential tariff triggered when household income falls short of a threshold determined by the Equivalent Economic Situation Indicator (ISEE)*.

2009 In order to contrast the effect of increasing costs for heating and electricity on vulnerable households the Government launches an energy rebate for electricity and gas (“bonus gas” and “bonus elettrico”)

* The ISEE is an indicator that takes into account households' income, net wealth and size. It serves as a mean-tested screening in order to select those families that can have access to social benefits or subsidized care services.

Households receiving the energy bonuses

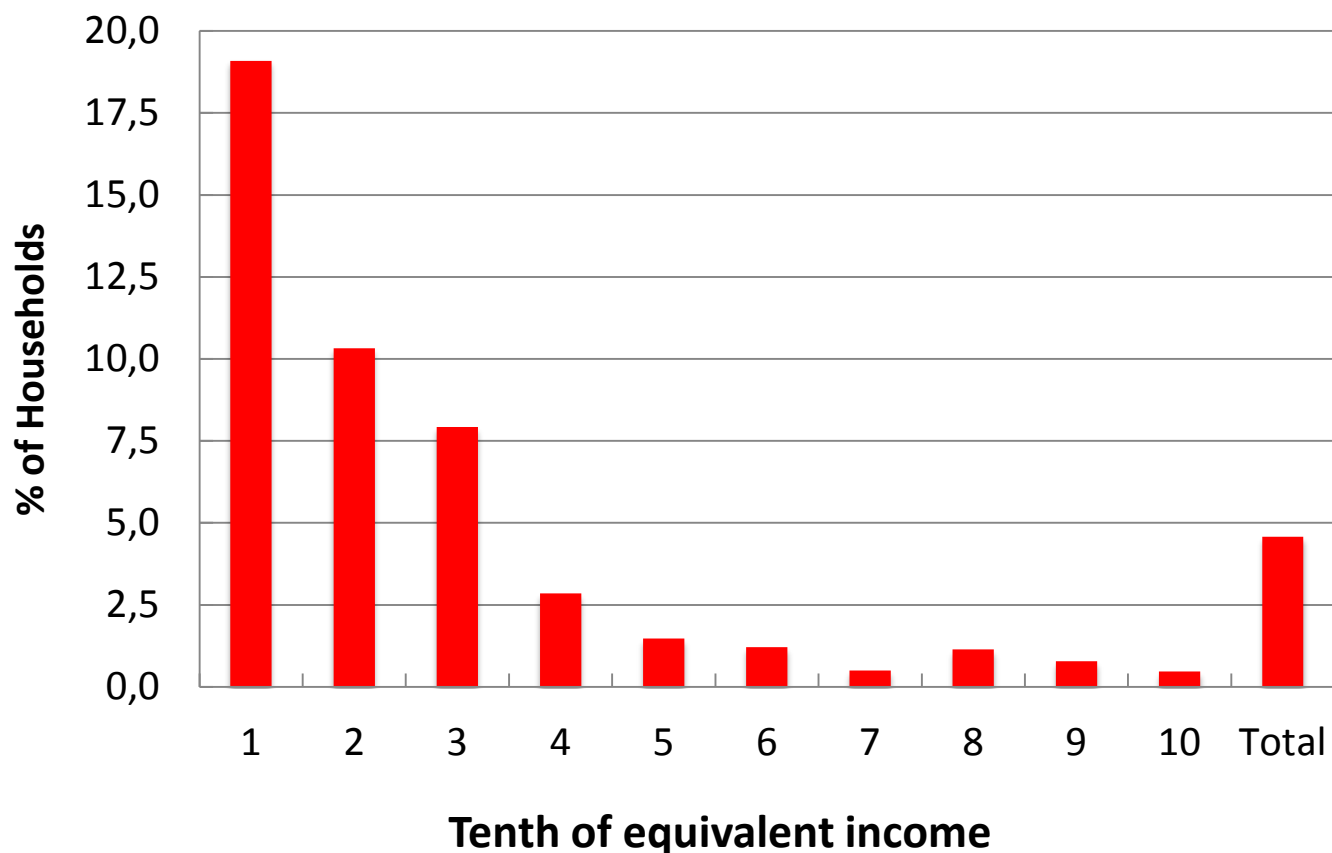
	Bonus elettrico	Bonus gas	Bonus elettrico or bonus gas*
2008	1.061.109	-	1.061.109
2009	1.035.855	604.078	1.639.933
2010	971.776	637.757	1.609.533
2011	996.090	624.717	1.620.807
2012	946.727	611.695	1.558.422
2013	966.511	626.869	1.593.380

* Assuming that the same family can not qualify for both transfers

An estimate of the energy rebates (euro per year)

Household size	2009	2010	2011	2012	2013
1-2 members	183	185	199	236	261
3-4 members	200	201	215	254	281
5+ members	289	290	316	369	408
% of households' energy expenditure (all households)					
1-2 members	13,0	13,6	14,6	16,6	
3-4 members	10,6	10,9	11,9	13,6	
5+ members	14,2	14,5	16,9	18,5	
% of households' energy expenditure (households receiving the bonus)					
1-2 members	16,4	16,3	17,6	19,7	
3-4 members	12,5	13,1	14,4	15,7	
5+ members	18,6	15,2	19,9	23,5	

And the energy rebate goes to ... (SHIW 2012)





Do the energy rebates reach EP households?

An exercise using stochastic simulation

Simulation of the households benefiting from the energy rebate (4 stages)

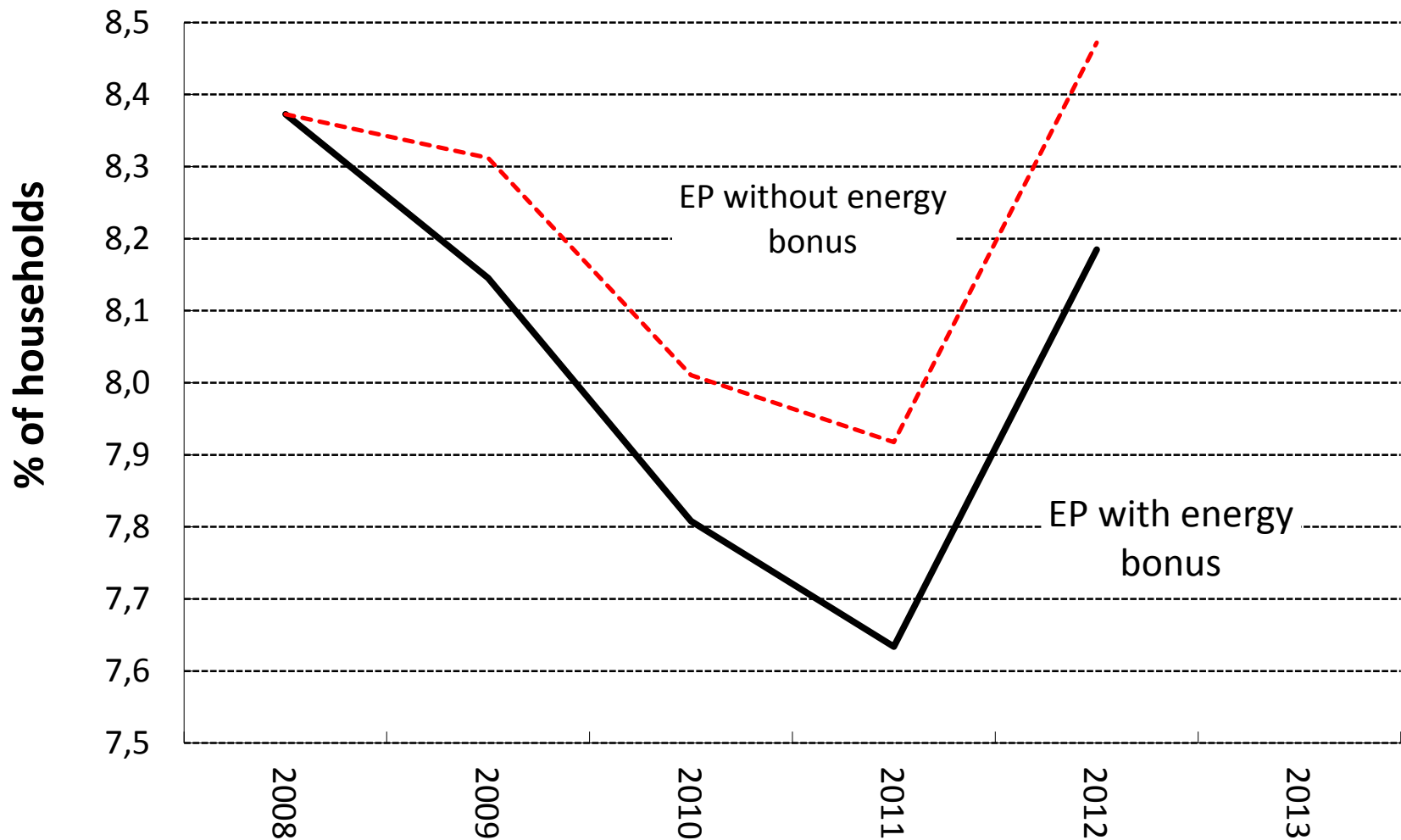
1. We use the SHIW to approximate the ISEE for each household in the sample (info on income and net wealth)
2. On the same dataset, we then estimate for each household the eligibility condition (ISEE computed $<$ threshold) and the probability that she demanded the bonus using two logistic regressions (item in the SHIW questionnaire from 2012)
3. The parameters of these regressions are then projected on HBS data and fitted probabilities are calibrated using the information published in AEEG, 2013.
4. Finally the estimated probabilities are compared with a sequence of random variates (Bernoulli trial)

First results are not encouraging...

In 2012 the i -th household ...

	... receive the energy bonus?		Total
... is energy poor (η_3)?	No	Yes	
No	21.791.058	1.374.173	23.165.231
Yes	1.784.200	280.863	2.065.063
Total	21.791.058	1.374.173	23.165.231

First results are not encouraging...



Source: our computation on AEEGSI, SHIW and HBS data

Conclusions

- According to our EP indicator in the period 1997-2012, the proportion of EP households has been stable at around 8% (higher but stable in warm regions and lower but growing in other areas).
- The probability of being EP is higher for households in the lower part of the expenditure distribution, living in the south, that do not own their residence. In a multivariate framework the economic vulnerability doubles the probability of being an EP family.

Conclusions

- According to our simulations, the tools to contrast EP (the energy bonus) had a modest effect (taking out of poverty an average of 71,000 households in 2009-2012).
- The results of this stochastic exercise should be considered with caution although they are consistent with the limited scope of the bonus which excludes households without heating expenditure and those that use different fuels for heating purposes.

What next?

- Impact assessment of different renewable financing strategies on EP (e.g. carbon tax vs electricity bill vs income taxation)

From a methodological point of view

- Assessment of the statistical variability of the measures (sampling variability)
- Appraising of the stochastic nature of the Bernoulli experiment (multiple imputation framework to assess uncertainty)



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Thanks for you attention