Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Targeting Efficiency in Means Testing: A Comparison of Money-Metric and Counting Approaches

Federico Perali

federico.perali@univr.it

University of Verona

Martina Menon

University of Verona

Eva Sierminska

Luxembourg Institute of Socio-Economic Research

Research Article

Keywords: Means testing, multidimensional poverty, asset-based poverty, well-being, targeting efficiency

Posted Date: August 4th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10143309/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Targeting Efficiency in Means Testing: A Comparison of Money-Metric and Counting Approaches *

Martina Menon†, Federico Perali‡and Eva Sierminska§

June 24, 2026

June 2026

Abstract

The design of means-testing instruments requires not only choosing what information to collect about households, but deciding how that information should be aggregated into eligibility criteria. This paper addresses the second, comparatively neglected question by comparing the targeting efficiency of two multidimensional approaches to means testing, a money-metric index and a counting-based poverty measure, applied to an identical informational base comprising monetary resources, asset holdings, and household demographic characteristics. Because both frameworks draw on the same dimensions, the same deprivation thresholds, and the same equivalence scales, any difference in targeting performance can be attributed exclusively to aggregation structure. Using household-level data, we assess the relative ability of each approach to correctly identify eligible beneficiaries against an externally defined benchmark. The results show that the money-metric approach, which aggregates dimensions cardinally in a welfare-theoretically consistent manner that preserves interpersonal comparability, delivers substantially lower targeting errors than the counting approach, which treats dimensions as binary and non-compensable. These findings establish that aggregation structure, independently of informational content, is a first-order determinant of means-testing performance, with direct implications for the design and harmonization of social protection eligibility criteria.

Keywords: Means testing, multidimensional poverty, asset-based poverty, well-being, targeting efficiency.
JEL Classification: D13, H31, I32, O15.

*The authors have benefited from helpful comments and suggestions from Rolf Aaberge, Francesco Andreoli, Emanuele Bracco, Gaurav Datt, Koen Decancq, Eugenio Peluso, Jacques Silber, and Claudio Zoli. All errors or omissions are the sole responsibility of the authors.

†Department of Economics, University of Verona, via Cantarane 24, 37129 Verona (Italy), telephone: +39 045 80 28 420, email: martina.menon@univr.it.

‡Corresponding author: Department of Economics, University of Verona, via Cantarane 24, 37129 Verona (Italy), telephone: +39 045 80 28 486, email: federico.perali@univr.it.

§LISER, Maison des Sciences Humaines 11, Porte des Sciences, Belval (Luxembourg), telephone: +352 58 58 55 409, email: eva.sierminska@liser.lu.

1 Introduction

The effectiveness of means-testing instruments depends on two distinct choices: what information to collect about households, and how to aggregate that information into a poverty classification. The first choice has received sustained attention in the literature, generating debate about the relative merits of income, consumption, assets, and multidimensional deprivation indicators. The second choice, how dimensions of deprivation should be combined once selected, has received comparatively less scrutiny, yet it is equally consequential. Two instruments that draw on identical information about a household's income, wealth, and circumstances can produce systematically different eligibility classifications simply by virtue of how they aggregate that information. Understanding which aggregation structure performs better is therefore a fundamental question for the design of means-testing instruments, prior to and independent of any particular distributional context.

This paper addresses that question directly. We compare two multidimensional approaches to means testing, a money-metric index and a counting-based poverty measure, constructed from an identical set of deprivation dimensions: the same monetary resources, the same asset holdings, and the same household demographic characteristics. The money-metric approach aggregates these dimensions cardinally into a single welfare-consistent indicator, preserving interpersonal comparability through equivalence scales grounded in expenditure function theory. The counting approach identifies households as deprived dimension by dimension, relative to dimension-specific cutoffs, and classifies them as poor when deprivations exceed a threshold, without requiring cardinal aggregation or interpersonal comparability. By holding all informational content constant across both approaches, we isolate the pure effect of aggregation structure on targeting performance.

These findings have direct relevance for ongoing efforts to modernize and harmonize eligibility criteria, particularly within the European Union, where social protection systems face increasing fiscal pressure (World Bank 2022; OECD 2023; Costella et al. 2024), member states rely on markedly different approaches to means testing (Marchal and Van Mechelen 2017), and cross-country coordination is an explicit policy objective (European Commission 2017; Cantillon and Vandenbroucke 2014; Immervoll 2012).

Means testing is traditionally employed to determine eligibility for income-support programs, such as universal credit schemes or guaranteed minimum-income benefits, and relies on metrics that capture economic disadvantage.[1] Most commonly, eligibility assessments are based on a unidimensional indicator of living standards, typically disposable income or consumption per capita or per adult equivalent (Skoufias and Coady 2007). Households are deemed poor, and therefore entitled to transfers, when the chosen metric falls below an established threshold. However, the empirical literature shows that income alone does not fully reflect household economic security, especially in settings where assets provide insurance against shocks or shape long-term opportunities. A multidimensional perspective may therefore better capture the information relevant for welfare-consistent eligibility decisions (Alkire and Santos 2014, Atkinson 2003, 2019, Bourguignon and Chakravarty 2003, Brandolini et al.

[1] Eurostat defines means-tested benefits as those social benefits that are explicitly or implicitly conditional on the beneficiary's income and/or wealth falling below a specified level (MISSOC 2013).

2010, Ravallion 2016).

In advanced economies where formal labor markets dominate and earnings are well-documented, disposable income constitutes a reasonably accurate measure of living standards (Atkinson 2019, Ravallion 2016). Notably, Ravallion (2016), while endorsing income as the appropriate welfare anchor in such settings, is also among the most prominent critics of composite multidimensional indices that aggregate heterogeneous dimensions without a coherent welfare-theoretic foundation. His concern bears directly on the present comparison: the counting approach's atheoretical aggregation of binary deprivations across incommensurable dimensions is precisely the practice he cautions against, whereas the money-metric's cardinal aggregation through equivalence scales provides the welfare-theoretic grounding he regards as essential. However, income alone is insufficient to characterize household well-being. A substantial literature emphasizes the multidimensional nature of economic security and the role of assets, financial and real, as buffers against shocks and as determinants of long-term opportunities (Alkire and Foster 2011, Atkinson 2019, Bourguignon and Chakravarty 2003, Brandolini et al. 2010, Carter 2008, Carter and Barrett 2006, Gornick et al. 2009, Weisbrod and Hansen 1968). During periods of economic stress, assets function as a form of private insurance (Haveman and Wolff 2004, Attanasio et al. 2015) and contribute to permanent income dynamics (Blundell et al. 2016, Meghir and Pistaferri 2011). For poor families especially, asset ownership can ease short-term hardship and improve long-term prospects. As highlighted by Grinstein-Weiss et al. (2014), even small asset holdings may translate into better outcomes for children, underscoring the intergenerational relevance of wealth.

Beyond monetary resources, non-monetary dimensions, health, education, demographic composition, and household structure, shape people's ability to cope with adversity. For example, a household may be income-poor yet possess substantial resilience because of favorable health or social conditions, while another may display the opposite configuration. It is difficult to compare the standard of living of a high income person with no wealth with an income poor but wealthy person. These observations imply the need for interpersonal comparisons trying to rank in terms of well-being, for example, an unhealthy person living in a rich family or a healthy person living in a poor one. Therefore, the implementation of theoretically admissible comparisons requires a multidimensional approach that takes proper account of demographic differences among households.

Alkire and Seth (2013) argue that much of the targeting literature proxies poverty using unidimensional metrics, and that the accuracy of proxy means tests can be limited when poverty itself is multidimensional. Expanding the informational space raises conceptual and normative questions, specifically regarding which dimensions to include, how to weight them, and how to ensure that the resulting measure is aligned with a coherent welfare framework (Decancq et al. 2015).

Given these complexities, a multidimensional perspective may better capture the information relevant for welfare-consistent eligibility decisions. In this context, two prominent approaches exist. Money-metric measures aggregate multiple deprivation dimensions into a cardinal index with an interpretable welfare basis, while counting approaches identify households as deprived if they exhibit shortfalls in a sufficient number of dimensions without relying

on cardinal aggregation. Although both approaches are used in policy analysis, they embed distinct value judgments thus comparing these two approaches allows us to assess the empirical consequences of these different normative assumptions on the actual selection of beneficiaries.

This paper compares these two multidimensional approaches as tools for means testing and evaluates their relative targeting efficiency. We evaluate which approach performs better in minimizing both Type I (inclusion) errors, incorrectly classifying non-poor households as eligible, and Type II (exclusion) errors, wrongly excluding households that should qualify for support (Kanbur et al. 1995, Ravallion 2009, van de Walle 1998). Using rich household-level data from the 2010 Survey of Household Income and Wealth (SHIW) for Italy, we examine how each tool classifies households across a broad set of deprivation indicators, how sensitive these classifications are to underlying distributions, and how well they align with normative eligibility objectives. By identifying the more efficient instrument, we provide evidence on the extent to which multidimensional money-metric and counting tools differ in their capacity to support coherent and harmonized means-testing tools and eligibility criteria.

We make three contributions. First, we develop a transparent framework for comparing money-metric and counting methods within a unified multidimensional poverty concept, clarifying the welfare-theoretic principles that differentiate them. Second, we assess the targeting efficiency of each instrument by estimating both inclusion and exclusion errors under alternative eligibility thresholds, thereby providing a direct measure of their policy performance. Third, we document the implications of these differences for welfare-policy harmonization within the European Union. Our results indicate that the money-metric approach consistently achieves higher targeting precision, suggesting that it offers a more reliable and theory-consistent basis for constructing unified eligibility criteria.

We begin by outlining the aggregation methods underlying the two multidimensional frameworks. We then describe the experimental design adopted to compare their targeting performance. The analysis uses household-level data from the 2010 Survey of Household Income and Wealth (SHIW) conducted by the Bank of Italy described in Section 4. The subsequent section presents the comparative results, and the final section discusses their empirical and policy implications. We argue that establishing a unified and theoretically consistent means-testing tool is a crucial step toward greater coherence in European welfare systems, particularly in a context of recurrent social and economic emergencies.

2 Targeting the Poor Using Multidimensional Means Testing Approaches

When the objective is to identify households that are poor or vulnerable, means testing requires an efficient targeting tool grounded in multidimensional indicators of well-being. Such tools may rely on a money-metric index that aggregates the relevant dimensions of deprivation into a single welfare-consistent measure, or on an indicator-based approach that treats each dimension separately and identifies poverty through a counting rule. To reflect the multidimensional nature of living standards, we describe each household's "living situation" through income, asset holdings (financial and non-financial), demographic characteristics, and

other relevant aspects of life. Individuals are assumed to possess full information about their circumstances and to be capable of making informed judgments about what constitutes a good or bad life.

Alkire and Foster's (2011) method of multidimensional measurement of poverty and well-being describes a "living" situation using Sen's concepts of functionings and capabilities referring to what a person manages to do or be. The method identifies "who is poor" by aggregating the multiple dimensions of deprivations. The Alkire-Foster method is also used to target services or conditional cash transfers to poor beneficiaries who meet multiple criteria (Alkire and Seth 2013).

By contrast, a money-metric approach to well-being seeks to place heterogeneous deprivation dimensions on a cardinal, welfare-consistent scale and is therefore appropriate to implement interpersonal comparisons. The equivalent income index represents the level of income that would make an individual as well off in the actual and in a hypothetical reference "living" situation.[2] This index incorporates differences in household composition and needs through equivalence scales and naturally accommodates asset-based components of poverty, as discussed in the next section. It also accounts for other relevant dimensions of well-being by composing them into a one dimensional vector of well-being using equivalence scales to adjust for demographic differences.

Although both approaches aim to identify those in need of support, neither is designed to capture subjective well-being. While reported happiness tends to correlate positively with income "all things considered," the relationship is not strictly monotonic.[3] An income-rich but unhappy individual should not be considered more entitled to public transfers than an income-poor but happier one, particularly given the former's greater capacity to self-insure. These features render subjective measures unsuitable for means testing.

Assets play a crucial role in determining eligibility for means-tested benefits and in shaping households' economic security. Ownership of tangible and financial assets influences life-cycle opportunities and buffers households against shocks (Carter 2008, Carter and Barrett 2006). In the presence of income volatility, assets enable consumption smoothing when current income falls, and persistent poverty may arise when either permanent income or asset holdings drop below critical thresholds (Carter and Barrett 2006, Morduch 1994). Incorporating wealth into means-testing tools is therefore essential for accurately identifying those whose living standards are structurally inadequate.

In what follows, we provide a detailed description of the money-metric and counting approaches used to identify and target the poor. Although conceptually distinct, both approaches share a common feature in our context: each includes asset information alongside

[2]We adopt the traditional definition of equivalent income, also termed distribution of welfare (King 1983, Lewbel 1989 and 1991, Blackorby and Donaldson 1991, Perali 2003), which is invariant to the base income chosen for comparisons and therefore permits full interpersonal comparability.

[3]In the 2010 SHIW data used in our empirical application, the correlation between disposable income and the "unhappy" category (1–3 on the Likert scale) is 0.07; with the "fairly happy" category (4–7), –0.20; and with the "very happy" category (8–10), 0.15—all statistically significant at the 5 percent level. Moreover, the share of unhappy respondents rises from 14 percent in the lowest income quintile to 23 percent in the highest. This pattern indicates that subjective well-being violates basic monotonicity requirements relative to income and therefore cannot serve as a valid targeting instrument. In addition, self-reported happiness is not incentive-compatible and is difficult to verify administratively (Alexandrova 2017, Ch. 6).

income and demographic characteristics in order to capture the multidimensional structure of economic vulnerability.

2.1 The Money-Metric Approach

The empirical literature emphasizes that both current income and net worth are key—though not exclusive—determinants of an individual's "economic position" (Haveman and Wolff 2004, Weisbrod and Hansen 1968). Net worth, defined as total assets minus liabilities, provides information on long-run economic security, while liquid assets capture a household's capacity to cope with short-run shocks.[4] To make wealth commensurable with income for welfare analysis, net worth is commonly converted into an annuity value and added to disposable income.

Following Weisbrod and Hansen (1968) and Brandolini et al. (2010), we define the current income of individual (or household) i as

$$CY_i = Y_i + rNW_i, \tag{1}$$

where after-tax disposable income Y_i is the sum of net payroll labor, pensions and other transfers, NW_i is net worth measured in the previous year, and r is the average rate of return on assets.[5]

Equivalence Scales

Household composition and other relevant circumstances—such as health or employment status—can be incorporated into money-metric measures through equivalence scales. Let C denote the set of weights used to adjust for differences in needs. Within this set, C^d contains *data-driven* scales estimated from observed consumption behavior, while C^n contains *normative* scales that require explicit value judgments when data are unavailable or unreliable (Decancq and Lugo 2013). A representation of household i composition in a general form is

$$\varsigma_i\left(d_i, n_i\right) = 2D_0 + \sum_{v=1}^{V} C_v^d d_{iv} + \sum_{l=1}^{L} C_l^n n_{il}, \tag{2}$$

where D_0 is equal to 0.5 for one-adult households and 1 for two-adult households, C_v^d denotes the cost of demographic characteristic v, d_{iv} is its size (e.g. the number of children of a given age), C_l^n is the cost of normative characteristics n_{il} such as unemployment, disability, single parenthood, or poor health for which in general data are not available or household surveys are not representative for the specific characteristic so that estimation of the corresponding weight is unreliable. Decancq and Lugo (2013) term equivalence scales combining statistical

[4] The distinction is particularly salient for households whose wealth is concentrated in illiquid forms. For example, farmers often "live poor and die rich": although their net worth is high due to the value of land and other farm assets, these assets cannot easily be liquidated for immediate consumption needs (El-Osta, Mishra, and Morehart 2007). In the United States, nearly half of farm households have both income and wealth above the median US households, but a substantial share have either high income and low wealth ($< 3\%$) or low income and high wealth (43%).

[5] Appendix A provides detailed definitions of the income and wealth components and the interest rates used in the analysis.

evidence and value judgments as "hybrid." When the information set C is limited to objective demographic characteristics C^d, household equivalence scales reduce to the data-driven scale

$$\varsigma_i\left(d_i\right) = 2D_0 + \sum_{v=1}^{V} C_v^d d_{iv}. \tag{3}$$

Equation (3) estimates the number of equivalent adults in the household, and it is used in lieu of family size to construct corrected per capita expenditures. The choice of equivalence scale is well known to affect poverty measurement and targeting outcomes (Atkinson 1995, Burkhauser et al. 1996, Cowell and Mercader-Prats 1999, de Vos and Zaidi 1997, Perali 2003).

Equivalent Money-Metric Indicators

For our purposes, the equivalent money-metric index specializes to

$$I_i = \begin{cases} CY_i^* = \frac{Y_i}{\varsigma_i(d_i)} + \frac{rNW_i}{\varsigma_i(d_i)}, \\ \\ CY_i^{**} = \frac{Y_i}{\varsigma_i(d_i,n_i)} + \frac{rNW_i}{\varsigma_i(d_i,n_i)}, \end{cases} \tag{4}$$

where CY_i^* is the equivalent money metric index adjusted using data-driven scales, while CY_i^{**} is adjusted using hybrid equivalence scales.

To capture differences in the liquidity of asset types, we decompose net worth NW_i into financial FW_i and non-financial NFW_i components:

$$I_i = \frac{Y_i}{\varsigma_i} + \frac{r_1 FW_i}{\varsigma_i} + \frac{r_2 NFW_i}{\varsigma_i}, \tag{5}$$

with ς_i being either data-driven $\varsigma_i\left(d_i\right)$ or hybrid $\varsigma_i\left(d_i, n_i\right)$ equivalence scales. The rates r_1 and r_2 reflect the respective liquidity-adjusted returns.

A General Multidimensional Money-Metric Index

A generalization of the welfare metric in equation (4) is given by (Anand and Sen 1997, Bourguignon and Chakravarty 2003, Decancq and Lugo 2013, Dutta et al. 2003)

$$I_i(\xi_i) = \begin{cases} \left[w_1 I_{i1}\left(\xi_1\right)^{\beta} + ... + w_J I_{iJ}\left(\xi_J\right)^{\beta}\right]^{\frac{1}{\beta}}, & \text{for } \beta \neq 0, \\ \\ I_{i1}\left(\xi_1\right)^{w_1} \times ... \times I_{iJ}\left(\xi_J\right)^{w_J}, & \text{for } \beta = 0, \end{cases} \tag{6}$$

where $I_i\left(\xi_i\right)$ is a weighted mean of order β of the transformed achievements $I_{ij}\left(\xi_{ij}\right)$ with $j = 1, ..., J$, and ξ_i is the vector of the relevant well-being dimensions of individual i. The dimension specific weights w_j are non-negative and $\sum_{j=1}^{J} w_j > 0$. They may sum to one, but not necessarily.[6]

[6]The transformation function $I_i\left(\xi_i\right)$ may take the form of common scaling (normalization relative to the population mean or median), a linear range-based index as in the Human Development Index ($\beta = 0$), or any monotonic transformation.The parameter β governs concavity and reflects society's aversion to deprivation.

Assuming identity transformations and $\beta = 1$ the index becomes

$$I_i\left(Y_i, NW_i, d_i, r_1, r_2\right) = w_1 \frac{Y_i}{\varsigma_i\left(d_i\right)} + w_2 \frac{r_1 FW_i}{\varsigma_i\left(d_i\right)} + w_3 \frac{r_2 NFW_i}{\varsigma_i\left(d_i\right)} = w_1 Y_i^* + w_2 FW_i^* + w_3 NFW_i^*, \tag{7}$$

where the numerator Y_i is disposable income, r_1 is the rate of return on financial assets, FW_i is the worth of financial wealth net of liabilities, r_2 is the rate of return on non-financial assets, NFW_i is the net worth of non-financial assets and $\varsigma_i\left(d_i\right)$ is a data-driven equivalence scale. In the baseline equation (5) it is assumed that each dimension has equal weight $w_1 = w_2 = w_3 = 1$.

The index operationalizes interpersonal welfare comparisons that are Cardinally Fully Comparable (CFC), as it is invariant to affine transformations of individual utility functions (D'Aspremont and Gevers 2002). The connection between the empirical money-metric index and CFC can be made explicit by interpreting disposable income and annuitized wealth as observable counterparts of the expenditure function. Let $C_i(u_i, p, d_i)$ denote the minimum income required to achieve utility u_i, given market prices p and household characteristics d_i. Under Independence of the Income Base preferences (Blackorby and Donaldson 1991, Lewbel 1989 and 1991, Perali 2003, Menon, Giovanis and Perali 2023), $C_i(u_i, p, d_i) = G_i(u_i, p)\varsigma_i(d_i)$, implying that $C_i(u_i, p, d_i)/\varsigma_i(d_i) = G_i(u_i, p)$ is invariant to the choice of reference utility, since the right-hand side does not depend on household characteristics and is therefore common across household. The empirical index $I_i = Y_i^* + r_1 FW_i^* + r_2 NFW_i^*$ can thus be interpreted as an estimate of $G_i(u_i, p)$, where disposable income and annuitized wealth proxy the resources available to achieve utility. This construction yields a cardinal welfare measure that is fully comparable across individuals.

From a welfare-theoretic perspective, it is useful to distinguish between Cardinal Full Comparability (CFC) and Ordinal Full Comparability (OFC) in the sense of D'Aspremont and Gevers (2002). CFC requires interpersonal welfare comparisons to be invariant to affine transformations of individual utility functions, while OFC only requires invariance to monotonic transformations. The money-metric approach satisfies CFC and therefore also OFC, as it generates a complete cardinal ordering of individual well-being. By contrast, counting-based approaches do not satisfy OFC. Although they rely on ordinal information at the dimensional level, they do not generate a complete interpersonal ordering of well-being. Individuals are classified into poverty states based on deprivation counts, but no welfare ranking, ordinal or cardinal, is defined across individuals.

Poverty Identification

To identify the poor, we adopt a cutoff expressed in terms of equivalent disposable income $Y_i^* = Y_i/\varsigma_i\left(d_i\right)$. Let Z_{Y^*} denote the relative poverty line, or eligibility threshold, associated with the distribution of Y^*. A household is poor, or eligible, when the equivalent money

A larger β assigns greater weight to dimensions where deprivation is high; smaller β, reduces substitutability across dimensions, with $\sigma = 1/(1-\beta)$. When $\beta = 1$, the index reduces to a weighted arithmetic mean (if the weights sum to 1); when $\beta = 0$, substitutability is unitary; as $\beta \to -\infty$, dimensions become perfect complements.

metric index CY_i^* is less than Z_{Y^*}

$$CY_i^* < Z_{Y^*} \implies Y_i^* < (Z_{Y^*} - rNW_i^*) \tag{8}$$

or when equivalent disposable income Y_i^* is lower than the threshold level decreased by a proportion r of the equivalent property income $NW_i^* = NW_i/\varsigma_i(d_i)$. The proportion of the population living in households with equivalent current income below the poverty line gives the headcount index H. The headcount index H measures the share of households below this threshold.[7]

Asset-specific poverty lines can be derived by scaling the income line to reflect how long assets can sustain minimum consumption. Figure 1 illustrates the income-poor and asset-poor regions in light blue and red, respectively, and the subset of households identified as poor in both dimensions. The dashed area refers to those households which would have been classified as poor if the wealth dimension had not been taken into account.

The money-metric index based on equivalent current income is a multidimensional measure of well-being that aggregates information across dimensions at the individual level, producing a single indicator of equivalent income. Poverty measures are then obtained by aggregating this index across individuals (Aaberge and Brandolini 2015). By contrast, in multidimensional poverty indices such as the Human Poverty Index (UNDP 1997) and related counting approaches, this order of aggregation is reversed: achievement is first defined by counting the proportion of people failing to attain a minimum standard in each deprivation dimension, and the resulting achievement matrix is then aggregated across dimensions and individuals. Moreover, while the money-metric approach relies on a single eligibility threshold applied to a cardinal welfare indicator, counting-based indices typically adopt dimension-specific achievement lines.

What ultimately distinguishes the two approaches is their treatment of heterogeneity, the definition of achievement, and the aggregation over dimensions. In the money-metric framework, heterogeneity is addressed through equivalence scales, and multidimensional information is first aggregated into a cardinal welfare indicator, with achievement defined relative to this aggregate measure. In the counting framework, achievement is instead defined dimension by dimension, producing a binary achievement matrix that is subsequently aggregated across dimensions. For expositional clarity, we deliberately abstract from other differences and focus on this fundamental distinction in the sequencing of aggregation and achievement.

To ensure that any discrepancy between the households identified as poor under the money-metric and counting approaches can be attributed to the method of aggregation rather than to differences in informational content, we impose a common informational structure across the two approaches. Both are based on the same set of dimensions, disposable income (Y), financial wealth (FW), non-financial wealth (NFW), and, to remain consistent with our empirical application, four additional characteristics capturing 1. poor health (HE), 2. single parenthood (SP), 3. unemployment (U), and 4. retirement (RE). Achievement lines

[7] The relative poverty line based on equivalent disposable income depends on the choice of the equivalence scale, unlike absolute poverty thresholds based on the cost of a reference consumption basket. As equivalence scales change, so does the relative poverty line.

and equivalence scales are defined consistently across approaches. In the money-metric case, these characteristics enter through hybrid equivalence scales, while in the counting approach they define dimension-specific achievements. Holding dimensions, thresholds, and equivalence scales constant allows differences in targeting outcomes to be traced back to the aggregation rule itself rather than to ancillary modeling choices.

2.2 The Counting Approach

The multidimensional methodology proposed by Alkire and Foster (2011) aims to identify poor households and construct aggregate poverty measures by combining a counting-based approach to multidimensional deprivation (Atkinson 2003) with axiomatic principles developed in the welfare economics literature (Bourguignon and Chakravarty 2003). The resulting Multidimensional Poverty Index (MPI) captures deprivations in basic services and human functionings associated with human development (Alkire and Santos 2014). Poverty is defined by the joint distribution of deprivations across dimensions rather than by a single aggregate welfare indicator. By convention, a household is identified as multidimensionally poor if it is deprived in a combination of dimensions whose weighted sum exceeds a predetermined cutoff, typically set at 30 percent of total possible deprivations.

A Numerical Illustration

To clarify the connection between the money-metric and counting approaches, we introduce a numerical example that mirrors the structure of Section 2.1. Consider the matrix of equivalent achievements

$$\xi_i^* = [Y_i^* \sim FW_i^* \sim NFW_i^*]\,,$$

where $Y_i^* = Y_i/\varsigma_i\,(d_i)$ denotes the vector of equivalent disposable income, $FW_i^* = r_1 FW_i/\varsigma_i\,(d_i)$ the vector of equivalent financial wealth, and $NFW_i^* = r_2 NFW_i/\varsigma_i\,(d_i)$ the vector of equivalent non-financial wealth. The notation $[\sim]$ indicates horizontal concatenation of vectors into a matrix.

As shown in equation (5), the money-metric index aggregates these achievements as:

$$I_i^* = [\xi_i^*]\,\iota' = \begin{bmatrix} 13.1 & 2 & 0 \\ 15.2 & 3 & 25 \\ 12.5 & 1.5 & 142 \\ 20 & 7 & 235 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}', \tag{9}$$

where each row corresponds to an individual and each column to an achievement dimension scaled by the data-driven equivalence factor $\varsigma_i(d_i)$. The values reported in this matrix are for illustrative purposes and refer specifically to the four individuals i described in this numerical example. This representation makes explicit that the money-metric approach aggregates across dimensions prior to defining poverty status. Additional household circumstances—such as health status or single parenthood—can be incorporated implicitly through hybrid equiv-

alence scales $\varsigma_i(d_i, n_i)$, yielding the alternative index

$$I_i^{**} = [\xi_i^{**}]\,\iota' = [Y_i^{**} \sim FW_i^{**} \sim NFW_i^{**}],$$

where $Y_i^{**} = Y_i/\varsigma_i(d_i, n_i)$, $FW_i^{**} = r_1 FW_i/\varsigma_i(d_i, n_i)$, and $NFW_i^{**} = r_2 NFW_i/\varsigma_i(d_i, n_i)$.

In contrast, the counting approach does not aggregate achievements prior to identification. To illustrate this difference, we extend the informational space by adding two non-monetary dimensions: health status (HE) and single parenthood (SP). These dimensions are treated symmetrically with income and wealth in the achievement matrix but are not incorporated through equivalence scaling. It is important to clarify the role of household heterogeneity in the counting framework. Unlike the money-metric approach, the Alkire–Foster methodology does not incorporate equivalence scales in the construction of achievement vectors. Introducing equivalence scales at the dimension level would implicitly impose cardinal tradeoffs across dimensions prior to identification, effectively collapsing the counting approach into a money-metric framework. For this reason, household heterogeneity in the counting approach is addressed exclusively through the definition of dimension-specific achievements and deprivation cutoffs rather than through ex ante scaling of resources. As a consequence, differences between the money-metric and counting approaches reflect not alternative informational content, but fundamentally different ways of defining achievement and aggregating multidimensional deprivation.

Achievement and Deprivation Matrices

Let $x = [x_{ij}]_{N\times J}$ define the achievement matrix summarizing the joint distribution of J dimensions across N individuals, where $x_{ij} \geq 0$ represents the achievement of individual $i = 1, \ldots, N$ in dimension $j = 1, \ldots, J$. Dimensions are equally weighted, with $w_j = 1/J$ and $\sum_{j=1}^{J} w_j = 1$. We consider the same $N = 4$ individuals and $J = 5$ dimensions: equivalent disposable income Y^*, equivalent financial wealth FW^*, equivalent non-financial wealth NFW^*, health status HE – indicating whether at least one household member suffers from a chronic illness, and single parenthood SP

$$x = [x_1^* \,|\, x_2] = \left[\begin{array}{ccc|cc} Y^* & FW^* & NFW^* & HE & SP \\ 13.1 & 2 & 0 & 0 & 0 \\ 15.2 & 3 & 25 & 0 & 1 \\ 12.5 & 1.5 & 142 & 0 & 1 \\ 20 & 7 & 235 & 1 & 0 \end{array}\right] \tag{10}$$

and the vector of deprivation cutoffs is

$$z = \left[\begin{array}{ccc|cc} 13 & 3 & 120 & 1 & 1 \end{array}\right],$$

where the first three thresholds correspond to income and wealth poverty lines, and the last two indicate deprivation in health and family structure.[8]

[8] Although the money-metric approach is explicitly anchored to a notion of relative poverty, the dimension-specific cutoffs used in the counting framework should not be interpreted as defining absolute poverty levels.

Interpersonal comparisons play a limited role in this framework: achievements are evaluated dimension by dimension relative to fixed cutoffs, and no cardinal aggregation across individuals is performed prior to identification. This contrasts sharply with the money-metric approach and will be central to our empirical comparison.

Counting the Poor

Define the deprivation matrix deprivation matrix as $g^0 = [g^0_{ij}]_{N\times J}$, where

$$g^0_{ij} = \begin{cases} w_j & if\ x_{ij} < z_j \\ 0 & otherwise \end{cases}.$$

For the example above

$$g^0 = \left[g^0_1 \,\vdots\, g^0_2\right] = \left[\begin{array}{cc:cc} 0 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{array}\right]. \tag{11}$$

Let $c_i = \mid g^0_i \mid$ denote the weighted deprivation count for individual i, where here and throughout $\mid v \mid = \sum_i v_i$ denotes the sum of the elements of a vector v. Following Alkire and Foster (2011), identification proceeds via a dual cutoff method. First, dimension-specific cutoffs z_j determine deprivation status. Second, a poverty cutoff K determines whether an individual is multidimensionally poor:

$$\rho\left(x_i, z\right) = \mathbf{1}\left(c_i > K\right).$$

Union $K = 1$ and intersection $K = J$ criteria represent extreme cases; intermediate values of K balance inclusion and exclusion errors. A person is identified as poor if her weighted deprivation count is greater than the poverty cutoff K, $c_i > K$. This can be called a dual cutoff identification method, because it uses the deprivation cutoff z_j to determine whether a person is deprived or not in each dimension, and the poverty cutoff K to determine who is to be considered multidimensionally poor. The aggregation of $\rho(x_i, z)$ generates an overall measure of multidimensional poverty $M(x, z)$.

Applying the identification function $\rho(x_i, z)$ yields the censored deprivation matrix $g^0\left(K\right)$, obtained by replacing rows corresponding to $c_i < K$ with zeros. For $K = 3$

$$g^0\left(K\right) = \left[\begin{array}{cc:cc} 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right]. \tag{12}$$

Let q denote the number of poor individuals. The censored deprivation count is $c_i(K) =$

Rather, they identify deprivations along selected dimensions, without implying a minimum aggregate standard of living.

$\rho(x_i; z)c_i$ and the average deprivation share among the poor is

$$A = \frac{|c(K)|}{qJ}.$$

where $c_i(K)/J$ represents the share of possible deprivations experienced by poor individual i. The censored deprivation matrix contains the weighted deprivations of exactly those persons who have been identified as poor and excludes deprivations of the non-poor. This partial index conveys relevant information about multidimensional poverty, namely, the fraction of possible dimensions j in which the average poor person suffers deprivation.

The adjusted headcount ratio, obtained as the mean μ of the matrix $g^0(K)$, which combines information on the prevalence of poverty and the average extent of a poor person's deprivation, is defined as

$$M_0 = \mu(g^0(K)) = H \cdot A, \tag{13}$$

showing that M_0 can also be expressed as the product of the multidimensional head count ratio $H = q/N$, and the average deprivation share among the poor A. As noted by Aaberge and Brandolini (2015), M_0 coincides with an Atkinson-type primal measure of deprivation (Atkinson 2003). The measure is decomposable by population subgroups and dimensions and satisfies monotonicity: if a poor person becomes deprived in an additional dimension, A rises and so does M_0. Equivalently, M_0 can be interpreted as the total number of deprivations experienced by the poor, $|c(K)| = |g^0(K)|$, divided by the maximum number of deprivations $N \cdot J$. The adjusted headcount ratio can be used with purely ordinal data, such as self-reported health, and cardinal data such as income.

Weights, Heterogeneity, and Identification Strategies

Achievements can be linearly aggregated using alternative weighting structures (Decancq and Lugo 2013). In the context of multidimensional deprivation measurement, aggregation across dimensions is implemented by defining "importance weights" inversely related to the degree of marginalization of the population sharing the same deprivation dimension (Desai and Shah 1988, Decancq and Lugo 2013). Such data-driven weights capture the subjective evaluation of individuals attaching greater importance to deprivations. In the context of the present study, we adopt equal normative weights, consistent with the HDI and MPI, as our focus is not on the choice of weights but on the implications of alternative aggregation structures for interpersonal comparisons.

Importantly, unlike the money-metric approach, the counting framework does not incorporate equivalence scales. For example, Cavapozzi et al. (2015) specify income and wealth dimensions in per capita terms, which is equivalent to adopting a household equivalence scale equal to family size and implicitly assigning the same weight to adults and children. While convenient, this normalization constitutes an implicit assumption about household needs and introduces cardinal scaling of achievements prior to identification. Such choices may critically affect the identification of the poor and blur the conceptual distinction between counting-based and money-metric approaches. A further asymmetry in the counting framework de-

serves explicit attention. In the present implementation, the monetary dimensions entering the achievement matrix , Y^*, FW^*, NFW^*, are already expressed in equivalent adult units, so equivalence scaling is implicitly present for those dimensions. The non-monetary dimensions, however, health status (HE) and single parenthood (SP), enter as raw binary indicators without any household-size adjustment. The deprivation of a chronically ill person living alone is assigned identical weight to that of a chronically ill member of a large multi-earner household; a single parent in a small household is treated identically to a single parent in a large one. This internal asymmetry means the counting approach applies commensurability standards to monetary dimensions that it withholds from non-monetary ones, without theoretical justification for the difference. The money-metric resolves this inconsistency by routing all characteristics, monetary and non-monetary alike, through the equivalence scale denominator, ensuring that interpersonal comparability is maintained uniformly and consistently across every dimension that enters the welfare index.

Figure 1 illustrates the union, intermediate, and intersection identification strategies. The intersection approach targets the most severely deprived but may exclude individuals experiencing substantial hardship in fewer dimensions such as income-poor but healthy households. Because the set of individuals deprived in all dimensions shrinks rapidly as the number of dimensions increases, the means testing experiment described in the next section focuses on cases with three and five dimensions.

3 The Means Testing Experiment: Targeting Efficiency Compared

A wide range of targeting tools has been developed to identify households eligible for social transfers. These tools are commonly classified according to the procedure used to reach those in need, including means testing, proxy means testing, and categorical targeting based on geographic or demographic characteristics (Coady et al. 2004). Means testing identifies eligible beneficiaries by measuring household living standards—traditionally using income or consumption data, sometimes augmented with asset information—and applying a monetary eligibility criterion. It is typically used to allocate cash transfers or subsidized services. Although administratively costly, means testing can achieve relatively low inclusion and exclusion errors when accurately verified (Castañeda et al. 2005).

Alternative approaches trade off precision for administrative simplicity. Proxy means testing relies on observable household characteristics correlated with welfare, while categorical targeting distributes benefits to groups defined by location or vulnerability status, often without formal verification of economic resources. Targeting can be applied at the household or individual level, although intra-household allocation is rarely addressed due to data limitations.

In practice, most European countries include some forms of financial or non-financial assets in the means testing tool. In some cases the tool is designed as a money-metric index, in others it is more similar to a counting approach. For example, Italy adopts a means testing tool called ISEE (*Indicatore della Situazione Economica Equivalente*) based on an index that composes

disposable income and assets weighted by equivalence scales to account for differences across households (Baldini et al. 2002). In the US, the income and asset dimensions are treated separately (Castañeda et al. 2005, Lindert 2005). The Inter-American Development Bank (IDB) has adapted and promoted the Alkire-Foster methodology to help governments in Latin America target beneficiaries of Conditional Cash Transfer Programmes (CCT). The Alkire-Foster measure was adopted in Mexico for targeting beneficiaries by Oportunidades. In India, the Below the Poverty Line (BPL) is an Alkire-Foster targeting method accounting also for non-financial assets such as land, housing and other property (Alkire and Seth 2013).

Design of the Targeting Experiment

The experiment is designed so that aggregation structure is the only dimension along which the two approaches differ. As established in Section 2, both the money-metric index and the counting measure are applied to an identical informational base, the same monetary dimensions, the same household characteristics, the same deprivation thresholds, and the same equivalence scales. Any difference in targeting performance that emerges can therefore be attributed solely to how each instrument processes shared information, not to what it observes. This is not a comparison of two approaches that differ in what they know. It is a controlled experiment on aggregation structure, with everything else held constant.

Evaluating targeting performance requires an external classification of households against which the accuracy of each approach can be measured. We construct a benchmark poor group whose composition is determined independently of both methods under evaluation. This benchmark is not intended to represent the "true" poor population, indeed, no such ground truth exists, since poverty thresholds are inherently normative constructs. A government poverty line, whether set at sixty percent of median income or calibrated to the cost of a reference consumption basket, reflects a social judgment rather than an empirical discovery. Any externally given, normatively determined classification therefore serves equally well as an evaluation device: what matters is that the benchmark is exogenous to both approaches, not that it corresponds to some privileged definition of poverty. In the present case, this exogeneity is reinforced at three levels: the benchmark threshold does not coincide with the money-metric eligibility criterion used in the experiment, it does not coincide with national poverty lines. The benchmark functions as a genuinely neutral reference, and the invariance of the main findings across three structurally distinct benchmark definitions, reported in Section 5, confirms that the results do not depend on this particular normative choice.

For the purpose of the experiment, a household is included in the benchmark poor group if all three of the following conditions are jointly satisfied

1. *Low equivalent disposable labor income*: household equivalent disposable labor income, computed using data-driven equivalence scales common to both approaches, falls below an exogenously fixed threshold set at the 40th percentile of the income distribution (approximately 6,500 euro);

2. *Low saving capacity*: during the previous year, the household either was unable to save or had to draw down past savings to meet current expenditures;

3. *Self-reported economic hardship*: the household reports meeting its needs "with many difficulties."

Conditions (2) and (3) are not alternative poverty criteria but serve to refine the benchmark, ensuring consistency with condition (1) by excluding households with temporarily low income but no material strain. In the data, fewer than one-fifth of households failing condition (1) satisfy either (2) or (3), indicating limited inconsistency. Moreover, 81 percent of benchmark-poor households report no purchases of durable goods during the reference year, suggesting that low saving capacity reflects economic constraint rather than intertemporal choice. The third criterion is inherently multidimensional: when households assess their ability to meet needs, they implicitly aggregate across the different forms of scarcity they face. This feature makes the benchmark particularly suitable for evaluating multidimensional means-testing tools.

We acknowledge that alternative benchmark definitions could be adopted. However, our purpose is to construct a stable and externally given classification against which to evaluate targeting performance. To verify that our results are not driven by this particular benchmark choice, we conduct extensive robustness checks using alternative benchmark definitions, reported in Section 5.

Targeting Errors under Imperfect Information

In real-world policy settings, administrators do not observe poverty status directly. As a result, targeting is subject to two types of classification errors: inclusion errors and exclusion errors.

Let $N(T = 1, \text{Benchmark} = 0)$ denote the number of households that do not belong to the benchmark poor group but are classified as eligible for transfers by a given means-testing tool. Let $N(\text{Benchmark} = 0)$ be the total number of non-poor households.

A Type I (inclusion) error occurs when a non-poor household is incorrectly included among beneficiaries (Cornia and Stewart 1995, Ravallion 2009, Smolensky et al. 1995).

Definition 1. *Proportion of Type I errors ($T1$).*

$$T1 \equiv \frac{N(T = 1, \text{Benchmark} = 0)}{N(\text{Benchmark} = 0)}. \tag{14}$$

It is the proportion of (ineligible) non-poor who are included in the program. When an inclusion error occurs, the proportion of the population receiving cash benefits $P = N(T = 1)/N$, where $N(T = 1)$ is the number of households who are eligible for participating in welfare programs and N is the total population, is larger than it ought to be, thus, entailing a leakage of transfers to the non-poor. These errors raise the cost of the program without improving efficiency. Inclusion errors increase program costs through leakage to non-poor households and may exacerbate social polarization without improving welfare outcomes (Ravallion 2004).

Let $N(T = 0, \text{Benchmark} = 1)$ denote the number of benchmark-poor households that are excluded by the means-testing tool, and let $N\,(\text{Benchmark} = 1)$ be the total number of benchmark-poor households. A Type II (exclusion) error occurs when a poor household is incorrectly denied access to benefits.

Definition 2. *Proportion of Type II errors (T2).*

$$T2 \equiv N(T = 0, \text{Benchmark} = 1)/N(\text{Benchmark} = 1). \tag{15}$$

It is the proportion of the poor who are excluded from the program. Exclusion errors reduce program coverage and may generate social costs by leaving vulnerable households unprotected (Bibi and Duclos 2007).

Targeting Efficiency

In general, reducing inclusion errors increases exclusion errors and vice versa. The effectiveness of a targeting rule therefore depends on its ability to balance these two types of mistakes.

Definition 3. *Best targeting method.* The most efficient targeting method is the one that minimizes the joint incidence of Type I and Type II errors, thereby maximizing the proportion of correctly classified households.

This definition assigns equal weight to inclusion and exclusion errors. For a methodological comparison of the kind conducted here, where the objective is to evaluate aggregation structures rather than to calibrate a specific program, equal weighting is the appropriate neutral baseline. It avoids embedding normative judgments about the relative fiscal or social costs of the two error types that vary across countries, programs, and political contexts, and are therefore not intrinsic properties of the aggregation methods themselves. In practice, a substantial literature in welfare economics regards exclusion errors as more socially costly than inclusion errors: leaving a genuinely poor household without support carries higher welfare costs than extending benefits to a near-poor household (Cornia and Stewart 1995; Bibi and Duclos 2007). Under such asymmetric weighting, which most normative frameworks would favor, the money-metric's advantage over the counting approach would only strengthen, since its exclusion errors are already substantially lower across the large majority of specifications examined. The equal-weighting criterion adopted here therefore represents a conservative evaluation standard from the perspective of the money-metric approach. The experiment compares the targeting efficiency of the two approaches against this neutral benchmark, with the understanding that any departure toward socially realistic asymmetric weighting would reinforce rather than qualify the main finding.

4 Data

We use the 2010 Italian Survey of Household Income and Wealth (SHIW) conducted by the Bank of Italy. The survey is nationally representative and covers 7,951 households, comprising approximately 19,836 individuals residing in about 300 Italian municipalities. SHIW provides detailed information on individual and household characteristics (age, gender, education, employment status), household and individual incomes, consumption, saving behavior, and balance-sheet components, including financial and non-financial wealth. The survey also contains information on self-reported health status and subjective well-being. Health status is measured for each household member using a six-point subjective scale ranging from very

good (1) to very bad (5), with a residual category for don't know (6). In our analysis, health status enters as an objective non-monetary dimension through a binary indicator identifying households with at least one member reporting bad or very bad health. Although SHIW also collects information on happiness—measured on a ten-point Likert scale—this variable is not used in the empirical analysis. As discussed in Section 2, subjective well-being does not satisfy basic monotonicity or incentive-compatibility requirements and is therefore ill-suited for means-testing purposes (Alexandrova 2017, Ch. 6).

Descriptive statistics of the raw data are reported in Table 1 and 2. Table 1 describes the joint distribution of household disposable income and self-reported difficulty in meeting monthly needs. This evidence supports the construction of the benchmark group of poor households used in the targeting experiment. Approximately 40 percent of households report no difficulty in meeting monthly needs, while another 40 percent report doing so with some difficulty. The share of households reporting many difficulties, the group selected as benchmark poor, is 14.65 percent. Among households in the lowest income quintile, 56.82 percent report many difficulties, while about 19 percent of households in the upper three quintiles also report severe difficulty. This pattern illustrates the limits of income alone as a sufficient indicator of economic well-being and motivates the inclusion of additional dimensions such as health status and family structure. Conversely, only 2.14 percent of households in the lowest quintile report meeting monthly needs easily or very easily, whereas such responses are concentrated in the top quintile (46.88 and 65.96 percent, respectively).

Table 2 documents the relationship between income and saving behavior, another key dimension used to refine the benchmark. Among households in the lowest income quintile, 72.13 percent report zero savings and 11.30 percent report negative savings, accounting for roughly 30 percent of all households with dissavings. Only 9.10 percent of households in the lowest quintile report positive savings, corresponding to 16.57 percent of all saving households.

Combining income insufficiency, lack of saving capacity, and self-reported economic hardship yields a benchmark poor group comprising 11.31 percent of the sample, or 899 households. Table 3 reports descriptive statistics for the benchmark poor and the remaining 88.69 percent of non-poor households across all poverty-relevant dimensions used in the experiment. Mean disposable income of non-poor households is approximately 2.6 times that of the benchmark poor. Mean income from financial assets is negative for the poor group, and 49.6 percent report having been unable to save during the previous year. Mean property income among non-poor households is about 2.5 times that of the poor. Single-parent households represent 6 percent of the poor group, compared with 3 percent among the non-poor. Poor households are also more exposed to health risk: 20.20 percent report at least one member in bad or very bad health, compared with 10.20 percent among the non-poor. Double-earner couples are more prevalent among non-poor households (44.5 percent) than among the poor (27.8 percent). The share of households with at least one retired member is 41.70 percent among the poor and 48.50 percent among the non-poor. Unemployment of the household head is substantially more frequent among the poor (30.8 percent) than among the non-poor (9.91 percent). Table 3 also reports current income (money-metric) levels, along with the mean values of both data-driven and hybrid equivalence scales. The two scales do not differ signifi-

cantly across groups. Equivalent current incomes, computed under both scaling schemes, are reported for completeness.

The data-driven equivalence scales used in the analysis are estimated by Menon and Perali (2010) using Italian household expenditure data. Their estimates indicate that the cost of living for a single individual is approximately 60 percent higher than that of a member of a couple, reflecting the inability to share household public goods such as housing and utilities. Children cost between 30 and 40 percent of an equivalent adult in a couple, depending on age, while the presence of an additional adult adds approximately 15 percent of the cost of an equivalent adult.

The normative weights incorporated in the hybrid equivalence scale are derived following Anand and Sen's (1997:6) recommendation that weighting schemes be established through "questioning and debating in public discussions" because "it is crucial that the judgments that are implicit in such weighting be made as clear and comprehensible as possible and thus be open to public scrutiny."[9] Single parenthood, a recognized risk factor for poverty, is assigned a weight of 0.40, corresponding to an implicit allowance of 6,000 euro when the equivalent income threshold is set at 15,000 euro. Unemployment is assigned a weight of 0.40, retirement a weight of 0.20, and disability exceeding 50 percent a weight of 0.50. The hybrid equivalence scale, defined as the linear aggregation of data-driven and normative components (see equation (2)), is used to compute equivalent income and equivalent financial and non-financial wealth.

The poverty cutoffs associated with each selected dimension are reported in Table 4. As shown in Table 5, the selected poverty dimensions are generally weakly but statistically significantly correlated, indicating that they capture distinct aspects of economic vulnerability rather than redundant information. This correlation structure supports the use of a multidimensional framework in the targeting experiment.

5 Results: Comparison of the Money-Metric and Counting Approach

The central question addressed in this paper is whether money-metric and counting-based approaches can be used interchangeably to identify poor households. In answering this question, we place particular emphasis on the role of household heterogeneity and on how inter-household comparisons are implemented under the two frameworks. Because reliable information on assets is central to efficient targeting, we also investigate the relative contributions of financial and non-financial wealth to poverty identification. To ensure meaningful comparisons, both approaches are implemented using the same informational content so that the reported differences reflect exclusively the alternative aggregation structures of the money-metric and counting approaches. In the money-metric framework, the normative characteristics enter through the hybrid equivalence scale, while in the counting framework they are

[9]These weights have been "normatively" determined through "questioning and debating in public discussions" within the "Fattore Famiglia" proposal to reform the Italian means testing tool as documented in Menon, Perali, and Polin (2017).

treated as additional dimensions of the achievement matrix.[10]

We organize the results around four questions: (i) the relevance of financial and property assets for identifying the poor; (ii) whether money-metric and counting approaches are substitutes; (iii) which targeting tool is socially preferable according to a unified efficiency criterion; and (iv) how equivalence scales and the number of dimensions affect targeting performance.

Relevance of Financial and Property Assets

The simulations are conducted using three monetary dimensions—disposable income, financial asset income, and property income, and four household characteristics (HE, SP, RE, and U). In the data, 13.16 percent of households are non-poor in all dimensions. Households deprived in one, two, or three dimensions account for 38.94, 25.23, and 14.22 percent, respectively. Only 7.04 percent of households are deprived in four dimensions and 1.36 percent in five dimensions, while none are deprived in all dimensions simultaneously. This distribution highlights how the profile of poverty varies with the number and type of deprivations considered.

Table 6 reports poverty rates based on current income (CY), disposable income (Y), financial wealth (FW), and non-financial wealth (NFW), under both data-driven and hybrid equivalence scales. Ignoring asset information leads to a substantial overestimation of poverty: approximately 9 percent more households are classified as poor when assets are excluded. While 44 percent of households are financially deprived and 30 percent are property deprived, this does not imply that financial deprivation is intrinsically more important than property deprivation; such judgments depend on normative weighting (Cavapozzi et al. 2015). Introducing normative equivalence scales increases poverty rates by about 3 percent among the asset-poor and 5 percent among the income-poor. Normative adjustments affect approximately 0.6 percent of the financially poor and 1.9 percent of the property poor.

Comparing money-metric targeting performance with and without asset information (Table 7) shows that both Type I and Type II errors differ significantly across specifications. Incorporating assets substantially reduces inclusion errors, while the use of hybrid equivalence scales significantly reduces exclusion errors. Relying on income alone generates approximately 8 percent additional misclassifications under data-driven scales and 10 percent under hybrid scales.

Table 8 reports multidimensional poverty measures based on income, financial, and property dimensions under alternative identification strategies: the union rule, deprivation in at least two dimensions MPI(2), and the intersection rule MPI(3). The headcount ratios are 59.30, 25.20, and 8.10 percent, respectively, while the adjusted headcount M_0 equals 30.90, 19.50, and 8.10 percent. Under equal dimension weights, the relative contribution of income ranges between 21 and 27 percent, financial deprivation between 39 and 47 percent, and property deprivation between 32 and 34 percent, indicating that the ability to save is the dominant contributor to multidimensional poverty.

Expanding the information set from three to seven dimensions (Table 9) increases the proportion of households identified as poor under the union strategy from 59.30 to 86.80 percent,

[10]Unlike the illustrative example in Section 2.2, the empirical analysis extends the set of normative characteristics to include poor health, single parenthood, retirement, and unemployment (HE, SP, RE, U), for which objective market-based information is unavailable.

while reducing intensity to 23.90 percent. Under the intersection rule requiring at least three deprivations, the headcount is 22.70 percent and the adjusted measure 11.10 percent. As the number of dimensions increases, the relative contribution of each dimension declines, particularly for financial wealth, while health status becomes relatively more important than single parenthood. When at least five dimensions are considered, the contributions of disposable income, financial wealth, and property wealth converge at approximately 19 percent each.

Are the Money-Metric and Counting Approaches Substitutes?

Table 10 evaluates whether the two approaches yield similar classifications. If they were substitutes, correct classifications and error rates would not differ significantly. The results reject this hypothesis. Introducing data-driven equivalence scales in the counting approach increases correct classifications by about two percentage points, but this difference becomes negligible as the number of dimensions increases.[11] As dimensionality rises, correct classifications among the non-poor increase, while correct identification of the poor declines sharply, from about 10 percent with three dimensions to 1.4 percent with five dimensions. This pattern indicates that increasing dimensionality under the counting approach disproportionately increases exclusion errors.

The Preferred Targeting Tool

To establish a ranking between the two approaches, we apply the targeting efficiency criterion described in Definition 3 of Section 3, which assigns equal weight to Type I and Type II errors. Given the hypothetical nature of the experiment, this symmetric weighting avoids embedding normative judgments about fiscal versus social costs. Table 11 shows that adding assets to the money-metric index reduces inclusion errors from 17.5 to 7.6 percent, while increasing exclusion errors from 18.5 to 37.9 percent.

Importantly, even after this increase, exclusion errors under the money-metric approach remain substantially lower than those observed under the counting approach. Under the counting framework with an intersection of at least three dimensions, introducing data-driven equivalence scales reduces exclusion errors from 58 to 28 percent, but simultaneously increases inclusion errors from 7 to 16 percent. As the cutoff rises to five dimensions, inclusion errors approach zero, but exclusion errors increase dramatically, effectively excluding almost all poor households from program participation. These results demonstrate that the counting approach is extremely sensitive to the number of dimensions considered.

The targeting error rates in Table 11 are sample proportions subject to sampling variability. Binomial standard errors are given by $se = \sqrt{p(1-p)/n}$, where $n = N(B = 0) \approx 7,052$ for Type I rates and $n = N(B = 1) \approx 899$ for Type II rates. Standard errors for Type I rates range from 0.02 to 0.45 percentage points across specifications. Those for Type II rates range from 0.38 to 1.65 percentage points. For all counting specifications except one, the money-metric asset-based index exhibits a significantly lower total error sum: the gaps range from roughly 20 to 53 percentage points, each exceeding eight standard errors. The exception

[11] Note that it is not possible to add normative scales in the MPI because the MPI already includes the same dimensions.

is counting MPI with three dimensions and data-driven equivalence scales, whose total error sum (44.55 percent) is within one percentage point of the money-metric sum (45.49 percent), a difference of 0.94 percentage points against a standard error of 2.27 percentage points and a z-statistic of 0.41. These two specifications are therefore statistically indistinguishable on total error. However, their error compositions differ sharply and significantly: the money-metric index achieves its total with a Type I rate of 7.56 percent and a Type II rate of 37.93 percent, while the counting MPI(3) achieves it with a Type I rate of 16.41 percent and a Type II rate of 28.14 percent, gaps of 8.85 and 9.79 percentage points respectively, each exceeding four standard errors. The choice between these two profiles is not an empirical question but a normative one, contingent on the relative social costs assigned to inclusion and exclusion errors. Under equal weighting, the criterion adopted in this paper, the two approaches are equivalent, but money-metric achieves this parity with substantially better control of inclusion errors.

Targeting Efficiency and Inter-household Comparisons

Table 12 compares the characteristics of households identified as poor under the hybrid money-metric index CY^{**} and under the counting MPI with an intersection of at least four dimensions. The profiles of potential beneficiaries differ markedly. Ignoring household composition increases the risk of inclusion errors for single individuals with low income but limited need. Conversely, households with single parents or poor health but sufficient resources may be incorrectly included, while couples with children facing genuine hardship may be excluded. Notably, the profiles of the poor are more similar when comparing the money-metric index to the MPI that corrects income components using equivalence scales. The most striking discrepancy in Table 12 concerns retirement status: 37.67 percent of households identified as poor under the hybrid money-metric are retired, compared with 68.14 percent under the counting approach without equivalence scales. This difference does not reflect a data artifact but a direct structural consequence of the two aggregation approaches. In the counting framework, retirement status is coded as an explicit deprivation dimension, Table 9 shows it contributes between 15 and 28 percent of multidimensional poverty depending on the specification, so retired households enter the pool of the counting poor partly by categorical definition, regardless of whether their pension income provides adequate consumption capacity. The money-metric, by contrast, includes pension income in disposable income Y through transfers and evaluates it against the eligibility threshold like any other income flow: a retired household with a sufficient pension falls above the threshold and is simply not classified as poor. The two approaches therefore do not merely measure retirement-related poverty differently, they embody fundamentally different conceptions of what retirement represents. The counting approach treats retirement as a deprivation state; the money-metric evaluates retirement outcomes. This distinction is a direct implication of the aggregation structures compared throughout this paper, and it illustrates concretely why structural choices in measurement carry first-order consequences for who is identified as eligible.

Logit regressions reported in Table 13 corroborate these findings. A remarkable feature of Table 13 deserves explicit comment. The pseudo-R^2 of the counting logit specifications (0.328

without scales and 0.329 with data-driven scales) is approximately twice that of the money-metric specification (0.146). This does not reflect a superiority of the counting approach but rather a characteristic of its selection mechanism. By requiring simultaneous deprivation in multiple dimensions, the counting approach identifies a sharply profiled but narrow group, predominantly elderly, chronically ill, and single-parent households, that matches its own dimensional criteria with high internal coherence. The money-metric, by contrast, identifies a broader and more heterogeneous group of households whose aggregate welfare falls below the eligibility threshold, including many who are not extreme outliers in any single dimension. A high pseudo-R^2 in the counting logit therefore signals internal consistency of a restrictive selection, not superior coverage of the underlying poor population. The dramatically higher exclusion errors under all counting specifications confirm precisely this: internal sharpness is achieved at the cost of leaving a large share of genuinely poor households unclassified.

Robustness Analysis

To assess robustness, we repeat the targeting efficiency comparison using two alternative poverty definitions based solely on consumption.[12]

The first alternative criterion defines a household as poor if its per-capita consumption is below 480 euro, which corresponds to the 60 percent of the median per-capita consumption. The second criterion is based on the official measure of the relative poverty. In the year 2010, the Italian Statistic Institute (ISTAT) defined the relative poverty line to be equal to 992.46 euro, which corresponded to the average per-capita consumption of a two-member household. The poverty line is then adjusted for the number of members living in a household. The first alternative defines households as poor if per-capita consumption falls below 480 euro, corresponding to 60 percent of median per-capita consumption. The second uses the official ISTAT relative poverty line for 2010 equal to 992.46 euro, which corresponded to the average per-capita consumption of a two-member household.[13] The overlap between the three poverty definitions is imperfect: nearly half of benchmark-poor households are not identified as poor under consumption-based criteria, while about 75 percent overlap between the two consumption measures.

Table 14 confirms the main findings. Across all poverty definitions, the money-metric approach exhibits higher targeting efficiency than the counting approach. Asset inclusion consistently reduces Type I errors while increasing Type II errors, regardless of the poverty definition. Comparing Table 11 and 14 shows that Type I errors vary little with the benchmark choice, while Type II errors increase substantially. Overall, the counting approach incorrectly excludes a larger share of poor households, while the money-metric approach balances inclusion and exclusion errors more effectively.

Taken together, the results indicate that money-metric and counting approaches are not interchangeable. The money-metric framework consistently achieves higher targeting efficiency,

[12]These criteria are not adopted as primary benchmarks because SHIW consumption data are measured with error, relying on a single expenditure question rather than diary methods.

[13]In the year 2010, ISTAT calculated the following poverty lines: 595.48 euro for a single, 992.46 euro for a childless couple, 1319.97 euro for a three-member household, 1617.71 euro for a four-member household, 1885.67 euro for a five-member household, 2143.71 euro for a six-member households, and 2381.90 euro for seven or more members.

is less sensitive to dimensionality, and provides more coherent inter-household comparisons. These properties make it a more reliable basis for harmonized means-testing systems.

6 Conclusions

This paper has compared the targeting efficiency of two multidimensional means-testing approaches, a money-metric index and a counting-based poverty measure, applied to an identical informational base comprising monetary resources, asset holdings, and household characteristics. The experimental design holds all dimensions and deprivation thresholds constant across both approaches, ensuring that any difference in targeting performance reflects exclusively the alternative aggregation structures, cardinal and welfare-theoretically grounded in the money-metric case, binary and non-compensable in the counting case, rather than differences in informational content. This design transforms the comparison into a controlled experiment on aggregation architecture: what each instrument observes is held fixed; only how it processes that information varies.

The results consistently favor the money-metric approach: it yields fewer total misclassifications, proves less sensitive to the number of dimensions considered, and produces more stable interpersonal comparisons across all benchmark definitions examined. The underlying reason is structural: theory-consistent aggregation, which respects interpersonal comparability and allows welfare-relevant compensation across dimensions, is a first-order determinant of means-testing performance, independently of what information the instrument uses. For policymakers engaged in modernizing eligibility criteria, these findings carry a direct implication: the choice of aggregation structure deserves explicit attention alongside the choice of dimensions. A money-metric instrument grounded in welfare theory provides a more coherent basis for eligibility determination not because it commands superior information, but because it processes shared information more effectively.

When targeting is performed under incomplete information, comparisons across households are necessarily imperfect. Households may differ substantially in their demographic characteristics, asset holdings, and exposure to risks, implying that they face different sets of opportunities and capabilities. In such contexts, means-testing tools that insufficiently account for heterogeneity may generate classifications that are formally consistent but substantively unfair, by comparing households that do not share comparable opportunity sets. Using detailed information on income, assets, and household characteristics to approximate the relevant space of functionings and living conditions can therefore reduce the risk of inappropriate interpersonal comparisons and improve the fairness of eligibility decisions.

The empirical results show that both asset information and household heterogeneity are crucial for the correct identification of the poor under both the money-metric and the counting approaches. Ignoring assets leads to systematic misclassification and higher leakage, while accounting for household characteristics substantially alters the profile of households identified as poor. When targeting efficiency is evaluated by jointly considering inclusion and exclusion errors, the money-metric approach consistently outperforms the counting approach. It yields fewer overall misclassifications, is less sensitive to the number of dimensions included, and produces more stable inter-household comparisons. By contrast, the counting approach proves

highly sensitive to dimensionality: reducing inclusion errors often comes at the cost of sharply higher exclusion errors, with important implications for program coverage.

From a policy perspective, these findings are relevant for ongoing efforts to improve the design and harmonization of means-testing systems. In settings such as the European Union—where social protection systems face increasing fiscal pressure and where coordination across countries is an explicit objective—the choice of targeting instrument is not neutral. A money-metric approach grounded in welfare theory and capable of integrating income, assets, and household needs into a single cardinal indicator provides a more coherent and reliable basis for eligibility determination than counting-based methods, particularly when resources are scarce and exclusion errors carry high social costs.

More broadly, the analysis suggests that moving beyond a simple dichotomy between money-metric and multidimensional approaches requires explicit attention to how information is aggregated and how heterogeneity is handled. Even when the same dimensions are considered, different aggregation structures can lead to markedly different policy conclusions. Recognizing these differences is essential for both empirical evaluation and the design of equitable and efficient social protection systems.

References

[1] Aaberge, R. and A. Brandolini (2015): "Multidimensional Poverty and Inequality," in *Handbook of Income Distribution*, Vol. 2a, edited by A. B. Atkinson and F. Bourguignon, Amsterdam: Elsevier.

[2] Alexandrova, A. (2017). *A Philosophy for the Science of Well-Being*. New York: Oxford University Press.

[3] Alkire, S. and J. Foster (2011): "Counting and Multidimensional Poverty Measurement," *Journal of Public Economics*, 95(7-8): 476-487.

[4] Alkire, S. and M. E. Santos (2014): "Measuring Acute Poverty in the Developing World: Robustness and Scope of the Multidimensional Poverty Index," *World Development*, 59: 251-274.

[5] Alkire, S. and S. Seth (2013): "Selecting a Targeting Method to Identify BPL Households in India," *Social Indicators Research*, 112(2): 417-446.

[6] Anand, S. and A. Sen (1997): "Concepts of Human Development and Poverty: A Multidimensional Perspective," Human Development Paper, UNDP.

[7] Atkinson, A. B. (1995): "On Targeting and Social Security: Theory and Western Experience with Family Benefits," in *Public Spending and the Poor*, edited by D. van de Walle and K. Nead, Baltimore: Johns Hopkins University Press.

[8] ____ (2003): "Multidimensional Deprivation: Contrasting Social Welfare and Counting Approaches," *Journal of Economic Inequality*, 1(1): 51-65.

[9] ____ (2019): *Measuring Poverty around the World*, Princeton University Press.

[10] Attanasio, O., E. Hurst and L. Pistaferri (2015): "The Evolution of Income, Consumption, and Leisure Inequality in the US, 1980-2010," in *Improving the Measurement of Consumer Expenditures*, edited by C. Carroll, T. Crossley and J. Sabelhaus, Chicago: University of Chicago Press.

[11] Baldini, M., P. Bosi and S. Toso (2002): "Targeting Welfare in Italy: Old Problems and Perspective on Reform," *Fiscal Studies*, 23(1): 51-75.

[12] Bibi, S. and J.-Y. Duclos (2007): "Equity and Policy Effectiveness with Imperfect Targeting," *Journal of Development Economics*, 83(1): 109-140.

[13] Blackorby, C. and D. Donaldson (1991): "Adult-Equivalence Scales, Interpersonal Comparisons of Well-Being, and Applied Welfare Economics," in *Interpersonal Comparisons and Distributive Justice*, edited by J. Elster and J. Roemer. Cambridge: Cambridge University Press.

[14] Blundell, R., L. Pistaferri and I. Saporta-Eksten (2016): Consumption Inequality and Family Labor Supply," *American Economic Review*, 106(2): 387-435.

[15] Bourguignon, F. and S. R. Chakravarty (2003): "The Measurement of Multidimensional Poverty," *Journal of Economic Inequality*, 1(1): 25-49.

[16] Brandolini, A., S. Magri and T. M. Smeeding (2010): "Asset-Based Measurement of Poverty," *Journal of Policy Analysis and Management*, 29(2): 267-284.

[17] Burkhauser, R. V., T. M. Smeeding and J. Merz (1996): "Relative Inequality and Poverty in Germany and the United States Using Alternative Equivalence Scales," *Review of Income and Wealth*, 42(4): 381-400.

[18] Cantillon, B. and F. Vandenbroucke (2014): *Reconciling Work and Poverty Reduction: How Successful Are European Welfare States?* Oxford University Press.

[19] Carter, M. R. (2008): "What We Can Learn from Asset-Based Approaches to Poverty," University of Wisconsin, Working Paper Series.

[20] Carter, M. R. and C. B. Barrett (2006): "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach," *Journal of Development Studies*, 42(2): 178-199.

[21] Castañeda, T., K. Lindert, B. de la Briere, L. Fernandez, C. Hubert, O. Larranaga, M. Orozco and R. Viquez (2005): "Designing and Implementing Household Targeting Systems: Lessons from Latin America and the United States," Social Protection Discussion Papers Series No. 0526, Human Development Network.

[22] Cavapozzi, D., W. Han and R. Miniaci (2015): "Alternative Weighting Structures for Multidimensional Poverty Assessment," *Journal of Economic Inequality*, 13(3): 425-447.

[23] Coady, D., M. Grosh and J. Hoddinott (2004): "Targeting Outcomes Redux," *World Bank Research Observer*, 19(1): 61-85.

[24] Cornia, G. A. and F. Stewart (1995): "Two Errors of Targeting," in *Public Spending and the Poor*, edited by D. van de Walle and K. Nead, Baltimore: Johns Hopkins University Press.

[25] Costella, C., A. Banthiya, R. Reilly, S. Sivanu, R. Slater, Y. Georgiadou and M. van Aalst (2024): "Mapping the Integration of Climate Considerations in Social Protection in LMICs: An Assessment of Ninety-Eight Climate-Relevant Social Protection Programs," *Climate Risk Management*, 46, 100660.

[26] Cowell, F. and M. Mercader-Prats (1999): "Equivalence of Scales and Inequality," in *Income Inequality Measurement*, edited by J. Silber, Dewenter: Kluwer.

[27] d'Aspremont, C and L. Gevers (2002): "Social Welfare Functionals and Interpersonal Comparability," in *Handbook of Social Choice and Welfare*, edited by K. Arrow, A. Sen, and K. Suzumura, Amsterdam: North Holland.

[28] de Vos, K. and M. A. Zaidi (1997): "Equivalence Scale Sensitivity of Poverty Statistics for the Member States of the European Community," *Review of Income and Wealth*, 43(3): 319-333.

[29] Decancq, K., M. Fleurbaey and E. Schokkaert (2015): "Inequality, Income, and Well-Being," in *Handbook on Income Distribution*, Volume 2a, edited by A. B. Atkinson and F. Bourguignon, Amsterdam: Elsevier.

[30] Decancq, K. and M. A. Lugo (2013): "Weights in Multidimensional Indices of Well-Being: An Overview," *Econometric Reviews*, 32(1): 7-34.

[31] Desai, M. and A. Shah (1988): "An Econometric Approach to the Measurement of Poverty," *Oxford Economic Papers*, 40(3): 505-522.

[32] Dutta, I., P. K. Pattanaik and Y. Xu (2003): "On Measuring Deprivation and the Standard of Living in a Multidimensional Framework on the Basis of Aggregate Data," *Economica*, 70(278): 197-221.

[33] El-Osta, H., A. K. Mishra and M. Morehart (2007): "Determinants of Economic Well-Being among U.S. Farm Households," *Agricultural Economics*, 36(3): 291-304.

[34] European Commission (2017): *The European Pillar of Social Rights*. Luxembourg: Publications Office of the European Union. https://ec.europa.eu/commission/priorities/deeper-and-fairer-economic-and-monetary-union/european-pillar-social-rights/european-pillar-social-rights-20-principles_en.

[35] Gornick, J. C., E. Sierminska and T. Smeeding (2009): "The Income and Wealth Packages of Older Women in Cross-National Perspective," *Journals of Gerontology: Series B*, 64(3): 402-414.

[36] Grinstein-Weiss, M., T. R. Williams Shanks and S. G. Beverly (2014): "Family Assets and Child Outcomes: Evidence and Directions," *The Future of Children*, 24(1): 147-170.

[37] Haveman, R. and E. N. Wolff (2004): "The Concept and Measurement of Asset Poverty: Levels, Trends and Composition for the U.S., 1983–2001," *Journal of Economic Inequality*, 2(2): 145-169.

[38] Immervoll, H. (2012): "Minimum-Income Benefits in OECD Countries: Policy Design, Effectiveness and Challenges" in *Counting the Poor*, edited by D. J. Besharov and K. A. Couch, Oxford University Press.

[39] Kanbur, R., M. Keen and M. Tuomala (1995): "Labor Supply and Targeting in Poverty-Alleviation Programs," in *Public Spending and the Poor*, edited by D. van de Walle and K. Nead, Baltimore: Johns Hopkins University Press.

[40] King, M. (1983): "Welfare Analysis of Tax Reforms using Household Data," *Journal of Public Economics*, 21(2): 183-214.

[41] Lewbel, A. (1989): "Identification and Estimation of Equivalence Scales under Weak Separability," *Review of Economic Studies*, 56(2): 311-316.

[42] ____ (1991): "Cost of Characteristics Indices and Household Equivalence Scales," *European Economic Review*, 35(6): 1277-1293.

[43] Lindert, K. (2005): "Implementing Means-Tested Welfare Systems in the United States," Social Protection Discussion Papers Series No.0532, Human Development Unit, The World Bank.

[44] Marchal, S. and N. van Mechelen (2017): "A New Kid in Town? Active Inclusion Elements in European Minimum Schemes," *Social Policy Administration*, 51(1): 171-194.

[45] Meghir, C. and L. Pistaferri (2011): "Earnings, Consumption and Lifecycle Choices," in *Handbook of Labor Economics*, Vol 4B, edited by O. Ashenfelter and D. Card, Great Britain: North Holland.

[46] Menon, M. and F. Perali (2010): "Econometric Identification of the Cost of Maintaining a Child," *Research on Economic Inequality*, 18: 219-256.

[47] Menon, M., F. Perali and V. Polin (2017): "Il Nuovo Indicatore della Situazione Economica Equivalente: È Una Vera Riforma?," *Rivista di Politica Economica*, 105 (10-12): 305-50.

[48] Menon, M., E. Giovanis and F. Perali (2023): "Disability Specific Equivalence Scales: A Case–control Approach Applied to the Aost of Acquired Brain Injuries," *International Journal of Health Economics and Management*, 23(4): 643-672.

[49] MISSOC (2013): "Overview of Means Testing in Missoc Countries," MISSOC Analysis 2013/1. European Commission, DG Employment, Social Affairs & Inclusion.

[50] Morduch, J. (1994): "Poverty and Vulnerability," *American Economic Review*, 84(2): 221-225.

[51] OECD (2023): "Social Expenditure (SOCX) Update 2023: The Rise and Fall of Public Social Spending with the Outbreak of the COVID-19 Pandemic," Paris: OECD Publishing.

[52] Perali, F. (2003): *The Behavioral and Welfare Analysis of Consumption*, Dordrecht: Springer-Verlag.

[53] Ravallion, M. (2004): "Who Is Protected from Budget Cuts?," *Journal of Policy Reform*, 7(2): 109-122.

[54] _____ (2009): "How Relevant Is Targeting to the Success of an Antipoverty Program?," *World Bank Research Observer*, 24(2): 205-231.

[55] _____ (2016): *The Economics of Poverty: History, Measurement, and Policy*, Oxford University Press.

[56] Skoufias, E. and D. P. Coady (2007): "Are the Welfare Losses from Imperfect Targeting Important?," *Economica*, 74: 756-776.

[57] Smolensky, E., S. Reilly and E. Evenhouse (1995): "Should Public Assistance Be Targeted?," *Journal of Post Keynesian Economics*, 18(1): 3-28.

[58] United Nations Development Programme, UNDP (1997): *Human Development Report 1997. Human Development to Eradicate Poverty*, New York: Oxford University Press.

[59] van de Walle, D. (1998): "Targeting Revisited," *World Bank Research Observer*, 13(2): 231-248.

[60] Weisbrod, B. A. and W. L. Hansen (1968): "An Income-Net Worth Approach to Measuring Economic Welfare," *American Economic Review*, 58(5): 1315-1329.

[61] World Bank (2022): "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Meauseres," World Bank, Living Paper Version 16.

Figure 1: Income and Asset Poverty

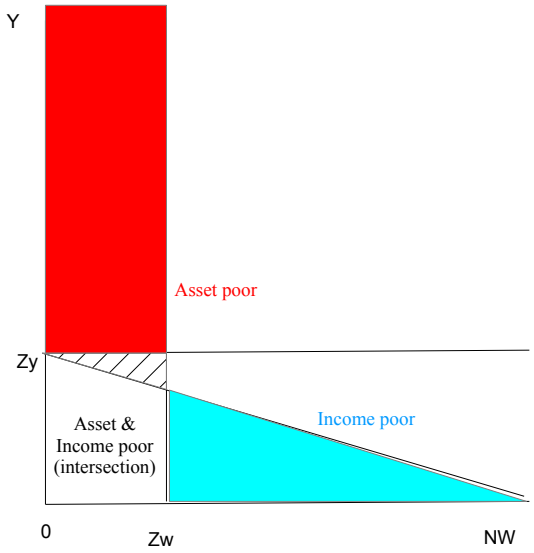


Table 1: Relationship between Needs Satisfaction and Income Quintiles

	Income Quintile					
Needs Satisfaction	1	2	3	4	5	Total
With many difficulties	56.82	23.86	12.02	5.32	1.97	100
	41.56	16.96	9.10	3.89	1.45	
With difficulties	30.51	30.83	19.25	14.44	4.98	100
	23.48	23.06	15.33	11.12	3.84	
With some difficulties	17.37	24.96	23.15	22.61	11.91	100
	25.99	36.3	35.87	33.86	17.88	
Fairly easily	4.77	14.45	20.93	26.71	33.14	100
	6.84	20.13	31.06	38.32	47.67	
Easily	3.65	7.31	15.98	26.18	46.88	100
	1.51	2.93	6.82	10.80	19.40	
Very easily	4.26	4.26	11.91	13.62	65.96	100
	0.63	0.61	1.82	2.01	9.76	
Total	100	100	100	100	100	

Note: Needs satisfaction refers to the question: "How does the income of your family allows meeting monthly needs?". For each of the six categories, figures reported in the first line are row percentages, while those reported in the second one are column percentages. Number of households 7,951.

Table 2: Relationship between Savings and Income Quintiles

	Income Quintile					
Savings	1	2	3	4	5	Total
Dissavings	29.90	19.60	16.94	17.44	16.11	100
	11.30	7.20	6.63	6.60	6.11	
Zero	25.83	23.88	19.85	17.76	12.68	100
	72.13	64.8	57.37	49.62	35.52	
Positive	9.10	15.82	19.10	24.03	31.95	100
	16.57	28.00	36.00	43.78	58.38	
Total	100	100	100	100	100	

Note: Savings refers to the question "All family incomes considered, in this year your family: 1) have borne expenditures exactly equal to all family incomes without being able to save money, 2) have spent less of all family incomes, thus being able to save money, or 3) have spent more of all family incomes, thus using savings accumulated in the past." For each of the three categories, figures reported in the first line are row percentages, while those reported in the second one are column percentages. Number of households 7,951.

Table 3: Descriptive Statistics of Welfare Dimensions by Benchmark Poor and Non-poor Households

	Poor	% of zero	Non-poor	% of zero
No. observations (%)	899 (11.31)		7052 (88.69)	
Disposable income (Y)	10458	4.34%	27470	0.52%
	6060		*19226*	
Income from financial assets (FW)	-191^a	49.61%	10.9^b	10.88%
	999		*2026*	
Income from property assets (NFW)	3180	41.49%	8107	15.60%
	6397		*10361*	
Single parent (SP)	6.23%		2.99%	
Poor health status (HE)	20.20%		10.20%	
Double earner (DE)	27.80%		44.50%	
Retired (RE)	41.70%		48.50%	
Unemployed (U)	30.80%		9.91%	
Money metric	13447	1.11%	35589	0.06%
	8915		*24758*	
Data-driven $\varsigma(d)$	3.12		3.07	
	1.14		*1.07*	
Hybrid $\varsigma(d,n)$	3.45		3.27	
	1.13		*1.07*	
Equivalent money metric adjusted by:				
Data-driven scales	4643	1.11%	12266	0.06%
	2691		*8224*	
Hybrid scales	4129	1.11%	11467	0.06%
	2462		*7810*	

Note: Standard deviations are given in italics. ^{a} 21.13% of negative values, ^{b} 17.77% of negative values. The mean (standard deviation) of income from financial assets conditional on positive values is 415.87 (1624.58) for non-poor households and 41.47 (577.33) for poor households. A household is classified as poor if the following criteria are jointly experienced 1) family needs are met "with many difficulties," 2) the family has either zero savings or dissavings (as defined in note of Table 2), and 3) family's equivalent disposable income falls below a threshold defined as the 40-percentile of the income distribution.

Table 4: Identification of Deprivation Cutoffs of Welfare Dimensions

Dimensions (D_{im})	Definition	Level ($Z_{D_{ij}}$)
Equivalent Money Metric (CY^*)	$0.6 \cdot median(CY^*)$	5816.25 euro
Equivalent Disposable Income (Y^*)	$0.6 \cdot median(Y^*)$	4500 euro
Equivalent Financial Income (FW^*)	$0.6 \cdot median(FW^*)$	6.23 euro
Equivalent Non-Financial Income (NFW^*)	$0.6 \cdot median(NFW^*)$	1170 euro
Single parent (SP)	if single parent	1
Poor health status (HE)	if at least one member is "bad" or "very bad"	1
Retired (RE)	if household head retired	1
Unemployed (U)	if household head unemployed	1

Note: Equivalent incomes calculated using data-driven equivalence scales.

Table 5: Pairwise Correlation among Welfare Dimensions

	Y^*	FW^*	NFW^*	SP	HE	RE	U
Y^*	1						
FW^*	0.119*	1					
NFW^*	0.289*	0.169*	1				
SP	−0.011*	−0.049*	−0.010*	1			
HE	−0.075*	0.011*	−0.046*	−0.027*	1		
RE	−0.019*	0.143*	0.098*	−0.104*	0.201*	1	
U	−0.219*	−0.013*	−0.093*	0.026*	−0.001*	−0.357*	1

Note: Equivalent incomes (Y^*= equivalent disposable income, FW^*= equivalent financial income, NFW^*= equivalent non-financial income) calculated using data-driven scales. SP = single parent, HE = poor health status, RE = retired, U = unemployed. * indicates significance at 5 percent level.

Table 6: Poverty Analysis: Money-Metric Approach

	Income dimensions			
	CY	Y	FW	NFW
Poverty line	Z_{Y^*}	Z_{Y^*}	Z_{FW^*}	Z_{NFW^*}
Headcount (data-driven scales) - %	10.62	19.52	43.63	29.49
Headcount (hybrid scales) - %	13.72	24.75	44.18	31.38

Note: The proportion of poor in terms of current income, CY, is defined by the relative poverty line of the equivalent income distribution, Z_{Y^*}. Y is disposable income, FW is financial income, and NFW is non financial income.

Table 7: Targeting Efficiency Comparison of Income and Asset-based Money-Metric Index

	$T1 = \frac{N(T=1,B=0)}{N(B=0)}$ Error of Type I	$T2 = \frac{N(T=0,B=1)}{N(B=1)}$ Error of Type II
With data-driven scales		
Income-based means testing	13.30	31.70
Asset-based means testing	5.50	49.28
With hybrid scales		
Income-based means testing	17.51	18.46
Asset-based means testing	7.56	37.93

Note: Figures are percentages. B stands for Benchmark. N is total sample size. Error of Type I occurs when a household is incorrectly classified as poor, while error of Type II incorrectly classifies a household as not poor.

Table 8: Poverty Analysis: Counting Approach with Three Welfare Dimensions

	Union		MPI(2)[a]		MPI(3)[a]	
H	0.593	*0.006*	0.252	*0.005*	0.081	*0.003*
M_0	0.309	*0.004*	0.195	*0.004*	0.081	*0.003*
Relative contributions (%)						
Y^*	21.07		26.88		33.33	
	0.36		*0.41*		*0.00*	
FW^*	47.09		39.12		33.33	
	0.42		*0.29*		*0.00*	
NFW^*	31.84		33.99		33.33	
	0.40		*0.37*		*0.00*	

Note: The welfare dimensions are: Y^*= equivalent disposable income, FW^*= equivalent financial income, NFW^*= equivalent non-financial income all calculated using data-driven equivalence scales. [a] Digits in parentheses indicate the number of dimensions used to calculate the index MPI. Standard errors are given in italics.

Table 9: Poverty Analysis: Counting Approach with Seven Welfare Dimensions

	Union		MPI(3)[a]		MPI(4)[a]		MPI(5)[a]	
H	0.868	*0.004*	0.227	*0.005*	0.085	*0.003*	0.014	*0.001*
M_0	0.239	*0.002*	0.111	*0.002*	0.050	*0.002*	0.010	*0.001*
Relative contributions (%)								
Y^*	11.66		18.75		19.54		19.68	
	0.22		*0.31*		*0.35*		*0.19*	
FW^*	26.07		24.92		22.75		19.86	
	0.27		*0.24*		*0.21*		*0.07*	
NFW^*	17.62		20.53		21.01		19.33	
	0.25		*0.30*		*0.30*		*0.31*	
SP - Single parent	2.01		2.11		2.50		4.79	
	0.12		*0.18*		*0.28*		*0.80*	
HE - poor health status	6.79		9.31		11.06		16.67	
	0.20		*0.31*		*0.45*		*0.69*	
RE - retired	28.50		15.39		13.09		11.35	
	0.36		*0.35*		*0.46*		*0.93*	
U - unemployed	7.34		8.99		10.06		8.33	
	0.21		*0.31*		*0.46*		*0.93*	

Note: The welfare dimensions are: Y^*= equivalent disposable income, FW^*= equivalent financial income, NFW^*= equivalent non-financial income all calculated using data-driven equivalence scales, SP = single parent, HE = poor health status, RE = retired, U = unemployed. [a] Digits in parentheses indicate the number of dimensions used to calculate the index MPI. Standard errors are given in italics.

Table 10: Matching between the Money Metric and Counting Approach

MPI without scales		Money metric (CY^{**}) % Non-poor	% Poor	MPI with data-driven scales		Money metric (CY^{**}) % Non-poor	% Poor
MPI(3)[a]	Non-poor	73.89	3.82	MPI(3)[a]	Non-poor	75.80	1.52
	Poor	12.39	9.90		Poor	10.48	12.20
MPI(4)[a]	Non-poor	82.93	8.26	MPI(4)[a]	Non-poor	84.69	6.85
	Poor	3.35	5.46		Poor	1.58	6.87
MPI(5)[a]	Non-poor	85.81	12.29	MPI(5)[a]	Non-poor	86.27	12.38
	Poor	0.47	1.43		Poor	0.01	1.35

Note: Figures are percentages. [a] Digits between brackets indicate the number of dimensions used to calculate the index MPI.

Table 11: Targeting Efficiency of the Money-Metric and Counting Approach

	$\frac{N(T=1,B=0)}{N(B=0)}$ Type I error	$\frac{N(T=0,B=1)}{N(B=1)}$ Type II error
	Money metric approach	
Income	17.51	18.46
Asset-based	7.56	37.93
	Counting approach	
Without scales		
MPI(3)	7.22	58.06
MPI(4)	1.05	87.88
MPI(5)	0.04	98.67
With data-driven scales		
MPI(3)	16.41	28.14
MPI(4)	4.55	60.96
MPI(5)	0.47	91.66

Note: Figures are percentages. B stands for Benchmark. N is the total sample size. Error of Type I occurs when a household is incorrectly classified as poor, while error of Type II incorrectly classifies a household as not poor. Digits in parentheses indicate the number of dimensions used to calculate the index MPI.

Table 12: Poverty Profile Description by the Money-Metric and Counting Approach

	Money metric (CY^{**})	Counting with 4 dimensions	
		without scales	with data-driven scales
No. of observations (%)	1091 (13.72)	700 (8.80)	672 (8.45)
Head age (mean)	55.42	64.39	60.16
No. of adults (mean)	2.12	1.76	2.19
No. of children (mean)	0.68	0.35	0.54
Couple	74.79%	37.28%	68.30%
Living alone	17.05%	44.12%	17.11%
Single parent	5.68%	11.14%	10.42%
Poor health status	23.47%	47.57%	46.13%
Retired	37.67%	68.14%	54.61%
Double earner	26.86%	4.29%	4.46%
Unemployed	35.93%	28.14%	41.96%

Table 13: Poverty Profile Analysis of the Money-Metric and Counting Approach

	Money-metric (CY^{**})		Counting index with 4 dimensions			
			without scales		with data-driven scales	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Head age	-0.016^{**}	0.004	-0.021^{**}	0.005	-0.021^{**}	0.005
No. of adults	-0.329^{**}	0.060	-0.282^{**}	0.094	-0.191^{*}	0.077
No. of children	0.313^{**}	0.052	0.201^{*}	0.087	0.291^{**}	0.077
Couple	1.190^{**}	0.158	-0.268	0.170	1.071^{**}	0.192
Living alone	0.497^{**}	0.189	0.966^{**}	0.217	0.386	0.240
Single parent	1.046^{**}	0.199	2.883^{**}	0.280	2.996^{**}	0.280
Poor health status	1.457^{**}	0.097	2.505^{**}	0.110	2.622^{**}	0.116
Retired	-1.016^{*}	0.471	1.177^{*}	0.547	1.966^{**}	0.472
Double earner	-1.739^{**}	0.466	-2.156^{**}	0.526	-1.444^{**}	0.431
Unemployed	0.279	0.476	1.961^{**}	0.567	2.977^{**}	0.480
Pseudo R^2	0.146		0.328		0.329	

Note: The asset-based money metric index is demographically adjusted using hybrid equivalence scales. ** and * indicate significance at 1 and 5 percent level, respectively.

Table 14: Targeting Efficiency Comparison of the Money-Metric and Counting Approach with Alternative Definitions of Poverty

	Poverty line = 480 euro		ISTAT poverty line	
	Type I error	Type II error	Type I error	Type II error
		Money-metric approach		
Income	17.99	42.91	18.21	33.67
Asset-based	7.03	54.25	7.03	43.76
		Counting approach		
Without scales				
MPI(3)	7.82	72.95	7.53	65.86
MPI(4)	1.16	92.22	1.08	89.92
MPI(5)	0.05	99.13	0.04	98.89
With data-driven scales				
MPI(3)	15.12	41.16	15.2	29.79
MPI(4)	4.46	72.44	4.26	64.94
MPI(5)	0.67	95.35	0.60	93.80

Note: Figures are percentages. Error of Type I occurs when a household is incorrectly classified as poor, while error of Type II incorrectly classifies a household as not poor. Digits in parentheses indicate the number of dimensions used to calculate the index MPI.

Appendix A: Definition of Net Worth in the Context of the SHIW 2010 Data Base

Definition A1. *Income* Y is net (after tax) disposable income given by the sum of payroll income from net wages and salaries including fringe benefits YL, non-labor income from pension and net transfers YT including scholarships, alimony and gifts and net self-employment income YM

$$Y = YL + YT + YM.$$

Definition A2. *Income from financial assets net of liabilities* YCF given by interests from deposits $YCF1$ evaluated at $r_1 = 0.633\%$, interests from government securities $YCF2$ evaluated at $r_2 = 1.759\%$, interests from other securities $YCF3$ evaluated at $r_3 = 5.639\%$ minus interest payments on financial liabilities $YCF4$ evaluated at $r_4 = 4.433\%$

$$YCF = YCF1 + YCF2 + YCF3 - YCF4.$$

Definition A3. *Property income* YCA given by income from real estate as actual rents $YCA1$ or as imputed rents (if the house is fully owned) $YCA2$

$$YCA = YCA1(+YCA2).$$

Total net worth is given by the sum of the financial net worth minus home equity. Liquid assets are the value of checking and saving accounts, value of stocks, value of bonds, cash value in a life insurance, and others.