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Joachim Merz • Tim Rathjen

Time and Income Poverty –
An Interdependent Multidimensional Poverty
Approach with German Time Use Diary Data

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Time and Income Poverty –
An Interdependent Multidimensional Poverty
Approach with German Time Use Diary Data

Joachim Merz and Tim Rathjen[1]

Abstract

Income as the traditional one dimensional measure in well-being and poverty analyses is extended in recent studies by a multidimensional poverty concept. Though this is certainly a progress, however, two important aspects are missing: time as an important dimension and the interdependence of the often only separately counted multiple poverty dimensions.

Our paper will contribute to both aspects: First, we consider time – and income – both as striking and restricting resources of everyday activities and hence account for time and income as important multiple poverty dimensions. Second, the interdependence of the poverty dimensions will be evaluated by the German population to allow an advanced approach to understand possible substitution effects and the respective trade offs between the dimensions.

Referring to the time dimension, we follow Sen's capability approach with its freedom of the living conditions' choice and social exclusion and argue, that restricted time might exclude from social participation. In particular, restricted genuine, personal leisure time (not entire leisure time) in particular is associated with a restricted social participation. The crucial question then is how to measure the substitution between income and such genuine leisure time. In our analysis we consider the country population's valuation with data from the German Socio-Economic Panel and estimate the substitution by a CES-utility function of general utility/satisfaction. Given this quantification we disentangle time, income and interdependent multidimensional poverty regimes characterising the working poor.

In addition, we quantify further socio-economic influences for each interdependent multidimensional poverty regime by a multinomial logit based on time use diary data of the German Time Use Study 2001/02.

One striking result for Germany: the substitution between time and income is significant and we find an important fraction of time poor who are unable to substitute their time deficit by income. These poor people are ignored within the poverty and well-being as well as the time crunch and time famine discussion so far.

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Zusammenfassung

Einkommen als traditionelles eindimensionales Wohlfahrts- und Armutsmaß wird in neueren Studien um ein multidimensionales Konzept erweitert. Obwohl dies sicherlich ein Fortschritt ist, fehlen zwei wichtige Aspekte: Zeit als eine wichtige Dimension und die Interdependenz der oft nur separat gezählten multiplen Armutsdimensionen.

Unsere Studie will zu beiden Aspekten einen Beitrag liefern: erstens, wir betrachten Zeit – und Einkommen – beide als entscheidende und beschränkende Ressourcen aller täglichen Aktivitäten und betrachten deshalb Zeit und Einkommen als wichtige Dimensionen einer multiplen Armutsanalyse. Zweitens, die Interdependenz der multiplen Armutsdimensionen wird durch die Bevölkerung insgesamt bewertet, um zu einem Verständnis möglicher Substitutions- und Austauschbeziehungen zwischen den Dimensionen zu kommen.

Hinsichtlich der Zeitdimension folgen wir Sen's „Capability"-Ansatz mit seiner freien Wahl der Lebensbedingungen und sozialer Exklusion und argumentieren, dass eine Einschränkung der Zeit die soziale Partizipation einschränken kann. Im Besonderen ist eine Beschränkung der persönlichen, genuinen Freizeit (nicht die gesamte Freizeit) verknüpft mit eingeschränkter sozialer Partizipation. Die entscheidende Frage jedoch ist, wie die Substitution zwischen Einkommen und solcher persönlicher Freizeit erfasst werden kann. In unserer Analyse berücksichtigen wir die Bewertung der Bevölkerung mit Daten des Sozio-ökonomischen Panels und schätzen die Substitution mit einer CES-Nutzenfunktion einer generellen Zufriedenheit. Mit dieser Qantifizierung können wir dann singuläre Zeit- und Einkommensarmut sowie erweiterte multiple Armutssektoren für die als arm geltenden Erwerbstätigen („working poor") herausarbeiten.

Wir quantifizieren zudem weitere sozio-ökonomische Einflußfaktoren für jede der interdependenten multidimensionalen Armutssektoren mit einem multinomialen logit Ansatz basierend auf den Zeittagebuchdaten der deutschen Zeitbudgeterhebung 2001/02.

Ein herausragendes Ergebnis für Deutschland: Substitution zwischen Zeit und Einkommen ist signifikant und wir finden einen hohen Prozentsatz von zeitarmen Menschen, die nicht in der Lage sind, ihr Zeitdefizit durch Einkommen zu substituieren. Dieser Personenkreis wird sowohl in der Armuts- und Wohlfahrtsdiskussion als auch in der Diskussion um Zeitstress und Zeitdruck bisher ignoriert.

JEL: D31, D13, J22

Schlagwörter: *Interdependente multidimensionale Zeit- und Einkommensarmut, Zeit- und Einkommenssubstitution, erweiterete ökonomische Wohlfahrt,Zufriedenheit, Schätzung einer CES-Nutzenfunktion, arme Erwerbstätige ("working poor"), Deutsches Sozio-ökonomisches Panel, Deutsche Zeitbudgeterhebung 2001/02*

1 Introduction

Recent poverty, well-being and inequality studies extend the traditional income based poverty concept by a multidimensional approach. At least three challenging questions thereby have to be answered for any empirical analysis: first: which poverty dimensions should be incorporated, second: how to model the inter-dimensional relations, and third: how to evaluate the set of dimensions to define an interdependent multidimensional poverty line to finally quantify poverty.

Our study will contribute to the multidimensional poverty discussion by a novel empirical based consideration of the interdependence of multiple poverty dimensions. First: beyond income as the central material resource, we consider time as a striking and prominent resource of everyday activities and participation in social life and hence focus on the two dominant poverty dimensions: time and income. Within Sen's capability frame we thereby consider time as genuine leisure time as an indicator of a finally remaining personal and genuine resort for social participation. Second: the interdependence of the poverty dimensions will be estimated by a CES-utility function approach specifying the individual's satisfaction/utility with a possible substitution and respective trade-off between time and money, and third: the value judgement of the multiple poverty threshold level will be estimated empirically by a "satisfaction with life" approach to draw an interdependent multidimensional poverty line and to quantify poverty in multiple dimensions for Germany.

In our empirical analysis we consider the population's evaluation with data from the German Socio-Economic Panel and estimate the substitution between genuine leisure time and income. The multidimensional poverty threshold utility level then is derived at the multiple dimensions' poverty lines. Given this quantification we then disentangle different single time, single income and multidimensional poverty regimes and discuss the results based on the German Time Use Survey 2001/02 with more than 35.000 diaries. We further quantify competing socio-economic explaining factors to be poor for each poverty regime by a multinomial logit estimation to extract significant influences and to provide hints of a targeted respective economic and social policy.

One striking result for Germany: the estimation of "satisfaction with life" utility results in a significant substitution between genuine leisure time and income. We face an important fraction of time poor who are unable to substitute their degree of time poverty by income. These poor people are ignored so far within the poverty and well-being as well as the time crunch and time famine discussion.

2 Background, Literature and Model Characteristics

2.1 Multidimensional Poverty and Time as a Poverty Dimension

Within the last decades emphasis of economic well-being and poverty research is laid on the multidimensionality of poverty and social exclusion (Deutsch and Silber 2005, Nolan and Whelan 2007, Groh-Samberg 2008, Lugo and Maasoumi 2008, Bourguignon and Chakravarty 2003, Tsui 2002). The income centred analyses are extended whereat the relative depreciation approach addresses the exclusion "from ordinary living patterns, customs and activities

caused by lack of resources" (Townsend 1979, 16). Within the "living conditions (Lebenslagen)" approach also other resources than income as the cause of disadvantages are incorporated when poverty are discussed (e.g. Andreß and Lipsmeier 1995). And, there is an increasing emphasis on multidimensional poverty and social exclusion which is strongly influenced by Amartya Sen's capability approach with its freedom to be able to satisfy the "ends", not "means" (Sen 1999, 90 and Sen 1985)[1]. As an empirical result the EU Laeken social inclusion indicator set considers not only income poverty and income inequality but also educational disadvantages, health inequalities, unemployment and worklessness (Atkinson 2003).

Though the discussion is broad for many dimensions to be included in a multidimensional poverty approach (Cappellari and Jenkins 2007 for a summary), however, the time dimension is hardly considered. Yet the time dimension is seen as an important poverty dimension under different perspectives.

From a sociology perspective, time crunch, time famine, time squeeze or harriedness describe increased experience of time pressure, which can be considered as a new social problem of post-industrial societies (Bonke and Gerstoft 2007, Sullivan 2007, Rosa 2003, Garhammer 2002a, Linder 1970). Though some researches see time pressure as an illusion and a consequence of choice rather than necessity (Goodin et al. 2005), increased economic and labour market problems escalate working pressure and time crunch. With focus on the time and income poor Bittman 1999 stated „The ability to participate in [social life] […] is the product of both access to leisure goods and services (income dimension), and a sufficient quantity of leisure time (time dimension)". Concerning market and nonmarket relations Vickery 1977 and Harvey 2007 argue that time poor individuals realize less household production as a result of their time deficit and hence create less goods and services in their own households; they have to substitute these "missing" products and services at the market.

From the economic perspective time itself and in connection with income is of longstanding and broad interest (Hamermesh and Pfann 2005, Diamond 1994). Within the microeconomic static neoclassical labour supply approach a rational individual there maximises its utility/satisfaction as a function of consumption (C) and leisure (L) subject to the time and budget restrictions.[2] The solution is the optimal allocation of total income (WT, W=wage, T=total time) between consumption expenditures (PC, P=prices, C=consumption) and valued leisure (WL): PC+WL=WT+G (G=other income). Though this is sometimes called the "labour/leisure" question, it is indeed a consumption/leisure one.[3]

In the sequel of this argument together with Osberg 2002 we argue, that "… there is good reason to think that people care about both money income and the amount of time they have to use to earn that income … [with the consequence that] any inequality measuring has to consider time if money income differences are heavily influenced by differences in working time" (Osberg 2002, 3). The working poor perspective here accentuates the swamping working hours to earn income but still being poor with no time remaining for any social participation.

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[1] For social cohesion see also Osberg 2003.

[2] The allocation of time over many periods is the well-known focus of the *intertemporal* neoclassical dynamic optimization model of the consumption-leisure decision (e.g. Hall 1988).

[3] Then the consumption expenditures are (PC) seen as an income equivalent.

The large literature on social interaction (e.g. Osberg 2003) moreover stresses the importance of social implications of work for an optimal co-ordination of human activities – here work and leisure – for individual well-being (Jenkins and Osberg 2005, Merz 2002) including its poverty aspect.

In our study, we do not focus on total leisure time (L) as the total counterpart to individual working hours, but focus on genuine leisure time. When working hour commitments by nonmarket, household work and further responsibilities are extracted form total leisure, then genuine leisure time could be seen as a final personal resort which remains after all market and nonmarket responsibilities for very personal activities and genuine social participation (e.g. playing soccer with other "social companions" (Jenkins and Osberg 2005, Merz and Osberg 2009)). When even this final resort of personal freedom is limited or not given anymore, then in our study somebody will be called time poor according to the (genuine) leisure time dimension.

2.2 Multidimensional Poverty, Interdependence and Evaluation of Poverty Dimensions

Given the decision which dimensions/components will be captured within multidimensional poverty a judgement about the poverty threshold has to be delivered for quantifying the extent of poverty. Multidimensional poverty in most cases is empirically measured by a list of some activities an individual is excluded from (e.g. Cappellari and Jenkins 2005). A more comprehensive approach has to choose weights when the dimensions are aggregated. The crucial questions, however, are how to substantiate the specific aggregation, how to respect the interdependence between the single dimensions, and how to evaluate the multidimensional threshold (e.g. Nolan and Whelan 2007, 148-150).

Within the quality of life literature there is a longstanding discussion and practice to summarize dimensions to produce a single index[4] by arbitrarily weighting the single dimensions (see Hagerty et al. 2001 for a review). Our concern, however, is to value the substitution between income and genuine leisure and its multidimensional poverty threshold empirically based. To evaluate the poverty dimensions and their interdependence we refer to the recent happiness/satisfaction literature (Frey and Stutzer 2005, 2002, Clark et al. 2008) with its direct measures of satisfaction about quality of life aspects.[5] In the sequel of these approaches we specify a utility function by time and income allowing substitution via a CES production function approach, and evaluate the dimensions' interdependence/simultaneity and the level of the multidimensional poverty threshold by empirical data for Germany.[6]

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[4] Like the UNDP's Human Development Index HDI which summarizes life expectancy, education and standard of living.

[5] For a critical discussion about subjective outcomes in economics and satisfaction as an economic variable see Hamermesh 2004 and Freeman 1978.

[6] Bonke et al. 2009 discuss time and money interdependencies however as a simultaneous determination of economic satisfaction and leisure satisfaction rather than overall satisfactions as a function of its determinants time and income.

3 Interdependent Multidimensional Poverty – Model and Empirical Strategy

After the motivation and justification of our multidimensional poverty characteristics in the last section, in principle, our model and empirical strategy is already at hand: first: the dimensions within our multidimensional poverty analysis will be income and personal, genuine leisure time; second: the interdependence between the dimensions will be estimated and evaluated by a CES utility function, and third: given this evaluation we can determine a population interdependent multidimensional poverty threshold and finally quantify and discuss the results of the extended poverty approach.

This model will now be applied to the German situation. Our empirical strategy follows four steps:

Step 1: Quantify the interdependence/substitution and evaluation of time and income by the estimation of a CES-utility function $u = f(I, L)$ with genuine time (L) and income (I) as the arguments.

Step 2: Find the multidimensional poverty threshold $u^{poor} = f(I^{poor}, L^{poor})$ as utility defined at the point of single time and income poverty thresholds.

Step 3: Compare each individual's time income dependent utility to the population's multidimensional poverty utility level and assign each individual to one of the multiple poverty regimes.

Step 4: Characterize and analyse the poor individuals' socio-economic background for each of the multiple poverty regime.

Within the single steps we also describe our respective data bases, the German Socio-Economic Panel and the German Time Use Study GTUS 2001/02.

Chapter 4 will focus on the time and income substitution estimates (steps 1). Chapter 5 then defines the actual interdependent multiple poverty threshold for Germany (step 2) and chapter 6 discusses the results (steps 3 and 4).

4 Time and Income Substitution – CES utility estimation

The interdependence of multidimensional poverty measured via information theory with specific distances to a multidimensional poverty line is discussed by Lugo and Maasoumi 2008.[7] Their resulting poverty index is of a CES-like form with some similarities to Bourguignon and Chakravarty 1999, 2003. In Lugo's and Maasoumi's empirical section they arbitrarily choose different elasticities of substitution between the poverty dimensions (Indonesians' expenditure, health status, and level of education). Whereas Lugo and Maasoumi as well as Bourguignon and Chakravarty just present some different elasticities for the sake of exposition the topic, we, however, follow an empirical evaluation of the

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[7] Multidimensional poverty indices in general are discussed e.g. in Tsui 2002.

substitution elasticity to allow a population based evaluation of interdependent multidimensional poverty of time and income as step 1:

> ***Step 1:*** **Quantify the interdependence/substitution and evaluation of time and income by the estimation of a CES-utility function with genuine time and income as the arguments.**

4.1   CES Utility Function of Time and Income Substitution

For an evaluation of the empirical based substitution magnitude we use a two-input production function (u) with income (I) and leisure time (L) as input factors and utility (u) as the output. Not to be restrictive to the kind of substitution we specify a Constant Elasticity of Substitution (CES) utility function[8] by

$$(1) \qquad u = f(I,L) = \gamma \cdot \left(\delta \cdot I^{-\rho} + (1-\delta) \cdot L^{-\rho} \right)^{-\frac{\upsilon}{\rho}}$$

with the substitution elasticity $\sigma = \dfrac{1}{1+\rho}$, ρ as a curvature parameter, γ as a constant[9], υ as returns to scale, and the input coefficients δ to be determined. The degree of substitution between the input factors is measured by the Hicks' elasticity of substitution as the relative change in the proportion of the two input factors as a function of the relative change of the corresponding marginal rate of technical substitution. With Figure 1 we can characterise the degree of substitution from perfect substitution ($\rho = -1, \sigma = \infty$) over a certain degree of substitution (including the Cobb-Douglas case with $\rho = 0, \sigma = 1$) to no substitution at all (complementary input factors, $\rho = -\infty, \sigma = 0$).

Figure 1: Isoquants and Outputs of CES Utility/Production Functions
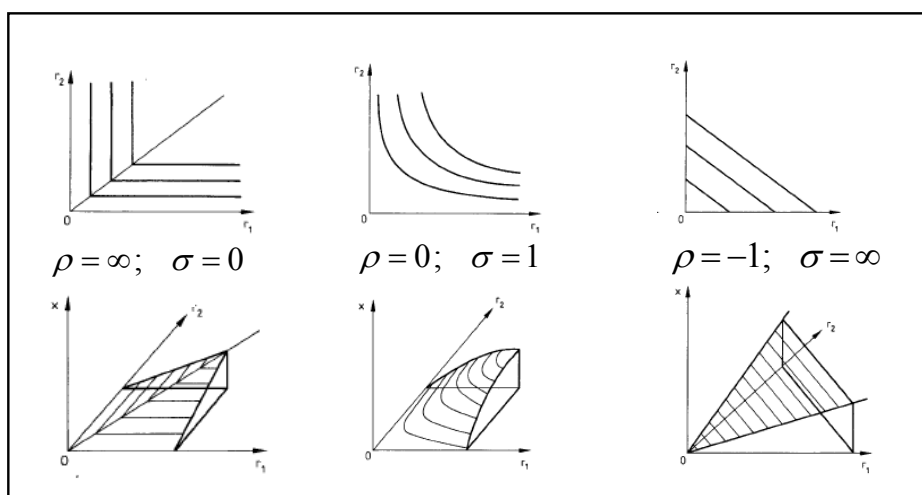
Source: According to Fandel 2005

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[8] See Fandel 2005 or for a general discussion of the CES production function and Hoff 2002 for more than two multiple input factors.

[9] In the production function discussion γ is formulated and interpreted as technical progress in different ways.

A direct estimation of the non-linear CES function has been suggested by Kmenta 1967 with an approximation by the first and second order terms in the Taylor Series expansion around the substitution elasticity of zero:

$$(2) \quad \ln u = \ln \gamma + \upsilon\delta \ln I + \upsilon(1-\delta)\ln L - \frac{1}{2}\rho\upsilon\delta(1-\delta)\left[\ln I - \ln L\right]^2 + \varepsilon$$

with ε as an iid distributed error term to allow a common reduced form estimation within the Classical Linear Regression Model frame as

$$(3) \quad \ln u = \alpha_0 + \alpha_1 \ln I + \alpha_2 \ln L \quad + \quad \alpha_3 \quad \left[\ln I - \ln L\right]^2 + \varepsilon$$

The structural form coefficients can be computed via:

$$\alpha_0 = \ln\gamma \iff \gamma = e^{\alpha_0}$$

$$\alpha_1 = \upsilon\delta \quad \text{and} \quad \alpha_2 = \upsilon(1-\delta) = \upsilon - \upsilon\delta \implies \alpha_2 = \upsilon - \alpha_1 \iff \upsilon = \alpha_1 + \alpha_2$$

$$\implies \alpha_1 = (\alpha_1 + \alpha_2)\delta \iff \delta = \frac{\alpha_1}{\alpha_1 + \alpha_2}$$

$$\alpha_3 = -\frac{1}{2}\rho\upsilon\delta(1-\delta) \iff \rho = (-2)\frac{\alpha_3}{\upsilon\delta(1-\delta)}$$

$$\implies \rho = (-2)\frac{\alpha_3}{(\alpha_1+\alpha_2)\frac{\alpha_1}{\alpha_1+\alpha_2}(1-\frac{\alpha_1}{\alpha_1+\alpha_2})} = (-2)\frac{\alpha_3}{\alpha_1 - \frac{\alpha_1^2}{\alpha_1+\alpha_2}}$$

Kmenta's approach has attractive features: OLS can be used and the CES parameters can be estimated in a simultaneous context. However, the estimation of ρ is dependent upon the scale of the inputs, and the approximation is good around the income and leisure time ratio about 1 and deteriorates for larger or smaller ratios (Thursby and Lovell (1978), p. 370). For reliable results this has to be tested after estimation.

4.2 CES Empirical Estimation of the Time and Income Substitution

To avoid an arbitrarily taken substitution elasticity our evaluation will follow satisfaction/ utility information revealed by the German population. Our actual data base will be the diary data of the German Time Use Study (GTUS). Since an adequate satisfaction question is not available in the GTUS we choose the German Socio-Economic Panel (SOEP) which provides necessary information for the evaluation and estimation of the time/income substitution.

SOEP data base: The SOEP is a wide-ranging representative longitudinal study of private households. It provides information on all household members, consisting of Germans living in the Old and New German States, foreigners, and recent immigrants to Germany (www.diw.de/soep). The SOEP was started in 1984. In 2002, there were 11.659 households and 31.087 persons sampled.

While the trade off between income and genuine leisure time does first and foremost exist for working people, we focus on the active population. With the argument that part-time workers are beyond the substitution question, persons with less or equal five hours paid work time a day are excluded. With the further restriction of available information of all three relevant

information (income, genuine leisure time, satisfaction) the data base finally involves 5.901 households and 10.831 persons.

Income, Time and Satisfaction – Empirical Assignments

Income: Based on individual earned income and income on invests as well as self-employed and business income, net income results after a reduction of individual direct taxes and social security contributions as well as an addition of state transfers.[10] The literature commonly discusses poverty within a household frame respected by an equivalence scale considering the age dependent needs/requirements and economies of scales of different household types. In Europe the so-called new OECD equivalence scale is reputable with weight one to the household head, 0.5 for further household members with the age of 15 or older, and 0.3 for all other members. **Net equivalent income** – the household net income divided by the household equivalence scale – then is allocated to all household members. This personalized net equivalent income is equivalent to a single person's income at the same well-being level. Net equivalent income constitutes the income variable for the following empirical analyses.

Time: Whereas net equivalent income is a widely accepted income measure for poverty analyses, a comparable measure and acceptance for time is not obvious. As discussed, in addition to paid working further obligations and responsibilities, which – at least at a first glance – are not in the substitution perspective like sleeping, housework child care, etc. result in genuine leisure time as a last resort of no obligations and individual leisure and freedom. With the available SOEP information we then define genuine leisure time as typical weekday time for "hobbies and other free-time activities" (see Figure 8 in Appendix, SOEP question 11, 2002). If one agrees with this approach a question remains: Is time to be considered individually or in the household context like the income approach. With the argument that individual time can not be reallocated between the household members (or only to a certain extent) and that genuine leisure time in particular is personal related, we further on stay on the measured individual time without a direct household reference.

Utility/satisfaction: The SOEP questionnaire among others has an 11 point scaled question about "satisfaction with your life in general" (see Figure 7 in Appendix). The general satisfaction answers will be the population's evaluation for the income and time individual importance. It is obvious that the concentration on these two explanatory factors can only serve as an approximation and is open for many discussions. Nevertheless, it seems to be the best available approach and data, which likewise are used in other studies, too (Bonke et al. 2006, Rode 2004, Clark and Oswald 1996).

CES utility estimation results

The CES utility function estimates then yields the Table 1 results.

Table 1: Income, Time and Satisfaction: CES Utility Estimation Results

Lhs: ln u (utility)	not standardized coefficients		Standardized coefficients	t-value	significance
	b	Std. deviation	beta		
const.	1,267	,033		37,913	,000
ln I (ln net equivalent income)	,056	,009	,123	6,347	,000
ln L (ln genuine leisure)	,052	,010	,180	5,153	,000
Kmenta_correction, quadr. term	,004	,001	,123	3,167	,002
R^2 / adj. R^2	3,7% / 3,7%				
n	10.827				

Source: SOEP 2002; own OLS calculations.

The important estimation result the respective coefficients are highly significant and will show a significant substitution between genuine leisure time and income.[11] The overall goodness of fit is low but comparable to other cross sectional results. The estimated CES utility function then is

$$(5) \qquad u = 3,550 \cdot \left(0,519 \cdot I^{0,297} + 0,481 \cdot L^{0,297}\right)^{-\frac{0,108}{-0,297}}$$

with $\gamma = e^{\alpha_0} = e^{1,267} = 3,550$

with $\upsilon = \alpha_1 + \alpha_2 = 0,056 + 0,052 = 0,108$

with $\delta = \dfrac{\alpha_1}{\alpha_1 + \alpha_2} = \dfrac{0,056}{0,056 + 0,052} = 0,519$

with $\rho = (-2)\dfrac{0,004}{0,056 - \dfrac{0,056^2}{0,056 + 0,052}} = -0,297$

Thus, we face a constant elasticity of substitution of $\sigma = 1,422$ with the Figure 2 isoquants of the utility function. The substitution between genuine time and income is a bit less distinct than in the Cobb Douglas type ($\sigma = 1$) situation. Thus it is a bit easier to substitute time by income than in the Cobb Douglas case. The returns to scale with $\upsilon = 0,108$ means that a doubling of the inputs time and income will raise utility by around 7%.[12] We discuss further implications within chapter 5.

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[11] Bonke et al. 2006 confirm the substitution of time and money but complements in satisfaction with Danish data.

[12] returns to scale: $f(k \cdot I, k \cdot L) = u \cdot k^{\upsilon}$ with k as a scalar.

Figure 2: Income, Time and Satisfaction: Indifference Curves of the Estimated CES Utility Function
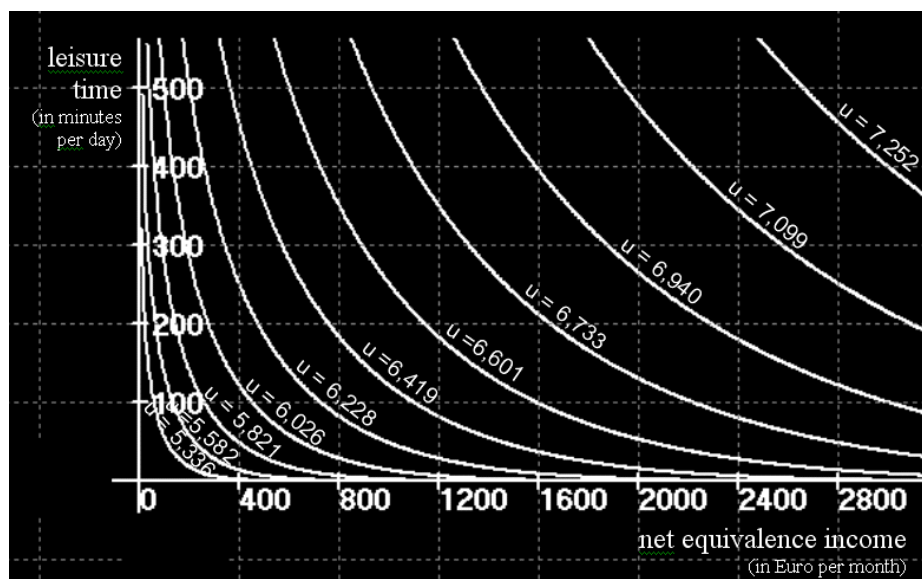
Source: SOEP 2002; own calculations.

As Thursby and Lovell (1978, 370) stated, the estimated CES parameters of the Kmenta approximation are only consistent under specific circumstances. The bias for all parameter estimates increases if ρ departs from zero (i.e. when σ departs from unity). As a rule of thumb, Hoff (2004, 301) advocates that ρ should generally not exceed +0.1 to +0.2. With our $\rho = -0.297$ we fit this criterion. In addition the approximation only converges to the true CES function if $\ln(I/L)$ is within the convergence circle with a radius of $\left|1/(\rho\delta)\right|$. Even with some extreme values for our case with income (I) = 6000 € net equivalence income per month and genuine leisure time (L) = 30 minutes per day the ratio $\ln(I/L)$=5,298 is within the required circle with radius $\left|1/(\rho\delta)\right|$=6,487. A third criterion considers the returns to scale:

Furthermore, the translog approximation quickly fails to predict the CES structure if the returns to scale υ exceeds unity (Hoff 2004, 301). With $\upsilon = 0,108$ in our case the third criterion is fulfilled and accentuates the goodness of fit of our estimates over a wide range of values outside the approximation point. Figure 2 provides an impression of the estimated curvature and substitution of time and income evaluated by the representative SOEP data.

To summarise: the significant CES coefficients together with the goodness of fit to several criteria of an approximation to a wide range of values accentuate the peculiar significant CES estimates and substitution between genuine leisure and income. We discuss implications of the substitution process with the poverty results then.

9

5 An Interdependent Multiple Poverty Threshold with Time and Income for Germany

Given the above evaluation of the time and income interdependence and evaluation the step 2 task now is:

Step 2: **Find the multidimensional poverty threshold** $u^{poor} = f(I^{poor}, L^{poor})$ **as utility defined at the point of single time and income poverty thresholds.**

Income poor: The member states of the European Union agree on a relative money income based definition for poverty. The concept identified those individuals as poor (having a poverty risk) whose net equivalent income is below 60% of median net equivalent income, a concept which is followed by the German Federal Poverty and Richness Reports (Bundesregierung 2005, XV). The monetary approach acts on the assumption that income as the central resource for goods and services is mainly determining the living standard (see the further discussion in chapter 2).

Time poor: Based on our general discussion of time as a poverty dimension, in principle we draw on Bittman's (1999, 14) time poverty approach: "A commonly employed standard used to benchmark [income] poverty [..] is 50 per cent of the median. [..] Applying an analogous standard (50 per cent of the median leisure time) [..] we can get some idea of what social situation produces the most severe kinds of time poverty". However, we adopt the agreement of the European Union on an income poverty definition described above and define the risk of time poverty at 60% of the median, here 60% of the median genuine leisure time.

As discussed and under the perspective of the very personal related genuine leisure time we do not consider any equivalized time concept.

Given these concepts we will use the German Time Use Survey (GTUS) to define actual poverty lines for the income and time dimension to find the respective interdependent multiple poverty threshold. Though we could stay on the SOEP data we prefer to take the more detailed and more accurate GTUS diary data to focus not the stylized but actual situation of the individual days under consideration.

GTUS diary data base: The actual German Time Use Survey was conducted by the Federal Statistical Office in 2001/2002. The original sample contains 35.813 diaries of three day of 11.962 persons with the age of 10 years or older in 5.171 households. In the time use diaries for each ten minute interval an activity, written in own words, are collected with an secondary (parallel) activity and "with whom" and "where" information (see Figure 6 in Appendix). Coded activities are available for the user. Supplementary personal and household questionnaires provide socio-economic background variables. Field work started in April 2001 and finished in May 2002.[13]

After excluding the non active population and respecting the 5 hours constraint analogous to the SOEP estimates the ready for estimation sample contains 8.147 diaries of 2.871 persons in 1.890 households.

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[13] For further GTUS information see www.forschungsdatenzentrum.de and the comprehensive *GTUS-Compass* about the broad range of GTUS 2001/02 information and its usage is provided by Statistisches Bundesamt 2006a.).

Net equivalized income is calculated as monthly net equivalent income out of the household questionnaire supplement.

Genuine leisure time will be defined as the sum of daily activities that are allocated to one of the main categories Social Life ("Sozialleben und Unterhaltung"; activities 500-531), Participation at Sportive Activities or Activities in the Nature ("Teilnahme an sportlichen Aktivitäten bzw. Aktivitäten in der Natur"; activities 600-649), Hobbiess and Games ("Hobbies und Spiele"; activities 700-739) and Mass Media ("Massenmedien"; activities 800-849).

Interdependent Multidimensional Poverty Threshold $u^{poor} = f(I^{poor}, L^{poor})$

The GTUS 2001/02 median net equivalence income of 1.322,58 € per month and yields the single 60% income poverty line of $I^{poor} = 793,55$ € (see Table 4 in Appendix). The median leisure time of 310 minutes per day yields the single 60% time poverty line of $L^{poor} = 186$ minutes (see Table 4 in Appendix).[14] Note, that these definitions typically are based on the total population (active and non-active). The later empirical investigation focus on the active population with its working poor.

The interdependent multidimensional poverty line then is given by that estimated CES utility isoquant which runs through the intersection of both single poverty lines:

$$(7) \qquad u^{poor} = f(I^{poor}, L^{poor}) = 3,550 \cdot \left(0,519 \cdot 793,55^{0,297} + 0,481 \cdot 186^{0,297}\right)^{-\frac{0,108}{-0,297}} = 6,418$$

To formulate a direct expression of the utility isoquant through (I^{poor}, L^{poor}) interdependent multidimensional poverty line, we resolve equation (7) for genuine leisure time L (as the ordinate) at $u^{poor} = 6,418$ and get:[15]

$$(8) \qquad L = \left(12,558 - 1,079 \cdot I^{0,297}\right)^{\frac{1}{0,297}}.$$

If an individual's utility – evaluated by the population's CES interdependence at its actual genuine leisure time and actual net equivalent income – will be less than 6,418 then this person will be called multidimensional poor.

6 Interdependent Multidimensional Time and Income Poverty – Results for Germany

Given the interdependent multidimensional poverty line from above we are now able to assign each individual not only to be poor or not but also to one of the poverty regimes under the multiple poverty line (step 3) as in Figure 4:

> *Step 3:* **Compare each individual's time income dependent utility to the population's multidimensional poverty utility level and assign each individual to one of the multiple poverty regimes.**

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[14] Descriptive information of net equivalent income and genuine leisure time can be found in the Appendix.

[15] See the single steps in the Appendix.

Based on the GTUS 2001/2 diary data we face the following descriptive results of the poverty head count ratios. Figure 4 and Table 2 provide information for each of the six poverty regimes as well as aggregates for a one dimensional poverty view only.

Figure 3: Multidimensional Poverty and its Regimes
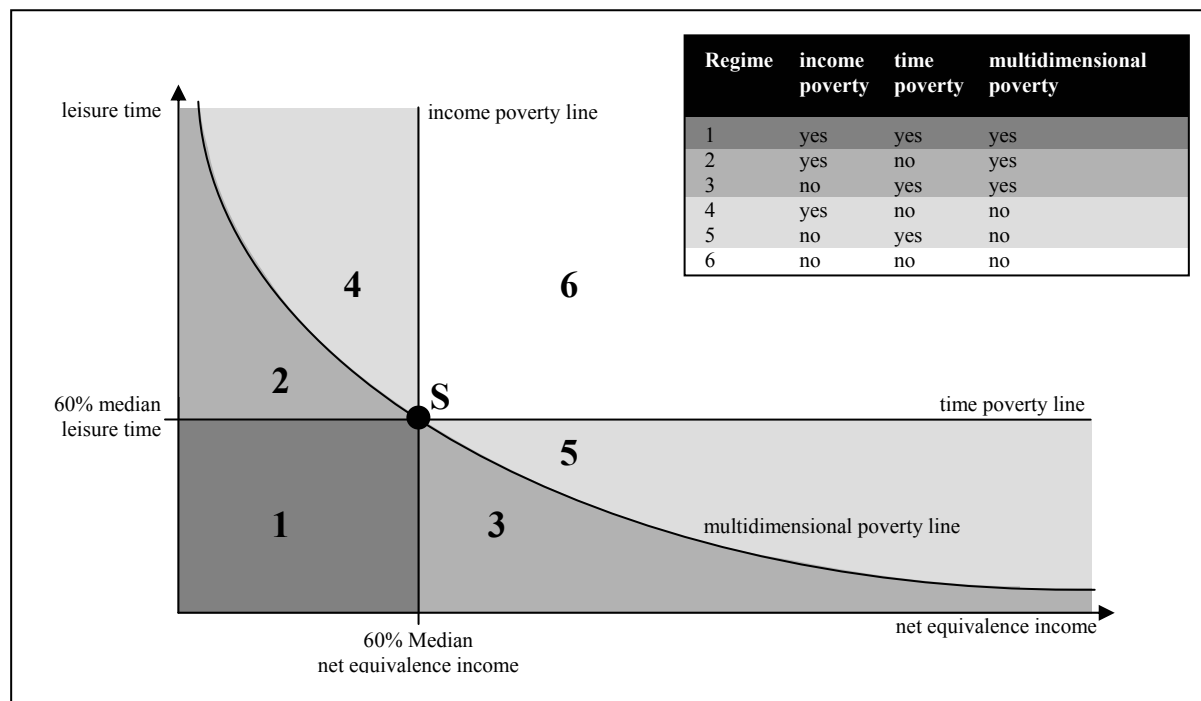
Source: own Figure.

Income poor (one dimensional, regimes 1, 2, 4): The traditional income based poverty measure counts those persons as poor which are under 60% median net equivalence income, which here are 795,33 € (regimes 1, 2 and 4); 4,8% then are income poor. Note, that this figure is for the active population only, the working poor. As to a recent study of the "working poor" based on the SOEP 2002 data about 6,8% of the active population are measured as income poor by the net equivalent concept (Rhein 2009, 4). With respect to the different data bases and a lower workweek there of about 19 hours, our result seems to be roughly confirmed.[16]

Multidimensional poor (regimes 1, 2, 3): All individuals of the active population below the multidimensional poverty line are called multidimensional (MD) poor (union of the regimes 1, 2 and 3). In Germany 2001/02 we face 12,3% of all the active population as poor in this multiple sense.

Compared to the traditional one-dimensional income poverty threshold (regimes 1, 2, 4) the evaluated multidimensional substitution would diminish income poverty (regime 4) by 1,3% (as percentage points here and in the following). These persons value their remaining genuine leisure time higher than the respective poor income and cross the multidimensional poverty line. On the other hand, the revealed substitution adds person to the poor, which spend efforts

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[16] Based on the total population, the recent the Federal Poverty and Richness Report the head count ration of the income poor based on the total population, active and non-active, is about 14%, however based on another data base, the Income and Consumption Survey (EVS) of 2003 and measured at 60% of the average (arithmetic mean) net equivalent income with 980 € (Bundesregierung 2008, 23).

and time to earn more than 60% median net equivalent income and are not considered so far as income poor: 8,7% earn more than the poverty threshold (795,33 €) but nevertheless are poor because of their evaluation of pressured leisure time, which is below the time poverty line (regime 3).

Time poor (one dimensional, regimes 1, 3, 5): An individual is time poor if his or her leisure time is under 60% median leisure time respectively being in a position below the time poverty line (regimes 1, 3 and 5). The respective head count ratios sums up to 47,3%. That almost 50% of the active are leisure time poor depends on the definition of its threshold with the active and the non-active population, where the non-active normally will have more time spend for leisure. Thus the time poverty line of about 3 hours a day is hardly exceeded by the time poor. The relatively large one dimensional time poor figure, however, is drastically reduced when substitution is considered: 36,2% of the active population with an income-time-position in regime 5 are able to or do substitute their time deficit by earning additional income. They trade off less genuine leisure time for more income. A further inspection according their working time efforts out of Table 2 refers to particular time intensive working schedules: with 43,3% in this regime more than the average of all active persons work more than 41 hours a week.

From the above 47,3% one dimensional time poor persons then only 8,7% remains poor (regime 3) trading off time for money above the income poverty threshold but still stay multidimensional poor.

Strict time and income poor (regime 1): This is the hard core of 2,5% multidimensional disadvantaged persons. They are poor by income as well as by the remaining genuine leisure time. They in particular have not an accepted minimum (evaluated by the German population) of leisure to participate in social life neither in the public nor in the private sphere. Remember: genuine leisure time here includes social life, sports activities, hobbies and games and mass media like TV. According to socio-characteristics (Table 2) 4,5% are working more than 41 hours; all minor working hour groups lie between 1,2% and 2,2% respectively 3,5% with less than 20 weekly working hours. The strict multidimensional poor are in particular foreigners (8,0%) compared to 2,4% Germans and particularly live in East Germany.

Figure 4: Multidimensional Poverty:
Overall results according to Poverty Regimes
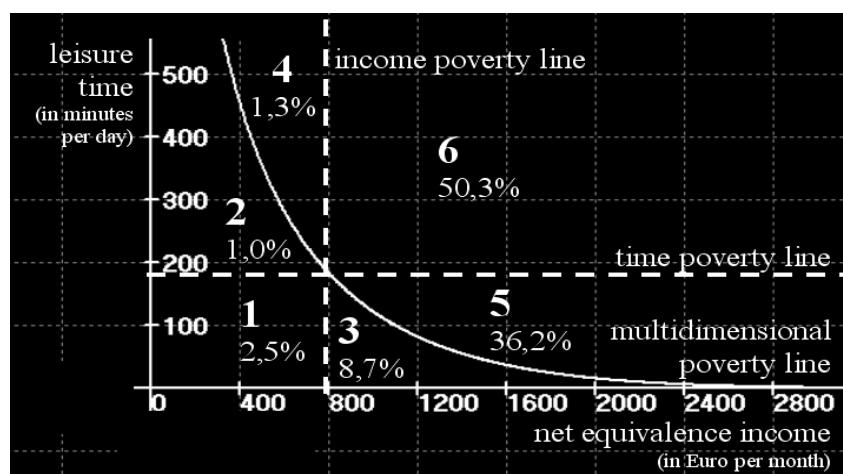
Source: SOEP 2002 and GTUS 2001/02, own calculations.

Socio-economic characteristics and multidimensional poverty

Discussing with Table 2 [17] socio-economic characteristics within multidimensional poverty in particular, we will focus on those poor who trade off time for money beyond the income poverty threshold but still stay multidimensional poor (regime 3). They face in general a time deficit which can not be substituted by their income though this income is above the income poverty line. The spectrum of multidimensional poor time-income positions in regime 3 varies from either very genuine leisure time poor people which might earn a lot of income (far right in Figure 3 of regime 3) to time poor people where the time deficit can not be substituted by the low income narrow above the income poverty line (near the intersection of the strict income and time poverty lines).[18] Nevertheless some further striking results out of Table 2 will be mentioned.

Gender: There are relatively more multidimensional (MD) poor women who in general are not able to substitute their time deficit by income probably because of further household obligations. This holds in particular for MD poor women with income above the income poverty line (regimes 3).

Age: Persons in their particular work intensive high time pressure age, between 25 and 44 years, say, yield a high regime 3 poverty ratio (10,2%) compared to the other age groups.

Education: Compared to other educational certificates a high scholl diploma and university degree prevent MD poverty the most.

Occupation: As it might be expected the self-employed, as liberal professions (Freie Berufe) and entrepreneurs, is the most time pressured and time poor group followed by white collar workers. In particular, for entrepreneurs almost 30% have to be assigned as MD poor. Though time pressure plays a prominent role, nevertheless, about 15,3% of the entrepreneurs are income poor (regimes 1, 2, 4), can not substitute above poverty income by time (regime 3: 15,2%) and face strict MD poverty (regime 1: 11,7%) the most. This is a strong hint to a larger group of low self-employed income which is confirmed e.g. by income analyses with the German Income Tax by Merz 2008, 2007, Merz and Zwick 2005.

Weekly working hours: Time intensive weekly working (41 hours and more) and time less intensive, part time working hours (thru 20 hours) cause the prominent MD poverty groups. They are also examples for the discussed situation in poverty regime 3 for the more extreme situation with relative high working efforts with respective high income and high time pressure (regime 3: 10,1%) as well as low working efforts with respective low above poor income and lower time pressure with both unable to substitute time for income still being MD poor.

Nationality: Foreigners compared to Germans face a higher risk to be MD poor (18,3% vs. 12,1%) with a pronounced higher risk to be strictly poor in the time and income dimension.

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[17] All percentages in Table 2 refer to the respective socio-economic group.

[18] The time poor persons of regime 5, however, are able to substitute their time deficit by their income above the income poverty line.

Table 2: Interdependent Multidimensional Poverty in Poverty Regimes by Socioeconomic Characteristics (in %)

	Poverty Regime						overall	Income poverty	Time poverty	Multidi-mensional poverty
	1	2	3	4	5	6				
Gender										
Male	2,5	1,2	8,3	0,9	34,8	52,3	100	4,6	45,6	11,9
Female	2,4	0,8	9,4	2,1	38,5	46,4	100	5,2	50,4	12,6
Age										
10 to 17	3,5	3,4	10,2	7,5	18,8	56,6	100	14,4	32,6	17,1
18 to 24	1,9	2,2	6,8	1,3	24,9	62,9	100	5,4	33,7	10,9
25 to 44	2,7	1,0	10,2	1,6	36,9	47,6	100	5,2	49,8	13,9
45 to 64	2,3	0,6	6,9	0,7	39,7	49,8	100	3,6	48,9	9,8
65 or older	4,5	2,6	11,3	4,2	43,0	34,3	100	11,4	58,8	18,5
Education										
No certificate	3,7	0,5	11,6	3,8	32,4	48,0	100	8,0	47,6	15,8
Secondary school I	2,0	0,6	9,6	2,0	32,7	53,1	100	4,5	44,3	12,1
Secondary School II	3,0	1,6	10,0	1,2	34,5	49,7	100	5,8	47,5	14,5
High school diploma	1,5	1,1	6,9	0,8	37,7	52,1	100	3,3	46,0	9,4
University degree	3,1	0,4	6,5	0,8	48,1	41,1	100	4,3	57,6	10,0
Occupational status										
Liberal professions	4,6	0,4	6,3	2,2	37,6	48,9	100	7,2	48,5	11,3
Entrepreneur	11,7	2,6	15,2	1,0	38,1	31,5	100	15,3	65,0	29,4
Civil servant	0,0	0,0	4,1	0,1	41,2	54,4	100	0,3	45,3	4,3
White-collar worker	0,7	0,4	6,8	0,5	41,4	50,2	100	1,6	49,0	7,9
Blue-collar worker	2,2	1,0	10,7	2,1	32,0	51,9	100	5,3	45,0	14,0
Other occupation group	6,3	4,2	10,8	3,9	18,6	56,2	100	14,4	35,8	21,3
Weekly working hours										
Thru 20	3,5	1,8	12,9	1,8	21,1	51,0	100	7,1	45,4	18,1
21 to 25	1,2	1,8	8,1	1,2	31,4	56,3	100	4,2	40,7	11,1
26 to 35	2,2	0,2	9,0	3,3	33,9	51,3	100	5,7	45,2	11,4
36 to 40	1,2	0,8	7,5	0,7	36,1	53,8	100	2,7	44,8	9,5
41 or more	4,6	0,7	10,1	0,9	43,3	40,3	100	6,3	58,0	15,5
Nationality										
German	2,4	0,9	8,8	1,3	36,3	50,3	100	4,6	47,4	12,1
Foreigner	8,0	5,3	5,1	3,1	29,7	48,8	100	16,4	42,8	18,3
Household/Family structure										
Single-household	1,9	0,8	7,6	1,8	38,8	49,1	100	4,5	48,2	10,3
Couple without kids	0,5	0,3	3,5	0,6	42,0	53,1	100	1,4	46,0	4,2
Couple with one kid	2,4	0,6	7,0	1,0	36,5	52,6	100	3,9	45,9	9,9
Couple with two kids	1,8	0,9	12,4	0,5	33,9	50,6	100	3,2	48,1	15,1
Couple, >= three kids	9,3	3,9	18,4	1,8	27,6	39,0	100	15,1	55,3	31,6
single parent, one kid	4,2	3,5	11,6	6,9	23,3	50,6	100	14,5	39,1	19,2
single parent, >=kids	5,2	1,7	9,8	4,2	32,8	46,2	100	11,2	47,9	16,8
other households	4,6	1,1	11,0	0,2	34,2	48,9	100	5,9	49,8	16,7
Region										
West Germany	1,8	0,9	7,3	1,3	35,7	52,9	100	4,0	44,8	10,1
East Germany	5,4	1,5	14,6	1,5	38,5	38,6	100	8,3	58,5	21,5
Overall	**2,5**	**1,0**	**8,7**	**1,3**	**36,2**	**50,3**	**100**	**4,8**	**47,3**	**12,2**

Source: own calculations with GTUS 2001/02, weighted data.

Household/Family structure: Single parents with kids have a higher risk to MD poverty (19,2% respective 16,8%) as well as strict time and income poverty (4,2% respective 5,2%)

than single parents without kids. A further striking result is observable regarding the number of kids in couple households. The head count ratio of working people that are able to substitute their time deficit by above poor income not being MD poor (regime 5) is diminishing as the number of children in the household is rising. At the same time, the head count ratio of working people that are not able to substitute their time deficit by income above poverty line (regime 3) is rising by an increased number of children (also see Figure 5). While the aggregate of both regimes is approximate constant by the number of children in any case (app. 45% being time poor), an expected move to MD poverty by the rising number of children will be evident.

Figure 5: Time poor and income above income poverty by household/family structure
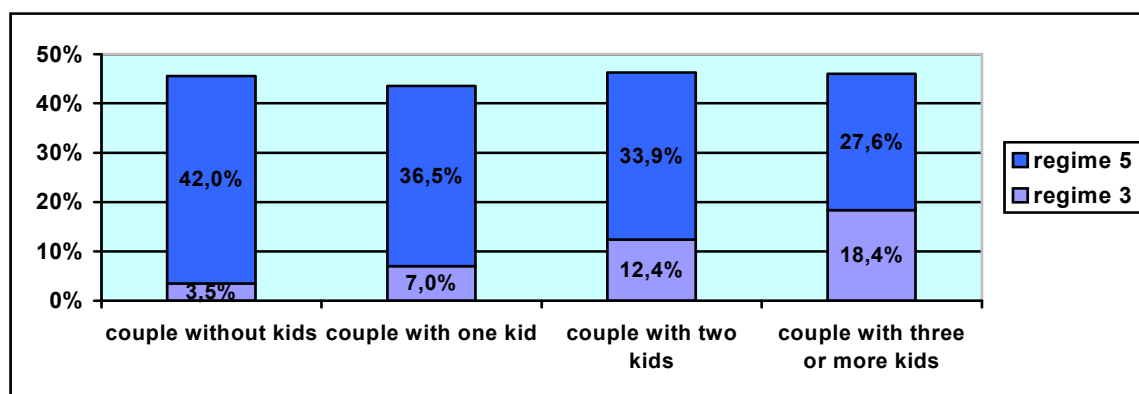
Source: own calculations with GTUS 2001/02, weighted data.

Region: MD poverty (21,5%) as well strict time and income poverty (5,4%, regime 1) is stronger in East Germany than in West Germany (10,1% respective 1,8%).

To summarise: MD poverty with its different poverty regimes heavily depends on the socio-economic individual living conditions and strikes also the empirical importance of time and time pressure of being poor in multiple dimensions in our society.

7   Multivariate Estimation of Explanatory Factors in Interdependent Multidimensional Time and Income Poverty Regimes

Whereas the last chapter discussed the influence of single socio-economic characteristics when MD poverty is explained, this final chapter analyses its significance when the characteristics compete against each other; this is the second task of our step 4:

> *Step 4:* **Characterize and analyse the poor individuals' socio-economic background for each of the multiple poverty regime.**

We present two multinomial logit estimates[19]: Non income and non time poverty (regime 6) is chosen as the reference category in Table 3, whereas strict income poverty (regimes 1, 2, 4)

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[19] For the econometrics of the multinomial logit model see e.g. Greene 2008, 842 pp.

is   the reference category in Table 8 (Appendix). Overall the goodness of fit according to Cox and Snell (0,362, respective 0,352), Nagelkerke (0,405 respective 0,398) and Mc Fadden (0,200 respective 0,201) is satisfactory for both models.

In accordance with the descriptive results, being female raises the probability to be time but not income poor (regimes 3 and 5) significantly, possibly due to childcare and household burden. Further, a university degree significantly raises the probability in the substitution regime 2 (not time but income poor, MD poor) but diminishes the probability within the substitution regime 3 (not income but time poor, MD poor).

Most coefficients for the occupational status, with regime 3 exception for entrepreneurs, are not significant. Entrepreneurs because of time pressure in particular have no chance to substitute time for income. In the multivariate analysis thus the occupational status for the other occupations plays not a significant role in explaining the probability to be MD poor with its different regimes any more.

The weekly working hour situation for all working hour groups and for all MD poverty regimes, however, is highly significant with prominently rising the risk of poverty when work is very time incentive (over 41 hours the week). Thus time pressure with squeezing genuine leisure time is an important part yielding MD poverty.

Personal income as well as the remaining household income (to test distinct parts of equivalent income) diminishes in the same way significantly all MD poverty regimes.

Moreover the estimation confirms that the number of kids in a household has a significant and discussed influence of the parents' income-time-position in particular for couples. The risk for MD poverty in all regimes is rising with an increased number of children.

Regional influences remain significant only for regime 5, raising the probability not being MD poor any more because of substitution time for income.

To summarise: Together with the more extended discussion with the descriptive results, the multinomial logit estimates strikes the importance of single socio-economic factors for a higher risk to be MD poor and within MD poverty regimes. To be a women, having a university degree or being an entrepreneur rises in particular MD poverty above the income poverty lines and genuine leisure time poverty which can not be traded for income (regime 3). Very important and significant for all MD poverty regimes is the individual working hour schedule. Intensified by non-market unpaid working hours in the household, rising paid and unpaid working hours not only yield diminishing genuine leisure time, but influence MD poverty in all its regimes by the importance of time pressure not substitutable by income.

Greater families have a higher risk to MD poverty regardless of being a couple or being single; again time pressure plays a crucial role in addition to the income burden. Living in East Germany has no effects for any single MD poverty regime, however, allows substitution time for income not being MD poor any more.

The second multinomial logit estimation with reference to the income poor accentuates the substitution areas when the time dimension extends pure income poverty (regimes 3 and 5, Appendix Table 3). The single impacts altogether confirm our discussed results.

Table 3: Multidimensional Poverty and its Regimes – Multinomial Logit Estimation for the Active Population

	category I **regime 1**	category II **regime 2**	category III **regime 3**	category IV **regime 4**	category V **regime 5**
constant	15,288 ***	16,777 ***	-,026	11,938 ***	-1,968 ***
Personal characteristics					
female	,514	-,357	,520 ***	-,626	,418 ***
age	,057	-,152	,047	,086	,057 ***
Age²/100	-,014	,273 **	-,050	-,042	-,060 ***
Education (reference: no certificate)					
secondary scholl_I (Hauptschule)	,581	1,557	-,061	2,006	-,124
secondary scholl_II (Realschule)	1,079	2,344 *	-,252 *	1,875	-,100
high scholl diploma	1,051	2,859 **	-,110	1,393	-,021
university degree	2,454	3,762 **	-,162 **	2,112	,071
Occupational status (reference: blue-collar w.)					
liberal professions	-,202	-2,133 *	-,285	-,039	-,249 *
entrepreneur	,570	,194	,483 ***	-,471	,213 *
civil servant	-,174	,753	-,275	,436	-,089
white-collar worker	,073	,243	-,060	,364	,062
other occupation group	1,206	,691	,082	2,789 ***	-,198
Weekly working hours (reference: 41 or more)					
thru_20	-2,454 ***	-2,388 ***	-,646 ***	-2,305 ***	-,487 ***
21 to 25	-4,220 ***	-2,233 **	-1,323 ***	-2,279 ***	-,526 ***
26 to 35	-1,551 ***	-2,320 ***	-,630 **	-1,452 **	-,401 ***
36 to 40	-1,762 ***	-1,002 *	-,799 ***	-1,670 ***	-,340 ***
Income situation					
personal net income	-,015 ***	-,016 ***	-,001 ***	-,013 ***	,000 ***
residual income	-,015 ***	-,016 ***	-,001 ***	-,013 ***	,000 ***
Nationality (reference: German)					
foreigner	1,797 **	2,238 ***	-,180	1,534 *	-,156
Household/Family structure (reference: couple without kids)					
single person household	-6,124 ***	-4,302 ***	-,545 **	-4,613 ***	,192 *
couple with one kid	5,044 ***	6,361 ***	,819 ***	3,561 ***	,041
couple with two kids	7,790 ***	9,648 ***	1,494 ***	6,065 ***	,018
couple with three or more kids	13,821 ***	15,343 ***	2,762 ***	10,933 ***	,086
single parent with one kid	,008	,836	,440 **	,333	,006
single parent with two kids	4,034 ***	5,696 ***	1,246 ***	3,378 ***	,166
other household structure	8,043 ***	7,983 ***	1,839 ***	5,001 ***	,011
Region (reference: West Germany)					
East Germany	,282	-,523	,617	-,160	,482 ***

Degrees of Freedom	135	Cox and Snell	.362
Prob. Value for LR	,000	Nagelkerke	,405
n (observations)	7499	Mc Fadden	,200

Reference category non poor
Level of significance: * 10%, ** 5%, *** 1%

Source: own estimation with GTUS 2001/02.

8   Concluding remarks

This study extends income poverty by the time dimension and analyses multidimensional (MD) poverty with its different MD regimes. A squeezed genuine leisure time is interpreted as an exclusion from social life in the sense of Sen's capability and freedom of choice approach when well-being is regarded. With a CES utility function estimation a significant substitution between income and time was evaluated by the German population via the German Socio-economic Panel SOEP 2002 data. With the revealed interdependencies we then could assign, based on detailed German Time Use diary data 2001/02, the individual income-time situation to interdependent multidimensional poverty and its regimes.

The descriptive analyses and the multinomial logit estimation strike the importance of socio-economic characteristics for being MD poor. We quantify gender, education, occupation, working hours, household/family structure, nationality and regional impacts on being poor in different MD poverty regimes. In particular the time burden of work and child care makes it more difficult to substitute the time deficit by income. For this and in particular for women thus time poverty and time pressure in general is an important impact for MD which result in MD poverty even when the income poverty threshold is exceeded but with time being so scarce and valuable that it can not be substituted by an income above the income poverty line.

Thus, our analysis result is a strong case to discuss poverty not any more by the income dimension alone, and also not by the time dimension alone, but with regard to the valued interdependence of time and income together. In particular, there is an important fraction of the population being (marginal) above the income poverty threshold, but by evaluation of the society are not able to trade off their pressured genuine leisure time (regime 3) for income. They are multidimensional poor and are excluded from social participation though they are not poor by its income resource.

Further research certainly is necessary for an extended analysis of time poverty and its impact even for a more dimensional poverty. And, beyond head count ratios, MD poverty intensity has to be quantified by poverty attributes like the poverty gap and distributional information in measures like the Foster-Greer-Thorbecke (FGT, Foster et al. 1984) or the Sen-Shorrocks-Thon poverty measure.[20]

A targeted economic and social policy, including a pronounced time policy for a better coordination of the daily life[21] – aiming at a reallocation of society resources to relieve the poor – should more than now respect and count the time in addition to the income dimension. Public efforts with regard to childcare, appropriate labour market, tax and transfer policies are obvious policy options.

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[20] Sen (1976), Shorrocks (1995), Thon (1979), Osberg and Xu (2002).

[21] Mückenberger 2008 and for new time policy European wide activities Garhammer 2002b.

Appendix

Figure 6: Extract of time use diary (German Time Use Survey 2001/2002)

Source: Time use diary (German Time Use Survey 2001/2002).

Figure 7: Question 135 personal questionnaire SOEP 2002

Source: GSOEP Personenfragebogen 2002.

Figure 8: Question 11 personal questionnaire SOEP 2002

Source: GSOEP Personenfragebogen 2002.

Table 4a: Distribution of net equivalence income

Statistiken

Nettoäquivalenzeinkommen

N	Gültig	76439206
	Fehlend	0
	Mittelwert	1428,0586
	Median	1322,5806
	Standardabweichung	649,49038
	Varianz	421837,756
	Minimum	166,67
	Maximum	6000,00

Source: GTUS 2001/02, own calculations.

Table 4b: Distribution of genuine leisure time

Statistiken

Freizeit_in_min

N	Gültig	206026753
	Fehlend	0
	Mittelwert	329,4714
	Median	310,0000
	Standardabweichung	166,03069
	Varianz	27566,189
	Minimum	,00
	Maximum	1370,00

Source: GTUS 2001/02, own calculations.

The reforming of equation 8 more detailed:

$$6,418 = 3,550 \cdot \left(0,519 \cdot I^{0,297} + 0,481 \cdot L^{0,297}\right)^{-\frac{0,108}{-0,297}}$$

$$\Leftrightarrow 6,418 = 3,335 \cdot \left(0,519 \cdot I_i^{0,297} + 0,481 \cdot L_i^{0,297}\right)^{0,364} \qquad \Big| \sqrt[0,364]{}$$

$$\Leftrightarrow 165,246 = 27,358 \cdot \left(0,519 \cdot I_i^{0,297} + 0,481 \cdot L_i^{0,297}\right)$$

$$\Leftrightarrow 165,246 = 14,199 \cdot I_i^{0,297} + 13,159 \cdot L_i^{0,297}$$

$$\Leftrightarrow 13,159 \cdot L_i^{0,297} = 165,246 - 14,199 \cdot I_i^{0,297}$$

$$\Leftrightarrow L_i^{0,297} = 12,558 - 1,079 \cdot I_i^{0,297} \qquad \Big| \ (\ )^{\frac{1}{0,297}}$$

$$\Leftrightarrow L_i = \left(12,558 - 1,079 \cdot I_i^{0,297}\right)^{\frac{1}{0,297}}$$

Table 5: Determinants for the income-time-position –
MNL-Estimation for working people with reference
categorie income poverty (regime 1+2+4)

	category I regime 3		category II regime 5		category III regime 6	
constant	-15,486	***	-17,414	***	-15,446	***
personal characteristics						
female	,625	*	,526		,108	
age	,016		,026		-,032	
Age²/100	-,076		-,085		-,025	
education (reference: no certificate)						
secondary scholl_II (Hauptschule)	-1,236		-1,305		-1,181	
secondary scholl_I (Realschule)	-1,680	**	-1,531	*	-1,432	*
high scholl diploma (without university degree)	-1,493	*	-1,406		-1,385	
university degree	-2,558	***	-2,327	**	-2,398	***
occupational status (reference: blue-collar w.)						
liberal professions	,052		,092		,341	
entrepreneur	,225		-,044		-,257	
civil servant	-,810		-,624		-,535	
white-collar worker	-,322		-,201		-,264	
other occupation group	-1,612	**	-1,897	***	-1,699	***
weekly working hours (reference: 41 or more)						
thru_20	1,626	***	1,785	***	2,271	***
21 to 25	1,601	**	2,395	***	2,920	***
26 to 35	,888	*	1,117	**	1,518	***
36 to 40	,764	**	1,222	***	1,562	***
income situation						
personal net income	,013	***	,015	***	,014	***
residual income	,013	***	,014	***	,014	***
Nationality (reference: German)						
foreigner	-1,926	***	-1,902	***	-1,747	**
household structure (reference: couple without kids)						
single person household	4,597	***	5,330	***	5,137	***
couple with one kid	-3,785	***	-4,562	***	-4,603	***
couple with two kids	-5,822	***	-7,297	***	-7,315	***
couple with three or more kids	-10,094	***	-12,767	***	-12,853	***
single parent with one kid	,188		-,245		-,252	
single parent with two kids	-2,740	***	-3,821	***	-3,987	***
other household structure	-4,910	***	-6,737	***	-6,747	***
region (reference: West Germany)						
East Germany	,638	**	,503		,021	

Degrees of Freedom	81		Cox and Snell	,352
Prob. Value for LR	,000		Nagelkerke	,398
n (observations)	7499		Mc Fadden	,201

reference categorie: income poverty (regime 1 + 2 + 4)
Level of significance: * 10%, ** 5%, *** 1%

Source: own estimation with GTUS 2001/02.

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