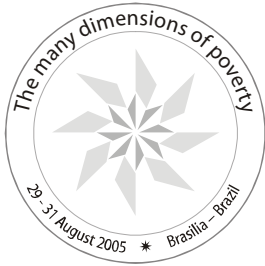# International Conference

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The Order of Acquisition of Durable Goods and the Multidimensional Measurement of Poverty

Conference paper

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**The Order of Acquisition of Durable Goods
and The Multidimensional Measurement of Poverty**

by

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and

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I. Introduction

In their study of *Poor Britain* Mack and Lansley (1985) combined a "direct" approach to poverty measurement, one that focuses on actual living conditions rather than on income or total expenditures, with a "consensual" approach that integrates information on what "public opinion" considers as necessary consumption. Such a direct measurement of poverty followed in fact Peter Townsend's (1979) original ideas in so far as poverty was defined as a lack of "socially perceived necessities" (Mack and Lansley, 1985). For Mack and Lansley (1985) an item should be classified as a necessity if more than 50% of the population considered it as such. Halleröd (1994) criticized such an approach and defined it as a "majority" rather than as a "consensual" approach. He suggested using a "proportional deprivation index" where all the original items taken into account in the survey are included in a weighting scheme where the weight of an item is derived from the proportion of individuals regarding this item as a necessity.

Taking a "direct" approach is certainly in line with the recent emphasis on the need to take a multidimensional approach to poverty measurement and seems to be relevant even in developing countries since many of them conduct consumption surveys. Adopting a "consensual" approach to poverty is however much more difficult since this implies increasing significantly the number of questions to be asked in the survey, making it then much more expensive. One may therefore wonder whether there does not exist an alternative approach where a list of necessities could be derived even when no question is asked as to whether a given item is a necessity or whether the respondent who does not own this item would have liked to have it.

The purpose of this paper is to propose a method that allows one to classify the individuals (households) by their wealth even when the survey does not ask the individuals what their total wealth is or which items they consider as necessities. The central element of the

proposed approach is not new at all. It is based on the concept of order of acquisition of durable goods that was suggested forty years ago by Paroush (1965). The idea is that in general households acquire durable goods in a given order and that the stage in this order in which each household is says something about its wealth. Naturally differences in tastes cannot be ignored and the method proposed attempts to neutralize such an impact. The novelty of this paper is that it combines this concept of order of acquisition of durable goods suggested by Paroush (1985) with more recent statistical techniques adapted to the analysis of qualitative variables. More precisely, once the order of acquisition has been defined, the information obtained will be analyzed on the basis of an order logit regression. Such an approach will allow us to estimate a latent variable that is assumed to measure the wealth of a household, then to compute, on the basis of the distribution of this latent variable, the percentage of households to be considered as poor and finally to derive the impact of various explanatory variables on the degree of (relative) deprivation of the various households.

The paper is organized as follows. Section II gives an overview on the ownnership of durable goods in Israel in 1995. Section III then explain the original ideas of Paroush (1965), that is, it shows how it is possible to derive an order of acquisition of durable goods. Section IV shows how to use ordered logit regressions to derive information on the percentage of poor households and on the determinants of poverty. Section V presents an empirical illustration based on the 1995 Israeli census. Concluding comments are given in Section VI.

II. On the Ownership of Durable Goods in Israel in 1995:

Our database, as indicated previously, is the 1995 Census of the Israeli population. This Census provides quite detailed information on the ownership of durable goods. However, because of the complexity of the algorithm that will be presented in Section III, we were not

able to use all the available information and had to limit ourselves to 11 items. Here are the durable goods that were taken into account in our study and whose ownership will be analyzed:

- washing machine

- dwelling

- VCR

- microwave oven

- air conditioner

- dishwasher

- personal computer

- dryer

- telephone

- television

- car

Let us first take a look at the impact on the ownership of the various durable goods of variables such as the gender, the household size, the age, marital status, year of immigration, years of schooling, number of months worked during the last twelve months, status at work, place of residence and religion of the head of the household[1]. Tables 1 to 10 are cross-tables and thus indicate only differences, say by gender or household size, in this degree of ownership and thus do not examine the specific impact of these variables on the ownership of durables, other things constant. Such a regression type analysis will be conducted in Section V when an ordered logit regression will be estimated where the dependent variable will be the probability of being poor, and the explanatory factors variables such as the gender, the age of the head of the household, etc…

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[1] This section is based on Deutsch, Israeli and Silber (2005).

Let us now present some cross-tables that will give an idea about the diffusion of the durable goods that were selected.

Table 1 shows the impact of gender on the ownership of durable goods. It appears that in most cases the degree of ownership is lower when the household has a female head than when the head is a man. The ownership of a phone or a TV is also slightly higher among female-headed households but it is not clear whether the difference between the genders is really significant. Note that quite important differences are observed (with male headed households being evidently better endowed than female headed households) in the case of the ownership of a car, VCR, a microwave oven, a dishwasher, a personal computer and a dryer.

Table 1: Ownership of Durable Goods by Gender of Head of Household

	Male	Female	Total
Share in Total Population	69.3	30.7	100.0
Ownership of dwelling	77.4	66.1	74.0
Phone	93.8	94.4	94.0
Television	91.6	92.5	91.9
VCR	55.3	41.4	51.0
Washing machine	90.3	83.1	88.1
Microwave oven	46.7	34.2	42.9
Dishwasher	24.6	16.0	22.0
Personal computer	27.4	17.7	24.4
Air-Conditioning	40.0	34.6	38.4
Dryer	20.5	13.1	18.2
Car	60.9	35.2	53.0
Total number of observations	141501	62597	204098

In Table 2 we examine the impact of the size of the household on the ownership of durable goods. Note that in most cases an inverted-U type of relationship is observed between the degree of ownership of a durable good and the size of the household. In most cases the highest values (which correspond to the highest proportion of households owning the durable good) are observed among medium sized households.

Table 2: Ownership of Durable Goods by Household Size

	1	2	3	4	5	6	7	8	9	10 or more	Total
Share in Total Population	19.5	23.4	15.6	17.4	12.9	6.1	2.5	1.3	0.7	0.5	100.0
Ownership of dwelling	60.3	70.2	73.3	80.1	84.6	85.2	84.3	83.6	83.3	86.2	74.0
Phone	92.0	94.5	94.6	95.6	95.8	93.8	90.6	86.8	83.4	81.0	94.0
Television	88.0	92.9	93.6	95.1	94.5	90.7	84.9	78.7	75.8	73.4	91.9
VCR	25.9	45.7	60.0	68.6	67.5	56.8	42.7	32.1	29.0	24.8	51.0
Washing machine	67.3	88.6	93.6	96.3	96.8	95.5	92.5	89.2	85.5	80.8	88.1
Microwave oven	20.7	37.2	49.3	58.1	59.8	51.1	36.6	26.3	22.3	18.6	42.9
Dishwasher	7.4	19.5	22.7	31.6	36.7	26.2	15.2	8.5	5.8	4.7	22.0
Personal computer	8.6	12.9	24.2	39.0	45.8	37.3	23.7	17.5	13.1	11.4	24.4
Air-Conditioning	32.0	43.4	39.5	43.8	42.0	31.2	20.9	14.0	11.2	11.6	38.4
Dryer	5.2	10.1	18.8	28.7	33.3	28.4	20.3	16.1	15.6	15.2	18.2
Car	23.2	44.9	60.7	71.5	72.9	65.6	56.5	48.8	47.2	46.7	53.0
Total number of observations	39816	47827	31900	35432	26237	12500	5196	2627	1507	1056	204098

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In Table 3 we examine the impact of the age of the head of the household on the degree of ownership of durable goods. Only in one case do we have a monotonic relationship between the ownership of the durable good and the age of the head of the household: the probability that a dwelling belongs to the household is higher, the older the head of the household. In all other cases we observe again an inverted-U relationship. This is particularly true for the presence of a car, VCR, a washing machine, a microwave oven, a dishwasher, a computer and a dryer. In all these cases the degree of ownership is higher among households whose head is 30 to 59 years old.

Table 3: Ownership of Durable Goods by Age of Head of Household

	less than 30 years old	30 to 59 years old	60 to 69 years old	At least 70 years old	Total
Share in Total Population	13.2	56.4	13.8	16.6	100.0
Ownership of dwelling	49.9	77.5	77.4	78.1	74.0
Phone	85.7	95.2	95.8	94.9	94.0
Television	82.5	92.9	94.7	93.5	91.9
VCR	38.5	61.4	49.3	27.1	51.0
Washing machine	74.6	93.1	89.6	80.5	88.1
Microwave oven	37.6	52.4	36.8	19.8	42.9
Dishwasher	6.7	28.1	22.3	12.9	22.0
Personal computer	18.3	35.3	10.3	3.9	24.4
Air-Conditioning	24.5	39.5	42.7	41.9	38.4
Dryer	12.3	25.7	9.5	5.0	18.2
Car	48.7	66.5	42.2	19.5	53.0
Total number of observations	26873	115107	28242	33876	204098

Table 4 indicates the impact of the marital status on the ownership of durable goods. It is easily observed that in all cases the highest degree of ownership is found among households whose head is married. With the exception of car ownership, the lowest levels of ownership are observed either among singles (ownership of dwelling, presence of a phone, a television, a washing machine, a dishwasher and an air conditioning) or among widow(er)s (VCR, microwave oven, computer and dryer).

Table 4: Ownership of Durable Goods by Marital Status of Head of Household

	Married	Divorced	Widowed	Single	Total
Share in Total Population	70.1	7.5	13.7	8.7	100.0
Ownership of dwelling	80.1	53.5	76.3	38.7	74.0
Phone	94.5	93.5	94.0	90.8	94.0
Television	92.6	91.9	93.1	84.2	91.9
VCR	58.4	43.1	28.7	34.0	51.0
Washing machine	93.9	82.4	78.9	60.8	88.1
Microwave oven	49.9	33.9	22.0	26.9	42.9
Dishwasher	27.1	13.0	11.1	5.5	22.0
Personal computer	29.2	19.0	6.1	19.9	24.4
Air-Conditioning	41.6	27.6	34.9	26.8	38.4
Dryer	22.7	12.6	5.9	6.8	18.2
Car	63.1	34.1	18.0	43.2	53.0
Total number of observations	143010	15368	28011	17709	204098

Table 5. gives the impact of the year of immigration of the head of the household on the ownership of durable goods. A distinction was only made between those who were born in Israel or immigrated before 1990 on one hand, and those who came after 1989 in which case a separate category was defined for each year of immigration (1990, 1991, 1992, 1993, 1994 and 1995). If we limit the analysis only to the recent immigrants (1990 and afterwards) it is observed that in many cases the degree of ownership decreases monotonically with the year of immigration. This is thus true of the ownership of the dwelling and a car, the presence of a phone, a television, a VCR, a washing machine, a microwave oven, a personal computer and air conditioning. The link is not clear for dishwashers and dryers. If one now compares new immigrants with heads of households who were either born in Israel or immigrated before 1990 the relationship with the degree of ownership of durable goods is often not very clear. One may however observe quite a higher degree of ownership among non recent immigrants as far as microwave ovens, dishwashers, personal computers, dryers and evidently dwellings are concerned.

Table 5: Ownership of Durable Goods by Year of Immigration of Head of Household

	Before 1990*	90	91	92	93	94	95	Total
Share in Total Population	86.3	4.2	3.5	1.7	1.6	1.7	1.1	100.0
Ownership of dwelling	78.6	57.5	50.4	45.4	40.3	27.9	10.7	74.0
Phone	94.7	95.5	92.0	89.2	86.7	83.7	75.0	94.0
Television	92.1	94.7	91.8	90.0	89.2	87.9	80.4	91.9
VCR	52.0	54.7	51.3	43.2	37.7	31.8	23.2	51.0
Washing machine	89.0	90.9	85.7	81.9	78.8	72.3	59.7	88.1
Microwave oven	46.3	29.5	23.0	18.7	15.6	14.9	10.3	42.9
Dishwasher	24.9	4.5	2.9	3.3	3.0	3.5	3.0	22.0
Personal computer	26.1	19.5	14.9	13.4	9.5	8.7	5.1	24.4
Air-Conditioning	41.0	36.8	17.7	14.9	13.3	13.9	12.5	38.4
Dryer	20.4	4.3	3.0	5.2	5.2	5.6	4.9	18.2
Car	56.2	48.4	38.6	33.7	21.8	12.1	5.7	53.0
Total number of observations	176043	8473	7137	3437	3285	3460	2263	204098

In Table 6 we examine the impact of the level of schooling of the head of the household on the degree of ownership of durable goods. In most cases this degree increases monotonically with this schooling level, this being true for the presence of a car, a phone, a television, a VCR, a microwave oven, a dishwasher, a personal computer, air conditioning and a dryer.

Table 6: Ownership of Durable Goods by Schooling Level (Years of Schooling) of Head of Household

	0	1-8	9-12	13 or more	Total
Share in Total Population	6.4	19.9	41.4	32.3	100.0
Ownership of dwelling	76.0	80.1	75.3	68.0	74.0
Phone	81.3	91.9	94.5	97.3	94.0
Television	83.9	92.5	92.1	92.9	91.9
VCR	25.2	38.2	53.9	60.4	51.0
Washing machine	70.6	86.2	90.3	89.9	88.1
Microwave oven	15.7	29.0	46.6	52.1	42.9
Dishwasher	4.5	12.7	22.6	30.3	22.0
Personal computer	2.8	8.5	22.2	41.3	24.4
Air-Conditioning	14.1	29.8	39.5	47.0	38.4
Dryer	2.8	7.5	19.4	26.5	18.2
Car	14.8	34.4	55.4	69.1	53.0
Total number of observations	13145	40564	84483	65906	204098

The schooling level seems thus to be quite a good proxy for the wealth of the household.

In Table 7 we indicate the impact of the number of months worked by the head of the household during the last twelve months on the degree of ownership of the various durable goods. As expected in most cases the greater the number of months the head of the household worked during the last twelve months, the higher the degree of ownership of the various durable goods.

Table 7: Ownership of Durable Goods by Number of Months Worked by the Head of the Household During the Last 12 Months

	4 months or less	5 to 8 months	9 to 12 months	Total
Share in Total Population	40.1	4.3	55.6	100.0
Ownership of dwelling	70.1	62.6	77.6	74.0
Phone	91.8	91.0	95.8	94.0
Television	89.4	89.9	93.8	91.9
Videotape	35.1	47.7	62.8	51.0
Washing machine	82.0	84.5	92.8	88.1
Microwave oven	26.9	37.6	54.8	42.9
Dishwasher	12.8	16.0	29.1	22.0
Personal computer	9.9	21.8	35.1	24.4
Air-Conditioning	32.7	29.2	43.2	38.4
Dryer	8.8	14.4	25.3	18.2
Car	27.6	49.6	71.6	53.0
Total number of observations	81905	8789	113404	204098

Table 8 gives the influence of the status at work of the head of the household on the degree of ownership of durable goods, a distinction being made between heads who do not work, are salaried or self employed. Here again a very clear relationship appears since in most cases the degree of ownership is highest among self-employed individuals. Note also that in most cases the degree of ownership is smallest when the head of the household did not work during the last twelve months.

In Table 9 we give the impact of the area of residence on the degree of ownership of durable goods. No clear-cut relationship emerges as may be easily observed.

Table 8: Ownership of Durable Goods by Status at Work of Head of Household

	Not working	Salaried	Self-employed	Other Status	Total
Share in Total Population	37.2	51.7	9.9	1.2	100.0
Ownership of dwelling	71.3	74.6	80.7	75.2	74.0
Phone	91.9	94.8	97.6	95.4	94.0
Television	89.6	92.9	95.3	92.3	91.9
VCR	34.5	59.4	69.1	58.2	51.0
Washing machine	82.2	91.2	95.1	80.5	88.1
Microwave oven	26.2	51.2	61.2	50.7	42.9
Dishwasher	12.6	25.0	40.8	28.6	22.0
Personal computer	9.0	32.4	39.6	33.1	24.4
Air-Conditioning	33.0	39.2	53.0	47.5	38.4
Dryer	8.4	22.3	33.2	22.8	18.2
Car	26.2	66.2	84.1	60.1	53.0
Total number of observations	76019	105461	20252	2366	204098

Table 9: Ownership of Durable Goods by Place of Residence of Head of Household

	Jerusalem	Tel-Aviv	Haifa	City with 100,000 to 200,000 inhabitants	City with 20,000 to 100,000 inhabitants	Municipality with 2,000 to 20,000 inhabitants	Other places	Total
Share in total Population	8.9	9.7	6.5	26.0	29.4	14.3	5.3	100.0
Ownership of dwelling	66.9	59.3	71.4	74.9	74.1	85.1	80.1	74.0
Phone	90.6	97.6	98.0	97.7	94.8	87.3	83.8	94.0
Television	84.1	93.7	94.7	93.0	94.4	89.7	84.8	91.9
Videotape	44.9	51.2	51.9	54.0	54.0	42.7	51.7	51.0
Microwave oven	37.5	36.6	45.2	43.0	45.5	41.5	49.2	42.9
Dishwasher	14.3	22.1	22.9	25.5	22.6	16.1	28.0	22.0
Personal computer	23.4	24.4	25.5	24.6	24.7	21.5	30.5	24.4
Air-Conditioning	7.9	52.9	41.2	46.2	41.0	25.3	41.4	38.4
Dryer	21.7	17.8	19.0	17.1	18.6	15.9	22.4	18.2
Car	48.1	48.5	53.9	52.2	53.6	54.7	64.5	53.0
Total number of observations	18077	19882	13263	53022	59917	29215	10722	204098

Finally in Table 10 we examine the impact of the religion of the head of the household on the degree of ownership of durable goods. It may be observed that in many cases this degree of ownership is highest among Jewish heads of household. If we take a look at the lowest levels of the indicators, it appears that no clear-cut answer may be given, though in many cases the degree of ownership is lowest among Muslims (presence of a phone, a VCR, a washing machine, a dishwasher, a personal computer and a dryer).

Table 10: Ownership of Durable Goods by Religion of Head of Household

	Jewish	**Muslim**	**Christian**	**Druze**	**Other**	**Total**
Share in Total Population	85.1	10.7	2.0	1.0	1.2	100.0
Ownership of dwelling	72.7	87.1	69.7	97.1	33.0	74.0
Phone	97.3	70.7	90.8	82.8	83.8	94.0
Television	93.2	82.8	92.3	82.3	87.1	91.9
VCR	55.0	23.9	44.9	31.0	40.6	51.0
Washing machine	90.0	74.2	91.3	88.7	74.3	88.1
Microwave oven	46.7	17.9	31.7	39.6	17.4	42.9
Dishwasher	25.0	2.9	14.5	6.5	3.7	22.0
Personal computer	27.1	7.1	17.0	11.3	13.0	24.4
Air-Conditioning	43.5	7.6	14.9	6.9	16.5	38.4
Dryer	20.6	3.3	12.0	5.4	4.4	18.2
Car	54.7	42.1	54.5	54.2	29.1	53.0
Total number of observations	173668	21863	4013	2091	2463	204098

We now turn to the concept of order of acquisition of durable goods.

III. On the order of acquisition of durable goods:

Forty years ago Paroush (1965) suggested using information available on the order of acquisition of durable goods to estimate the standard of living of households. Such a link will be examined in a latter section, on the basis of statistical techniques that did not exist at the time Paroush (1965) wrote his paper. Let us first describe how he suggested using the information available on the ownership of durable goods.

Assume we collect information on the ownership of three durable goods A, B and C. A household can own one two, three or none of these goods. There are therefore $2^3 = 8$ possible profiles of ownership of durable goods in this example. Table 11 summarizes the various possibilities. A number 1 indicates that the household owns the corresponding good, a zero that it does not.

Table 11: List of possible orders of acquisition when there are 3 goods

Ownership Profile	The household owns good A	The household owns good B	The household owns good C
1	0	0	0
2	1	0	0
3	0	1	0
4	0	0	1
5	1	1	0
6	0	1	1
7	1	0	1
8	1	1	1

If we assumed that every household followed the order A, B, C (that is, that a household first acquires good A, then good B and finally good C) there would be no household with the profiles 3, 4, 6 and 7. We do not want to assume however that every household has to follow this order A, B, C. There are always households that slightly deviate from this most common order of acquisition. Paroush suggested computing the number of changes in numbers (from 0 to 1 or from 1 to 0) necessary to bring a deviating household back to one of the profiles corresponding to a given order of acquisition of durable goods.

More precisely, for a given order of acquisition and k durable goods there are k+1 possible profiles in the acquisition path. Define the vector p_j (composed of 1 and 0) with $p_j = (p_{j1},\ldots,p_{jk})$ as a possible profile in the acquisition path, j=1,..k+1, and let x_i be the vector (composed of 1 and 0) describing the order of acquisition for individual i with $x_i = (x_{i1},\ldots, x_{ij},\ldots, x_{ik})$. Now compare de profile of individual i, (vector x_i), with every possible profile p_j in the acquisition path. S_i is the distance of the profile of individual i to the closest profile p_j in the acquisition path. That is,

$$S_i = \min [|x_i-p_1|,|x_i-p_2|,..,|x_i-p_{k+1}|], \text{ where } |x_i - p_j| = \sum_{h=1}^{k} |x_{ih} - p_{jh}|.$$

If there are N_i households having such a profile, Paroush (1965) suggested computing what he called the coefficient R of Reproducibility defined as

$$R = 1 - [(\sum_i N_i S_i)/(k \sum_i N_i)].$$

It can be proven that $(1/2) \le R \le 1$ and Paroush (1965) stated that "for most practical applications of the order of acquisition of durable goods a population is considered sufficiently "scalable" if about ninety percent of its purchases are "reproducible", provided the number of commodities is not very small."

Note that the "distance" d_{ip} between the order of acquisition of individual i and the profile $p_c = (p_{c1},\ldots,p_{ck})$ most common in the population will then be expressed as

$$d_{ip} = \sum_{h=1 \text{ to } k} |x_{ih} - p_{ch}| \tag{1}$$

Thus if A, B, C is the order of acquisition most commonly found in the population, the "distance" for an individual with profile 4 in Table 11 will be expressed as:

$$|0 - 1| + |0 - 1| + |1 - 1| = 2$$

Clearly k is the maximal value of the distance for an individual, assuming there are k goods (this is for example the case of an individual with profile 1 in Table 11). We may therefore define the "standardized distance" for individual i as (d_{ip}/k) Assume now there are N_i

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individuals (households) with a profile identical to that of individual i and N individuals in the whole population. The "average standardized distance" d_{sp} in the population may then be expressed as the weighted average of the "standardized distance" for the various individuals, that is as

$$d_{sp} = \sum_i (N_i /N) (d_{ip}/k) \tag{2}$$

As a consequence the "proximity index" R will be equal to the complement to 1 of d_{sp}, that is

$$R = 1 - d_{sp} \tag{3}$$

We do not know however what the most commonly order of acquisition in the population is. We have to discover it. We have therefore to compute the distances d_{ip}, the distance d_{sp} and the proximity index R for each possible order of acquisition. We know that there are k! such profiles. Let d_{ipl}, d_{spl} and R_l be respectively the distance for individual i, the corresponding "average standardized distance" in the population and the proximity index order of acquisition where profile l is the profile with which that of individual i is compared.. The most commonly selected order of acquisition in the population will then be the one with the highest value of the proximity index R_l.

It should be clear that discovering this most common order of acquisition requires a very high number of computations. For each individual in the sample, the determination of the minimum distance S_i of his profile to the profile in the order of acquisition is based on 12 comparisons. As our sample is based on 204,098 household, 2,449,176 comparisons are needed in order to determine the proximity index R for a single order of acquisition. This procedure has to be repeated 11! =39,916,800 times which is the total number of possible order of acquisition resulting from 11 durable goods. As a consequence 2,449,176 × 39,916,800 = 9.77×10^{13} was the total number of computations necessary to find the order of acquisition with the highest index of proximity R.

IV. From the order of acquisition of durable goods to the derivation of a deprivation index

The determination of a most common order of acquisition of durable goods allows us to use an ordered logit[2] procedure to better understand the factors affecting this order of acquisition, or more generally the factors having an impact on the standard of living. The idea, following Paroush (1965), is to assume that the stage in which a household is located in the order of acquisition of durable goods tells something on its standard of living or, if viewed the opposite way, on its level of deprivation.

Let D_i denote the level of deprivation of household i such that a higher value of D_i corresponds to higher degrees of deprivation . Such a deprivation score is assumed to be a function of H factors whose value for household i is X_{ih} , $h = 1$ to H. We may therefore express this latent variable D_i as

$$D_i = \sum_{h=1}^{k} \beta_h X_{ih} + \varepsilon_i \tag{4}$$

Such a deprivation level is however not observed. What is assumed is that this deprivation level is related to the stage of acquisition of durable goods in which the household is located. Going back to our sample composed of 11 durables, and assuming a given order of acquisition of durables, we define Y_i as the number of durables not owned by household i. We may then write that

$Y_i = 1$ if $D_i \leq \delta_1$ (the case where the household owns all the 11 durable goods)

$Y_i = 2$ if $\delta_1 \leq D_i \leq \delta_2$ (the household owns only the first 10 durables in the acquisition path)

$Y_i = j$ if $\delta_{j-1} \leq D_i \leq \delta_j$ (the household owns only the first j-1 durables in the acquisition path)

$Y_i = 12$ if $D_j \geq \delta_{11}$ (the household does not own any of the durable goods)

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[2] We could have also used an ordered probit model.

The parameters δ_m (m = 1 to 11) as well as the parameters β_h (h = 1 to H) will thus be estimated using the ordered logit procedure. It is then also possible to compute the probability that a given household with characteristics X_{ih} belongs to one of the profiles permitted by the order of acquisition of durable goods.

V) The Empirical Analysis:

Using the information available on the eleven durable goods that were selected, we have applied the algorithm described in section III and found (see Table 12) that the order of acquisition of durable goods with the highest proximity index was as follows: telephone, television, washing machine, apartment (or house), VCR, car, microwave oven, air-conditioner, dishwasher, personal computer, dryer. It is interesting to note that the order of acquisition is similar but does not coincide with the rank of the durables ordered by the percentage of ownership.

The proportion of households with a profile of acquisition of durable goods corresponding to the different stages of the order of acquisition given in Table 12 is 32% (65,333 households). The second stage of the empirical analysis will therefore be based only on these 65,333 households.

Table 12: Order of acquisition with highest proximity coefficient R (R = 0.917)

Rank	Durable Good	Ownership (%)
1	Telephone	94.0
2	Television	91.9
3	Washing machine	88.1
4	Apartment (or house)	74.0
5	VCR	51.0
6	Car	53.0
7	Microwave oven	42.9
8	Air-Conditioner	38.4
9	Dishwasher	22.0
10	Computer	24.4
11	Dryer	18.2

Table 13: Results of Ordered Logit Regression
(Dependent Variable = Latent variable measuring the level of deprivation)

Explanatory Variable	Coefficient	St. Error	t-value	P-value
Level of schooling	-0.1395	0.0018	-77.42	0.000
Household Size	-0.9191	0.0175	-52.62	0.000
Square of Household size	0.0751	0.0019	40.38	0.000
Age	-0.1582	0.0029	-54.61	0.000
Square of Age	0.0014	0.0000	51.04	0.000
Male	-0.1908	0.0477	-4.00	0.000
Jew	-0.9890	0.0673	-14.69	0.000
Muslim	0.4683	0.0728	6.43	0.000
Christian	0.1951	0.0840	2.32	0.020
Druze	0.0977	0.0989	0.99	0.323
Immigrated after 1989	2.2979	0.0216	106.50	0.000
Married	-0.3625	0.0364	-9.97	0.000
Divorced	0.9756	0.0394	24.74	0.000
Single	1.6400	0.0489	33.55	0.000
Lives in Jerusalem	0.6370	0.0273	23.33	0.000
Lives in Tel Aviv	0.2305	0.0264	8.73	0.000
Lives in Haifa	0.0289	0.0278	1.04	0.299
Working	-0.9153	0.0314	-29.17	0.000
Interaction male and married	0.3704	0.0565	6.55	0.000
Interaction male and divorced	0.4170	0.0819	5.09	0.000
Interaction male and single	0.1486	0.0785	1.89	0.058
Interaction male and works	-0.1179	0.0353	-3.34	0.001

Notes: Number of observations: 65333
Pseudo R-square: 0.1726
Log-Likelihood: -123827.97

Table 14: Information on the borders of the various ordered categories

Deprivation Level	Corresponding Ownership Level	Coefficient		St. Error	Observed Probability
		From	To		
1	Owns all the 11 durable goods		-11.299	0.111	0.1364
2	Owns 10 of the 11 (ordered) durable goods	-11.299	-10.633	0.110	0.0626
3	Owns 9 of the 11 (ordered) durable goods	-10.633	-10.061	0.109	0.0623
4	Owns 8 of the 11 (ordered) durable goods	-10.061	-9.515	0.109	0.0682
5	Owns 7 of the 11 (ordered) durable goods	-9.515	-8.997	0.108	0.0692
6	Owns 6 of the 11 (ordered) durable goods	-8.997	-8.404	0.108	0.0807
7	Owns 5 of the 11 (ordered) durable goods	-8.404	-7.786	0.107	0.0867
8	Owns 4 of the 11 (ordered) durable goods	-7.786	-6.191	0.106	0.2146
9	Owns 3 of the 11 (ordered) durable goods	-6.191	-4.716	0.105	0.1304
10	Owns 2 of the 11 (ordered) durable goods	-4.716	-3.315	0.106	0.0582
11	Owns 1 of the 11 (ordered) durable goods	-3.315	-2.396	0.108	0.0167
12	Owns 0 of the 11 (ordered) durable goods	-2.396		0.000	0.0141

For each household i owning durables according to the path of acquisition we calculated the number of durables not owned by the household (variable Y_i) and estimated an ordered logit type regression. The following exogenous variables were available in the 1995 Census and have been taken into account: the size of the household and its square, the age of the head of the household and its square, the number of years of schooling, the gender, the religion (three dummy variables), the marital status (three dummy variables) and the status at work (working or not) of the head of the household, the area of residence of the household (three dummy variables corresponding to the three big cities) and a variable indicating whether the head of the household immigrated to Israel after 1989. In addition we introduced interaction variables between the gender and the marital status and between the gender and the working status.

Results of the Ordered Logit Type Regression

These results are given in Table 12. It appears that the explanatory variables that have been introduced have generally a significant impact. Thus households whose head has a higher educational level have, ceteris paribus, a lower level of deprivation. This deprivation decreases and then increases again with the size of the household as well as with the age of the head of the household. The estimated turning points are respectively 6 individuals for the size of the household variable and 57 years for the age of the head of household variable.

Other things constant we also observe that the level of deprivation is highest among heads of household that are Muslims and lowest among those who are Jewish. This level of deprivation is also lowest when the head of the household is married and

highest when he/she is single. It is higher when he/she is a new immigrant, is highest when he/she lives in Jerusalem and lowest when he/she lives outside the three main cities.

As far as the combined effect of the gender, the marital and the working status is concerned, we usually observe, ceteris paribus, that whatever their gender or working status, divorced individuals have the highest level of deprivation and married individuals the lowest. As expected, whatever their gender and marital status, non working individuals have generally a higher level of deprivation. Finally in most cases, once the interactions are taken into account, for a given marital and working status, males seem to have a higher level of deprivation. Note however that some results indicate that among divorced individuals females have a higher level of deprivation.

To characterize the poor in the sample we calculated for each household in the sample the value of its latent deprivation variable D_i (equation 4) based on the coefficients of the ordered logit regression. We then defined as "poor" the top 25% of the distribution of the households classified by increasing level of latent deprivation. Table 15 gives the distribution of the households classified as poor by type of household.

Table 15: Incidence of Poverty by Gender of Head of Household

Percentage	Male	Female	Total
in Sample	67.6	32.4	100.0
Poor	15.8	44.2	25.0
Total	44150	21183	65333

by Household Size

Percentage	1	2	3	4	5	6	7	8	9	10 +	Total
in Sample	20.4	23.0	15.1	17.5	13.6	5.9	2.4	1.1	0.6	0.4	100.0
Poor	67.2	29.3	13.9	5.5	3.6	4.5	8.4	13.6	24.4	59.9	25.0
Total	13340	14999	9868	11427	8892	3842	1553	743	390	279	65333

by Age of Head of Household

Percentage	<30	30 - 59	60 -69	70+	Total
in Sample	8.9	56.2	16.1	18.8	100.0
Poor	51.8	11.4	27.4	51.0	25.0
Total	5834	36716	10521	12262	65333

by Marital Status of Head of Household

Percentage	Married	Divorced	Widowed	Single	Total
in Sample	69.3	7.5	16.2	7.0	100.0
Poor	10.0	53.8	52.1	80.2	25.0
Total	45265	4903	10585	4580	65333

by Year of Immigration of Head of Household

Percentage	>90	90	91	92	93	94	95	Total
in Sample	83.5	4.3	4.3	2.0	2.1	2.2	1.7	100.0
Poor	18.3	50.2	56.7	60.6	62.8	68.1	68.5	25.0
Total	54539	2816	2780	1325	1364	1428	1081	65333

by Schooling Level (Years of Schooling) of Head of Household

Percentage	0	1-8	9-12	13+	Total
in Sample	8.1	21.8	39.4	30.7	100.0
Poor	71.1	31.1	17.8	17.7	25.0
Total	5283	14215	25758	20077	65333

by Number of Months Worked by the Head of the Household During the Last 12 Months

Percentage	>4	5-8	9-12	Total
in Sample	44.2	4.0	51.8	100.0
Poor	44.8	22.2	8.3	25.0
Total	28895	2600	33838	65333

by Status at Work of Head of Household

Percentage	Not working	Salaried	Self Empl.	Other Status	Total
in Sample	41.5	48.0	9.5	1.0	100.0
Poor	45.7	11.6	3.3	15.5	25.0
Total	27112	31369	6193	659	65333

by Place of Residence of Head of Household

Percentage	Jerusalem	Tel-Aviv	Haifa	100-200	20-100	2-20	Other	Total
in Sample	7.6	8.6	7.0	26.9	32.0	13.4	4.4	100.0
Poor	40.1	34.0	26.5	22.8	23.4	21.2	15.5	25.0
Total	4985	5617	4563	17597	20932	8769	2870	65333

by Religion of Head of Household

Percentage	Jewish	Muslim	Christian	Druze	Other	Total
in Sample	86.8	9.1	1.9	0.9	1.3	100.0
Poor	23.7	29.4	33.6	13.4	73.8	25.0
Total	56706	5957	1248	559	863	65333

VI. Concluding Comments:

This paper proposed to measure the wealth of households on the basis of the order of acquisition of durable goods. This idea was originally suggested by Paroush (1965) but developments in computational abilities and new statistical techniques led us to extend his approach first by basing the study on eleven durable goods, second by applying an ordered logit regression type of analysis to derive the determinants of multidimensional poverty. The idea is that such an approach allows one to derive a latent variable measuring implicitly the well-being of households. On the basis of the distribution of this latent variable one may then fix a poverty line defined to be equal to some percentage of the median of the distribution and determine which households should be considered as poor. The database used was the 1995 Census of the Israeli population and it was found, on the basis of this ordered logit analysis, that poverty decreases with the schooling level of the head of the household, first decreases and then increases with his/her age and with the size of the household. Poverty was found to be higher when the head of the household is single and lower when he/she is married. Poverty is lowest when the head of the household is Jew and highest when he/she is Muslim. Poverty is also higher among households whose head immigrated in recent years, does not work or lives in Jerusalem. The impact of the gender on the probability for a household to be poor is less straightforward because there are significant interactions between the gender of the head of household on one hand and the marital status and the status at work on the other hand. In future research we plan to examine, using the technique presented in this paper, whether there exists also an order of "dis-acquisition" of durable goods and/or of "dis-connection" from the

society when a process of impoverishment and of deterioration of the social status of

the households leads them to become "socially excluded".

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