7. TESTING THE BEHAVIOR OF ROMANIAN HOUSEHOLDS[1]

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Abstract

This article aims to answer questions related to which model is more adequate to describe the Romanian household's behavior. There are two types of models, which are used whenever one attempts to model household allocation decision: the common utility model and the collective model. In this paper we test both the implications of the common utility model and the implications of the collective model using Romanian household data. The results are very strong. The common utility model fails to describe accurately the household's behavior, while the restrictions that the collective model imposes on the demand functions are supported by the Romanian household data.

Keywords: household allocation, common utility model, collective model
JEL Classification: D12, D13

The question of how to model household behavior has received much attention lately. There are two approaches to this problem. The first one draws on the individual utility model, and generalizes it to households by assuming that they are characterized by a common utility function. This approach is attractive especially due to its simplicity and the demands it puts on the data set; it requires information aggregated at the household level, which is the way information was generally collected. Unfortunately, it can lead to misleading results, especially in cases when who gets what in terms of income is influencing the household consumption decision.

Recently, there has been extensive work devoted to models that take the individuality of households into consideration. These classes of models are closer to reality, but more difficult to compute and test and require information, at least about income, disaggregated at the individual rather than household level. In this case, each household is characterized by a utility function, and within the household a decision of what to consume is achieved. In cases when one of the household members is a dictator, the two models yield similar results. If the allocation is efficient, and the individual members' utility function is egotistic, as defined by Becker, it is possible to separate the household allocation process into two stages. In the first stage, household members decide on an income sharing rule, in other words, they establish

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a method of dividing the household total income among themselves. In the second stage, each household member decides how to allocate his/her income share to different consumption goods, such as to observe the budget constraint determined in the first stage. For a more detailed discussion of the two types of models see Browning *et al*. (1993).

In this article, we verify which type of model is empirically supported by the Romanian household data by testing first whether the implications of the common utility model are supported by data or not. Second, we test whether the restrictions that the collective model imposes on the demand functions are valid or not in the context of Romanian couples of pensioners. The test used here is a modified version of the test derived by Browning *et al*. (1993).

Models of household behavior

The common utility model is an extension of the utility concept to households as a whole. The household is characterized by a utility function $U(C, L_1, L_2)$, which depends on total family consumption C, and on the leisure time of each family member. The household maximizes the above utility function under the budget constraint defined by individual earnings together with the household's non-labor income. The solutions to the maximization problem have the following form:

$$C = C(p,Z, Y,) \quad (1)$$

$$L_i = L_i(p, Z, Y,) \text{ for } i=1,2. \quad (2)$$

where: p is a vector of prices including wage rates, Z is a vector of demographic variables and Y is the total income.

The most important criticism of the common utility model arises from the functional form of the utility function, which depends only on the aggregate consumption, and not on how the consumption is divided across the household members. If all goods were public goods[2], the intra-household consumption allocation would not matter in welfare terms. However, there are a limited number of goods that can be considered public goods (heating, electricity, education, etc.). The insensitivity of the utility with respect to individual consumption means that the repartition of the total consumption between household members does not matter. The utility level is the same if consumption is split evenly between the two members, or if one member's consumption is C and the other one's is zero.

In the collective model each household member is characterized by a utility function. Depending on the functional form of the utility function, members can have the same preferences[3], "caring" preferences[4], or "egotistic" preferences[5]. The functional form of the demand functions are now of the following form:

$$C_i = C_i(p, Y, Z, y_m, y_f) \text{ for } i=1,2. \quad (3)$$

[2] *Public goods (at the household level) are goods that can be enjoyed by more persons at the same time. Examples of public goods are heating, electricity, etc.*

[3] *The functional form of the utility function in the situation of the same preference case is the following:* $U^i = F(C, L^1, L^2)$. *This case corresponds to the common utility model.*

[4] *The functional form for the "caring" preferences is the following:* $U^i = F^i(v^1(l^1,C^1), v^2(l^2,C^2))$.

[5] *The functional form of the "egotistic" preferences is the following* $U^i = v^i(l^i,C^i)$.

$$L_i = L_i(p, Y, Z, y_m, y_f) \text{ for } i=1,2. \quad (4)$$

where: y_m, y_f are the male and the female individual income, respectively.

One important property of the collective model is that if allocations are efficient and the utility function is "egotistic", then the allocation process can be viewed as a two-stage process. In the first stage total household income is divided across household members, according to an income sharing rule, and in the second stage each individual is deciding his/her consumption bundle, by maximizing his/her utility function subject to the budget constraint derived in the first stage.

The differences between equation (1) versus (3) and (2) versus (4) rest with the determining variables. In comparison to expression (1) and (2), in the equation (3) and (4) there also are individual income variables. This difference in the functional form of the demand equations in the two cases is the basis for the common utility model test known in the literature under the name of "income pooling test". This test consists in checking whether the coefficients of the individual income are simultaneously equal to zero in the individual demand equations. The failure to reject the equality to zero of individual income can be interpreted as a rejection of the common utility model. Unfortunately, the rejection is not enough in the sense that it gives no clue regarding an alternative model that is appropriate in case the common utility model fails to describe household behavior.

The test of the collective model

In order to test the collective model, one needs to derive the implications that it has over the demand functions. In the literature, the most common test used whenever data on prices are not available, as is the case for cross-section data, is the one derived in Browning *et al*. (1993). However, during the derivation of the test, the authors have used a somewhat unreasonable assumption. We will show that this assumption is not necessary to obtain testable restriction of the collective model.

The derivation follows up to some point the steps from the Browning *et al*. paper. We consider household aggregate consumption as the summation of male and female consumption:

$$C_i(y_m, y_f, Y) = F_{im}[Y_m(y_m, y_f, Y)] + F_{if}[Y_f(y_m, y_f, Y)] \quad (5)$$

where: F_{im}, F_{if} is the male and the female consumption, respectively, of good *i*, Y_m, Y_f is the male and the female share, respectively, of total household income, derived in the first stage of the allocation process, y_m, y_f, is the male and the female individual income, respectively, and *Y* is the household total income.

In the absence of saving, the following identity holds:

$$Y = y_m + y_f + y_0 = Y_m + Y_f = \mu(\mathbf{z})\cdot Y + [1 - \mu(\mathbf{z})]\cdot Y$$

where: y_0 is the non-labor income of the household, which is income from rents, interest rate from deposits, dividends, etc, and $\mu(\mathbf{z})$ is the income sharing rule.

We differentiate the above equation with respect to y_m:

$$\frac{\partial C_i}{\partial y_m} = \frac{\partial F_{im}}{\partial Y_m}\frac{\partial Y_m}{\partial y_m} + \frac{\partial F_{if}}{\partial Y_f}\left(\frac{\partial Y_f}{\partial y_m}\right) = F'_{im}\frac{\partial Y_m}{\partial y_m} + F'_{if}\frac{\partial (Y - Y_m)}{\partial y_m} \quad (6)$$

Here is where the difference between the Browning test and the current test lays. In the Browning article, the authors have computed the derivative of consumption with respect to the individual income considering that total household income is constant. Under this assumption, $\partial Y/\partial y_m$ is equal to zero, so the first part of the second derivative vanishes. In order that the above be true, either the female individual income, or non-labor income must accommodate to the change, so that the total income remains constant. We considered this assumption not very realistic, so we dropped it, and showed how, even in this situation, a test for the collective model can be derived.

Since $\frac{\partial Y}{\partial y_m} = \frac{\partial (y_m + y_f + y_0)}{\partial y_m} = 1$, equation (6) can be rewritten as:

$$\frac{\partial C_i}{\partial y_m} = (F'_{im} - F'_{if}) \frac{\partial Y_m}{\partial y_m} + F'_{if} \tag{7}$$

A similar equation can be derived for the consumption derivative with respect to the female individual income:

$$\frac{\partial C_i}{\partial y_f} = \left(F'_{im} - F'_{if}\right) \frac{\partial Y_m}{\partial y_f} + F'_{if} \tag{8}$$

In addition, we compute the consumption derivative with respect to the total income:

$$\frac{\partial C_i}{\partial Y} = \frac{\partial F_{im}}{\partial Y_m} \frac{\partial Y_m}{\partial Y} + \frac{\partial F_{if}}{\partial Y_f} \frac{\partial Y_f}{\partial Y} = F'_{im} \frac{\partial Y_m}{\partial Y} + F'_{if} \frac{\partial (Y - Y_m)}{\partial Y}$$

$$\frac{\partial C_i}{\partial Y} = (F'_{im} - F'_{if}) \frac{\partial Y_m}{\partial Y} + F'_{if} \tag{9}$$

Subtracting from both equation (7) and equation (8) the expression (9) we obtain:

$$\frac{\partial C_i}{\partial y_m} - \frac{\partial C_i}{\partial Y} = (F'_{im} - F'_{if}) \left(\frac{\partial Y_m}{\partial y_m} - \frac{\partial Y_m}{\partial Y} \right) \tag{10}$$

$$\frac{\partial C_i}{\partial y_f} - \frac{\partial C_i}{\partial Y} = (F'_{im} - F'_{if}) \left(\frac{\partial Y_m}{\partial y_f} - \frac{\partial Y_m}{\partial Y} \right) \tag{11}$$

If we take the ratio of (10) divided by (11) we end up with the following expression:

$$\frac{\frac{\partial C_i}{\partial y_m} - \frac{\partial C_i}{\partial Y}}{\frac{\partial C_i}{\partial y_f} - \frac{\partial C_i}{\partial Y}} = \frac{(F'_{im} - F'_{if}) \left(\frac{\partial Y_m}{\partial y_m} - \frac{\partial Y_m}{\partial Y} \right)}{(F'_{im} - F'_{if}) \left(\frac{\partial Y_m}{\partial y_f} - \frac{\partial Y_m}{\partial Y} \right)} = \frac{\left(\frac{\partial Y_m}{\partial y_m} - \frac{\partial Y_m}{\partial Y} \right)}{\left(\frac{\partial Y_m}{\partial y_f} - \frac{\partial Y_m}{\partial Y} \right)} \tag{12}$$

Looking at expression (12), one may be notice that while the left hand side of the equation is a function of the *i* good, the right hand side is not. Therefore, if we compute the same ratio of the difference of derivatives for all goods we obtain the

same quantity. This is the basis of the test for the collective model, which consists in checking whether the ratio of the difference of derivatives is equal across goods. If the null hypothesis can not be rejected, it is interpreted as proof that the collective model is good at describing household behavior.

Checking the behavior of Romanian households

The previous section introduced some simple tests for both models of household behavior. In this section we present the estimation of the demand system, the variables used for determining the allocation process, and some interesting results.

The data used for testing household behavior came from the 2003 Household expenditure survey. The data contains information on all types of expenditure and income, together with information regarding individual characteristics of all household members, including human capital information.

We will estimate simultaneously seven demand equations: demand for food, demand for non-food, demand for services, demand for utilities, demand for telecommunications, demand for transport, demand for adult goods. Although, the name of the group is self-explanatory, some groups need a little clarification. The food group contains food and beverages consumed at home, with the exception of spirits and tobacco which made up the adult goods group. Foods consumed in restaurants are included in the service group. The transport group contains all transport-related expenses, public transport, train/plane fair as well as all types of expenditure related to buying and owning a car. The estimation is performed on couples of pensioners in order to avoid the necessity to model the labor market decision, which is simultaneous to the consumption decision, and to limit the heterogeneity of the data. For the same reason, we have used the instrumental variable estimation for the total income variable, because it is influenced by previous labor market decision.

The variables used for explaining the demand equations are the income variables. We have introduced total income variable as well as individual incomes, which in our case are pensions. In a second estimation, we have used a functional form for the demand equations that is quadratic in income, which means that there are some quadratic income variables as well.

Since demands are determined by individual preferences which are not directly measurable, we have used some individual characteristics variables as proxies for preferences. We have introduced variables for both partners' age. We have constructed age group categories, since we consider that persons which are at different stages in their lives might have different preferences. Another variable used is both persons' education, in order to see whether persons with higher education have different preferences in comparison to persons with a lower level of education. We have introduced the number of children as well, since children are likely to have important impact on the demand equations. In order to capture the influence of tradition and customs, we have included regional variables and a variable for the rural households. The month of the interview is included as well in order to capture differences in consumption due to the seasonality of goods.

Another set of variables is introduced to capture the difference in patterns of consumption due to the difference in the accommodation conditions or the ownership of durables that households enjoy. Here we included dummies to account for accessibility to services, the existence of a fixed line phone, mobile phone, etc., the dimension of the living quarters, as well as the ownership of a car, computer, etc.

In the end, we introduced variables to capture some specific situations, like self-employment, self-employment in agriculture, presence of a loan, etc. Traditionally self-employed persons tend to report own expenditure as business expenditure, therefore tend to underreport some types of expenditure like transport, telecommunication, utilities, etc. Self-employed in agriculture are producing a large share of the household food, so they are likely to show smaller than normal food expenditures.

We have considered two functional forms for the demand equations, a linear one in incomes and a quadratic one in income:

$$C_i = a_i + b_i Y + c_i y_m + d_i y_f + e \mathbf{Z} + u_i$$

$$C_i = a_i + b_i Y + (c_i/2)Y^2 + d_i y_m + (e_i/2)y_m^2 + f_i y_f + (g_i/2) y_f^2 + h_i y_m y_f + j_i \mathbf{Z} + v_i \quad (14)$$

The outcome of the regression for linear functional form is presented in Table **1**. There are no important differences between the outcomes in the case of linear functional form in comparison to the quadratic form. Next, we present some interesting information regarding the determinants of the demand functions:

- The age of the household head is important, especially for the services, transport and adult goods equation. Older household heads reduce services expenditure as well as adult goods expenditure. The spouse age increases service demands, but decreases adult goods demand. It appears that older household members have conflicting preference in terms of services and same preferences in terms of adult goods.
- The number of children influences especially the food expenditure. Each child increases it by more than 50 RON. Part of the increase in food comes at the expense of lower services expenditure in households with children.
- The education of the household head influences services, transport, adult goods. Higher education is associated with higher services expenditure, and lower transport and adult goods expenditure. The spouse education level influences services, adult goods and utilities expenditure. Services expenditure decreases with the education level of the wife, but both adult goods and utilities expenditure increases by as much as 100 RON for adult goods and 144 RON for utility expenditure. Again, we can notice the conflicting preferences of spouses in terms of service and adult good expenditure. It is interesting to compare the coefficients of spouses with higher education, the female university graduate coefficient is higher than the male's (at all levels of education), suggesting that the educated females tend to have a stronger influence in the household consumption decision.

Table 1

The determinants of household expenditure

	Food expenditure		Non-food expenditure		Services expenditure		Transport expenditure		Adult goods expenditure		Utilities expenditure		Telecomm. Expenditure	
The age of the household head (the omitted category is age between 55-60)														
Age between 61-64	-4.89		4.62		-10.68	*	0.73		-4.61	*	3.64		-0.46	
Age above 65	-6.72		7.82		-14.62	**	7.37	***	-5.00	***	4.00		-0.60	
The age of the spouse (the omitted category is age between 55-60)														
Age between 61-64	1.82		-0.33		5.27		-2.69		-2.72	**	1.92		0.86	
Age above 65	4.13		10.90		13.85	**	-2.57		-10.65	*	-1.95		1.23	
Number of children														
1 child	56.75	*	-13.52	***	-18.42	*	-3.06		15.60	*	10.41	*	-2.23	**
2 children	55.06	*	30.60	***	-30.24	**	28.12	*	4.80		-7.60		0.29	
Education level of the household head (omitted category is no education)														
- primary school (1 – 4)	-21.19		14.23		14.66		-12.21		-8.53	**	-6.08		-1.94	
- secondary school (5 – 8)	-30.42		21.16		47.65		-27.67		-21.14	*	-15.14		-3.91	
- apprentice school	-26.41		28.88		68.64		-40.41	***	-29.59	***	-22.50		-5.41	
- high school	-24.67		36.22		105.61	***	-54.47	***	-34.69	***	-25.67		-8.80	
- foreman qualification	-34.00		53.15		122.79	***	-73.37	***	-44.72	***	-28.40		-9.59	
- short-term university	-43.38		65.49		152.06		-92.16	***	-65.02	***	-28.14		-13.34	
- long-term university	-40.37		63.21		184.15		-107.54		-66.16		-32.12		-12.34	
Education level of the spouse (omitted category is no education)														
- primary school (1 – 4)	-4.60		-25.15		-36.02	*	5.48		13.41	*	16.04	***	-0.07	
- secondary school (5 – 8)	-19.59		-55.94		-79.23	*	13.06		30.98	*	39.04	***	-1.59	
- apprentice school	-40.80		-77.54		-104.45	*	16.45		42.16	*	56.37	***	-2.62	
- high school	-41.95		-96.07		-140.06	*	20.87		53.73	*	80.11	***	-1.16	

	Food expenditure		Non-food expenditure		Services expenditure		Transport expenditure		Adult goods expenditure		Utilities expenditure		Telecomm. Expenditure	
- foreman qualification	-62.80		-121.52		-162.64	**	24.06		67.19	*	90.14	***	2.72	
- short-term university	-86.16		-169.02		-233.97	*	19.76		96.88	*	104.78		-1.92	
- long-term university	-100.67		-218.55		-258.72	**	35.80		106.56	*	144.20	***	-1.73	
Total income	0.07	*	0.11		0.12	*	0.02	*	0.02	*	0.03	*	0.01	*
The pension of the household head	0.27		-0.32		-1.01	***	0.51		0.37	***	0.27		0.06	
The pension of the spouse	0.52		0.97		1.11	**	-0.16		-0.53	*	-0.65		0.03	
Occupational status of the household head														
- pensioner	1.86		-9.21		5.09		-13.85	***	-9.31	***	-15.98		-4.01	***
- dependent	-18.70		11.93		-26.45		20.43		2.57		-5.93		0.27	
Occupational status of the spouse														
- self-employed in agriculture	-115.93		-233.86		-203.27		47.82		99.92	**	139.22		-1.44	
- member of an agricultural coop.	-1.88		-357.66		176.55		47.42		119.23	**	158.06		-5.94	
- income support dependent	-106.76		-207.15		-181.40		49.37		100.67	**	106.42		-1.11	
- pensioner	-123.42		-259.92		-237.26	***	53.72		119.87	*	163.94		-2.50	
- dependent	-78.47		-5.33		-204.86	***	34.78		103.67	*	128.13		-2.11	
Self-employed	21.81	*	-15.94		-23.46	***	1.81		13.95	*	1.70		-0.16	
Self-employed in agriculture	-31.74	*	-0.48		-15.80	*	-0.66		-1.96	**	-3.11	***	-1.95	*
Contracted a credit in the reference month	0.04	*	0.09	*	0.04	*	0.02	*	0.01	*	0.01		0.00	
Interest payments	-0.06	*	-0.12	*	-0.05	*	-0.03	*	0.00		-0.02	*	0.00	***
Cash at the beginning of the month	0.08	*	0.13	*	0.04	*	0.03	*	0.01	*	0.02	*	0.00	*

	Food expenditure		Non-food expenditure		Services expenditure		Transport expenditure		Adult goods expenditure		Utilities expenditure		Telecomm. Expenditure	
Acquisition of durables during the reference month	0.00		0.91	*	-0.07	*	0.02		-0.01		-0.06	*	0.01	***
PC ownership	14.22		-14.78		-7.79		10.55	***	-14.27	*	27.24	*	5.07	*
Fixed line phone	4.44	**	7.75	*	-3.00		3.62	*	0.88		6.92	*	22.35	*
Mobile phone	16.12	*	26.55	*	-5.68		10.56	*	10.71	*	-7.96	**	24.92	*
Car ownership	7.70	*	-8.33	*	-4.68		49.49	*	5.10	*	4.10	***	1.58	*
The status of the accommodation (owner occupied is the omitted category)														
Rented from the state	-7.47		35.52		17.49		26.16	*	2.53		-8.20		-2.40	
Rented from owner	-21.60		57.08		5.60		-4.96		-0.55		4.45		2.12	
Does not pay rent	15.39		0.06		2.74		-0.71		-6.16		-6.72		0.32	
The surface of the living quarters	-0.03		0.03		0.07		0.08	*	0.01		0.07	**	0.02	*
Inside toilet	60.30		0.14		9.60		3.94		16.34		19.56		3.07	
Outside toilet	43.76		13.46		11.92		8.19		12.13		-15.40		1.15	
No toilet	35.80		13.77		12.02		7.72		13.96		-21.07		1.82	
Rural area	-5.98		30.57		13.03		20.15	*	-6.22		-37.61	*	4.75	**
Constant	87.42		228.59		276.67	***	-128.62		-125.75	**	-82.57		-10.85	

Source: Household expenditure data and author's computations.

- Having a self-employed person in the household helps in terms of reduced service expenditure and the increased adult goods expenditure. Thus, it seems that part of the service expenditure is deducted as part of own expenses by the self-employed.
- The self-employed in agriculture decreases the food expenditure by 30 RON. This does not mean that they consume less food, but rather that a large part is produced in the household. Since we have not imputed this production, the effect appears as decreased expenses on food.
- Households owning a personal computer have increased transport expenditure and utilities expenses, but reduced adult good expenses. It seems like having a computer is a substitute for tobacco and spirit consumption. The increased utility bill comes probably from the electricity consumption.
- The presence of a fixed line phone in the household is associated with larger food, non-food, transport, utilities and telecommunication expenditure. The increased telecommunications expenditure is not surprising, since this is where the phone bill enters, but it seems that only households that are spending more for given incomes are willing to enter into a fixed line contract. The same is true for the mobile phone, but the difference in expenses (for a given income) of households with mobile phone and the ones without it is even higher.
- Car ownership is associated with higher expenses on food, adult goods and utilities, and lower non-food expenses. The transport expenditure increases by 50 RON due to the ownership of a car.
- The ownership of the accommodation is not very significant in terms of expenditure. But, once you have a house rented from the state, you are not willing to move so easily, so your transport expenses are increased, probably due to higher commuting expenses.
- The surface of the living quarters increases utilities expenditure, telecommunications and transport expenditure. The increase in utilities is not surprising since lighting, heating are in general proportional to the occupied space. Higher transport expenses for higher houses are a little surprising, but one needs to recall the fact that due to the cost of the land, higher houses are in general at the outskirts of urban areas. Moreover, the absence of utilities like natural gas, sewage, might increase costs for achieving a higher standard of living.
- Living in the rural area increases transport and telecommunication expenditure but decreases utilities expenses. The increased transport has to do probably with higher distances, as well as the absence of public transport. Decreased utilities expenses have to do probably with the absence of basic services in rural areas, and not with the reduced demand for services.

Checking the income pooling hypothesis

Our first goal is to test the income pooling hypothesis. As we have already explained, the presence of the individual incomes in the consumption equation cannot be explained by the common utility model. Therefore, if the coefficients of the individual

income are simultaneously different from zero in all seven demand equations we can interpret it as a proof that the data do not support the common utility model.

The rejection of the common utility model is achieved whenever in equation (13) $c_i = d_i = 0$ for all *i,* or, in equation (14) $c_i = d_i = e_i = f_i = g_i = h_i = 0$ for all *i.*

We applied the test to the models we run in the previous section.

Table 2

Income pooling test

Linear functional forms: $C_i = a_i + b_i Y + c_i y_m + d_i y_f + e \mathbf{Z} + u_i$	
Income pooling test $c_i = d_i = 0$	
F(14,3908)	2.48
Prob > F	0.0017
Quadratic functional forms: $C_i = a_i + b_i Y + (c_i/2)Y^2 + d_i y_m + (e_i/2)y_m^2 + f_i y_f + (g_i/2) y_f^2 + h_i y_m y_f + j_i \mathbf{Z} + v_i$	
Income pooling test ci = di = ei = fi = gi = hi = 0	
F(35, 3908)	3.52
Prob > F	0

Source: Household expenditure survey and author's computations.

Table 2 presents the result of the income pooling test for the two functional forms. It is interesting to see that for both functional forms the income pooling hypothesis is rejected at 99% confidence intervals. The test is stronger for the quadratic functional form. The above results point towards the conclusion that the Romanian couples of pensioners do not behave according to ways which are compatible with the common utility model.

Checking the implications of the collective model

In this section, we are implementing the test obtained in section 0 on both the linear form of demand equations and on the quadratic form of the demand equations. All that is needed is to compute the ratio of the differences in derivatives of the household demand functions.

For the linear demand functional form, equation (13), the derivatives are the following:

$$\frac{\partial C_i}{\partial y_m} = c_i + b_i \tag{15}$$

$$\frac{\partial C_i}{\partial y_f} = d_i + b_i \tag{16}$$

$$\frac{\partial C_i}{\partial Y} = b_i \tag{17}$$

Introducing (15), (16) and (17) into (12) we end up with the following expression:

$$\frac{\frac{\partial C_i}{\partial y_m}-\frac{\partial C_i}{\partial Y}}{\frac{\partial C_i}{\partial y_f}-\frac{\partial C_i}{\partial Y}}=\frac{c_i+b_i-b_i}{d_i+b_i-b_i}=\frac{c_i}{d_i}=\frac{c_j}{d_j}=\frac{\frac{\partial C_j}{\partial y_m}-\frac{\partial C_j}{\partial Y}}{\frac{\partial C_j}{\partial y_f}-\frac{\partial C_j}{\partial Y}} \tag{18}$$

Therefore, the test of the collective model in the case of linear functional form of the demand equations is a test of the equality of a ratio of two coefficients across all demand functions. The STATA software, which the author has used to estimate the demand equations, has a built-in test for the nonlinear restrictions, which simplifies a lot the implementation of the test.

In the case of functional forms of the demands which are quadratic in incomes, equation (15), the derivatives are as follows:

$$\frac{\partial C_i}{\partial y_m}=d_i+e_i y_m+h_i y_f+b_i+c_i Y \tag{19}$$

$$\frac{\partial C_i}{\partial y_f}=f_i+g_i y_f+h_i y_m+b_i+c_i Y \tag{20}$$

$$\frac{\partial C_i}{\partial Y}=b_i+c_i Y \tag{21}$$

Introducing (19), (20) and (21) into (12) we end up with the following expression:

$$\frac{\frac{\partial C_i}{\partial y_m}-\frac{\partial C_i}{\partial Y}}{\frac{\partial C_i}{\partial y_f}-\frac{\partial C_i}{\partial Y}}=\frac{d_i+e_i y_m+h_i y_f}{f_i+g_i y_f+h_i y_m}=\lambda \tag{22}$$

Equation (22) can be rewritten as follows:

$$d_i + e_i\, y_m + h_i\, y_f = \lambda(f_i + g_i\, y_f + h_i\, y_m) \tag{23}$$

Both sides of the (23) equation are functions of y_m and y_f . In order for the equality to hold, we need the coefficients of the individual income as well as the constant to be equal on both sides of the equality sign. From a mathematical point of view, this means:

$$d_i = \lambda\, f_i \; ; \; e_i\, y_m = \lambda\, h_i\, y_m \text{ and } h_i\, y_f = \lambda\, g_i\, y_f$$

The above three conditions can be written more compact as:

$$\frac{d_i}{f_i}=\frac{e_i}{h_i}=\frac{h_i}{g_i}=\ldots=\frac{d_j}{f_j}=\frac{e_j}{h_j}=\frac{h_j}{g_j} \tag{24}$$

Therefore, it can be noticed that the restrictions of the collective model over the demand functions can be written as equality of ratios of coefficients across all demands, similar to the linear functional form of demands. But in this case for each demand function there are three restrictions, in comparison to one in the linear case.

Table 3

Testing the collective model

Linear functional forms: $C_i = a_i + b_i Y + c_i y_m + d_i y_f + e \mathbf{Z} + u_i$	
Testing the implications of the collective model ci /di = …= cj /dj	
F(6,3908)	0.38
Prob > F	0.8946
Quadratic functional forms: $C_i = a_i + b_i Y + (c_i/2)Y^2 + d_i y_m + (e_i/2)y_m^2 + f_i y_f + (g_i/2) y_f^2 + h_i y_m y_f + j_i \mathbf{Z} + v_i$	
Testing the implications of the collective model di /fi = ei /hi = hi /gi = …= dj /fj = ej /hj = hj /gj	
F(20, 3908)	0.46
Prob > F	0.98

Source: Household expenditure survey and author's computations.

Table 3 presents the results of the tests of the collective model over the demand equations. The hypothesis that the restrictions of the collective model are holding could not be rejected for both functional forms. But what is more interesting is that in the case of quadratic functional form of demands, the implications are accepted at a 5% level of significance. These tests are conclusive and there is strong evidence suggesting that the Romanian couples of pensioners are behaving in ways which are compatible with the collective model.

Conclusions

This paper aimed at answering questions related to the adequacy of the common utility model or the collective model in describing the Romanian household's consumption behavior. In order to do this, I have employed two tests, the income pooling test, and a modified Browning test, which was derived in order to correct an assumption that I deemed unnecessary and unrealistic.

The tests were applied to a database consisting of couples of pensioners obtained from the Household Expenditure Survey. I have limited the analysis to pensioners in order to avoid modeling the labor market decision which is simultaneous to the consumption decision. Both tests were applied to both linear and quadratic in income functional forms of the demand function.

The income pooling test was rejected at high level of significance, which proved that the common utility model is not supported by the Romanian household data. However, the implications of the collective model, written in the form of the equality of the ratio of some coefficients, were very well supported by theory. The hypothesis could not be rejected, and in the case of the quadratic functional form the equality of the ratio of the coefficients is accepted at 98% confidence interval. We conclude that there is strong evidence suggesting that the Romanian couples of pensioners are behaving in ways which are compatible with the collective model.

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