SESO
UNIVERSITAIRE FACULTEITEN ST.-IGNATIUS TE ANTWERPEN

STUDIECENTRUM VOOR ECONOMISCH EN SOCIAAL ONDERZOEK

INTERDEPENDENT PREFERENCES AND WIFE'S LABOR SUPPLY

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Rapport 84/165

oktober 1984

* This article is an abstract of the author's doctoral dissertation. I am grateful to my promotor, A.P. Barten for his useful comments.

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D/1984/1169/21

ABSTRACT

This paper deals with wife's labor supply as being affected by social environment factors. Preferences being interdependent is of primary evidence for social scientists. In neoclassical economics, the discussion is not settled but rather avoided. We therefore trespass the implicit assumption of preferences independency imbedded in neoclassical demand theory and apply the theoretical propositions to the labor market, especially to wife's labor force participation. We conclude that for wifes to supply labor in the market, the reference group aimed at has a significant impact.

This paper deals with wife's labor supply as being affected by social environment factors. We therefore trespass the implicit assumption of preferences independency imbedded in neoclassical demand theory and in empirical studies based thereon.

Our argument is two-sided. Theoretically, the assumption of preferences independency lacks firm ground, albeit a cornerstone for the smooth transition from individual to aggregated demand. Preferences being interdependent is of primary evidence for social scientists focussing on social relationships e.g. sociologists, marketing researchers, psychologists... In neoclassical economics, the discussion is not settled but rather avoided. Economists have for a long time considered preferences being a subject for sociologists or psychologists. According to STIGLER and BECKER (1977): "De Gustibus non est disputandum". This attitude changed only recently. On the one hand, contributions have been made with respect to habit formation (e.g. PHLIPS (1972), POLLAK (1976a). On the other hand, authors like LEIBENSTEIN (1976) and POLLAK (1976b) have provided some framework for incorporating preferences interdependency in the theory. We have omitted the independency assumption and we have incorporated interdependency by defining a "group-reference" variable, giving rise to a reference effect, comparable to the well-known price effect. We discuss the theoretical aspects in section 1.

Because it is impossible to settle the dependency discussion from a pure theoretical point of view, our main contribution is empirically based, presented in section 2. We apply our theoretical propositions to the labor market, especially to wife's labor force participation. We verify whether wife's labor supply (1) can be explained more efficiently by adding

(1) Labor supply and labor force participation are considered to be fully interchangeable.

social environment factors to the explanatory economic variables commonly used in empirical studies. We will conclude that for wifes to supply labor in the market, the income level of the reference social group aimed at, has a significant impact.

In section 3 our results are summarized. Some important applications of social interaction theory in various fields of economics are indicated.

1. INTERDEPENDENT PREFERENCES: A THEORETICAL APPROACH

1.1. Some general considerations

The idea preferences being interdependent is common in several sciences. According to the French philosopher BAUDRILLARD (1970), the social dimension of a commodity is more fundamental than the intrinsic use the commodity offers. The concepts "conspicious leisure" and "conspicious consumption". both originated with the social scientist VEBLEN (1934) are expressions of the human desire for distinction or association.

In economics, the presence of the interdependency principle is overwhelming in marketing and welfare economics, e.g. the demonstration mechanism in marketing and externalities in welfare economics. Also the fertility theory as put forward by EASTERLIN (1973) and LEIBENSTEIN (1974) deals with the idea of preferences interdependency.

Although MARSHALL (1890) already made mention of preferences interdependency, neoclassical demand theory has only indirectly dealt with the concept by means of the price mechanism. Since prices represent consumer preferences, one's demand behavior can be regarded as being dependent on others' demand behavior. In our opinion however, prices are not a sufficient way to isolate the effect of interdependent preferences. As LEIBENSTEIN (1976) argues, there are stripenduous difficulties when carrying over from individual to aggregate demand. POLLAK (1976b) argues that aggregated demand (and prices) are not necessarily affected by the interdependency relationships.

DUESENBERRY'S (1949) relative income theory has given the concept a new lease of life. Although developed for macro-economic entities, his contribution to micro-economic analysis is at least as important. In fact, the relative income hypothesis is based on the fundamental principle that one's welfare is inter alia determined by other people's welfare. Later on , PRAIS and HOUTHAKKER (1955) have dealt with preferences interdependency though they failed to incorporate the concept in a system of demand equations. POLLAK (1976b) has recently developed a complete choice model based on interdependent preferences.

In what follows, we incorporate interdependent preferences in a complete system of demand equations. The way we do it differs from Pollak's approach since he uses "social translating". Following POLLAK and WALES (1980) under translating there is a close relation between the effects of changes in the social environment and the effects of changes of total expenditures. We propose "social scaling". Under scaling, the effects of changes in the social environment are closely related to the effects of price changes, as will be shown in a moment. We do not pretend social scaling being preferable to social translating since firm decisions about this matter can be made on empirical grounds only. This question being out of the purpose of our article, the procedure here developed has to be considered as a valuable alternative.

Our theoretical model requires four assumptions mainly dictated by the empirical work we have in mind. First, social influence pertains during one period, i.e. our approach is essentially static. This approach was necessary because of the cross section data used. Secondly, we consider the reference process as a one way influence. The behavior of a particular household is affected by the standard of living of another household, granted as reference household by the first one. The reverse relationship is excluded. This assumption was made to avoid simultaneity in the equation system, causing problems of tractability. Thirdly, only the goods consumed by the reference household are taken into consideration. We feel confident that in our society, social status is mainly related to consumption expenditures. The effort other people make to obtain the commodities is sparsely known and therefore has no impact. Finally, the reference household is exogenous. The analysis is therefore partial since demand behavior is conditional upon the reference household. Although we admit the reference household being endogenous in the long run, in the short run exogenity is more plausible.

With these assumptions, we can build up our model formally. A choice model is in general composed of a utility function and a budget restriction. Since one's utility or welfare depends on the standard of living of the other people, the utility function is the most appropriate way to integrate the interdependency concept.
Therefore (1):

$$\max_{\bar{q}} \quad U = U(\bar{q}, r)$$

$$\text{s.t.} \quad \bar{p}'\bar{q} = A$$

where $\bar{q}$ is the vector of choice arguments, $\bar{p}$ is the corresponding price vector, A is a scalar representing income, r is the standard of living or the consumption level of the reference group. The above representation is kept as general as possible. Depending on the problem, the vector $\bar{q}$ represents n market commodities or it contains the quantities of leisure as well. In the latter model, A corresponds to the potential income and $\bar{p}$ contains also the wage rates, usually considered as the price of time. In the remainder of this article, we consider a two members household; $\bar{q}$ and $\bar{p}$ are defined as:

$$\bar{q} = \begin{bmatrix} q \\ l_m \\ l_w \end{bmatrix} \quad \text{and} \quad \bar{p} = \begin{bmatrix} p \\ w_m \\ w_w \end{bmatrix}$$

(1) A bar (-) above a letter indicates a vector; a dot (.) a diagonal matrix.

The element q is the Hicksian composite of the commodities and p is the corresponding price; l_m and l_w are the leisure of the husband and wife respectively while w_m and w_w are their wages.

Maximization of the utility function under the budget constraint leads to the well-known first order conditions:

$$\bar{u}_q = \lambda \bar{p}$$

$$\bar{p}'\bar{q} = A$$

and the system of demand equations:

$$\bar{q} = \bar{q}\ (\bar{p}, A, r)$$

$$\lambda = \lambda(\bar{p}, A, r)$$

Prices and income are considered as given. Consequently, a change of the consumption level of the reference group can only affect demand as far as the marginal utility of the choice objects are affected. Total differentiation of the first order conditions and the demand system, results in BARTEN's (1966) fundamental matrix equation:

$$\begin{bmatrix} U & \bar{p} \\ \bar{p}' & o \end{bmatrix} \begin{bmatrix} Q_p & \bar{q}_A & \bar{q}_r \\ -\bar{\lambda}'_p & -\lambda_A & -\lambda_r \end{bmatrix} = \begin{bmatrix} \lambda I & \bar{o} & -\bar{v} \\ -\bar{q}' & 1 & -o \end{bmatrix} \qquad (1)$$

where $\bar{v}$ is the vector of the derivatives of the marginal utility with respect to the consumption level of the reference group. In what follows, we assume the marginal utility of leisure is not affected by others' standard of living, or,

$$\bar{v} = \begin{bmatrix} \frac{\partial^2 u}{\partial q \partial r} \\ o \\ o \end{bmatrix}$$

This approach is not essential to the analysis, but it keeps the interpretation of what we will call the reference effect simple. Assuming the inverse of the bordered Hessian matrix exists and equals:

$$\begin{bmatrix} U & \bar{p} \\ \bar{p}' & o \end{bmatrix}^{-1} = \begin{bmatrix} Z & \bar{z} \\ \bar{z}' & \xi \end{bmatrix}$$

we get:

$$\begin{bmatrix} Q_p & \bar{q}_A & \bar{q}_r \\ -\bar{\lambda}'_p & -\lambda_A & -\lambda_r \end{bmatrix} = \begin{bmatrix} \lambda Z - \bar{z}\bar{q}' & \bar{z} & -Z\bar{v} \\ \lambda \bar{z}' - \xi \bar{q}' & \xi & -\bar{z}'\bar{v} \end{bmatrix}$$

Equalizing λZ, the matrix of substitution effects, to K, and given $\bar{z}=\bar{q}_A$, the reference effect is:

$$\begin{bmatrix} \bar{q}_r \\ \lambda_r \end{bmatrix} = -\begin{bmatrix} \frac{1}{\lambda} K \bar{v} \\ -\bar{q}'_A \bar{v} \end{bmatrix} \qquad (2)$$

This means that a change in the consumption of other people is to be interpreted as some kind of (relative) price change. Indeed, the reference effect is proportional to the substitution effect with respect to p, the factor of proportionality being $-\frac{1}{\lambda}\frac{\partial^2 u}{\partial q \partial r}$. In other words, an increase of the marginal utility of consumption caused by an increased consumption of the reference group ($\frac{\partial^2 u}{\partial q \partial r} > o$) is perceived as a relative price decrease, represented by $-\frac{1}{\lambda}\frac{\partial^2 u}{\partial q \partial r}$. Assuming the utility function is well behaved, the final effect is positive ($\frac{\partial q}{\partial r} = \frac{1}{\lambda}\frac{\partial^2 u}{\partial q \partial r}\left.\frac{\partial q}{\partial p}\right|_{du=o} > o$). In neo-classical economics this situation is sometimes called the "keep up with the Jones"-effect or the "bandwagon"-effect, although it should be kept in mind that the definition is different from the one used in welfare economics. On the contrary, when a snob effect is prevailing, an increased consumption of the reference group is felt as a relative price increase ($-\frac{1}{\lambda}\frac{\partial^2 u}{\partial q \partial r} > o$), i.e. own utility is declining.

Up till now, abstraction has been made from the determinating factors of r. To integrate them in the analysis, it suffices to define r as a function of the consumption level of the m reference families : $r = r(q_1, \dots q_m)$ with q_i the consumption level of the i-th reference family. The extension is straightforward and has little effect on the theoretical analysis. However, it can be useful in empirical work for it allows to distinct the reference components with high and little influence.

1.2. Interdependent preferences and the concept of scaling

The idea of relating one's welfare to that of other people has been mentioned by DUESENBERRY (1949). BARTEN (1964) was the first to introduce scaling in demand theory as a method to construct family equivalence scales. Later on, the technique has been applied by MUELLBAUER (1977) and POLLAK and WALES (1980).

Under scaling, the original arguments of the utility function are related to scaling factors, i.e. the

consumption level of the household considered is related to that of the reference group. Obviously, leisure can be expressed in scaled units too. In the remainder of this article, we introduce leisure not as the amount of leisure one enjoys, but as the amount of leisure related to the committed leisure (e.g. 12 hours a day). Conformably to the assumptions made earlier, committed leisure is a physical rather than a sociological concept.

We restate the choice problem as

$$\max_{\bar{q}^*} \quad U = U(\bar{q}^*)$$

$$\text{s.t.} \quad \bar{p}'\bar{q} = A$$

where $\bar{q}^* = \begin{bmatrix} q^* \\ l_m^* \\ l_w^* \end{bmatrix}$

The argument $q^*=\frac{q}{r}$ is the proper consumption related to that of the reference group and can be interpreted as a fictive commodity. The argument $l_i^*=l_i/l_i^\circ$ is the i-th person's leisure (l_i) related to his committed leisure (l_i°).

Defining the budget restriction appropriately:

$\bar{p}^{*\prime}\bar{q}^* = A$ with $\bar{p}^* = \begin{bmatrix} pr \\ w_m l_m^\circ \\ w_w l_w^\circ \end{bmatrix}$ the vector representing fictive prices, we get the standard formulation.

Following the same line of reasoning as in the preceding section, total differentiation of the first order conditions and the demand system, results in

$$\begin{bmatrix} H & \bar{p}^* \\ \bar{p}^{*\prime} & o \end{bmatrix} \begin{bmatrix} d\bar{q}^* \\ -d\lambda \end{bmatrix} = \begin{bmatrix} \lambda I & \bar{o} & d\bar{p}^* \\ -\bar{q}^{*\prime} & 1 & dA \end{bmatrix}$$

and

$$\begin{bmatrix} d\bar{q}^* \\ d\lambda \end{bmatrix} = \begin{bmatrix} Q^*_{p^*} & \bar{q}^*_A \\ \bar{\lambda}'_{p^*} & \lambda_A \end{bmatrix} \begin{bmatrix} d\bar{p}^* \\ dA \end{bmatrix} \qquad (3)$$

where H is the Hessian matrix, specified in terms of the fictive arguments.
Applying further transformations, the fundamental matrix can now be written as

$$\begin{bmatrix} \dot{r}^{-1} H \, \dot{r}^{-1} & \bar{p} \\ \bar{p}' & o \end{bmatrix} \begin{bmatrix} Q_p & \bar{q}_A & Q_r \\ -\bar{\lambda}_p & -\lambda_A & -\bar{\lambda}'_r \end{bmatrix} = \begin{bmatrix} \lambda I & \bar{o} & -\dot{V} \\ -\bar{q}' & 1 & \bar{o}' \end{bmatrix}$$

The matrix $\dot{V}$ represents the effect of changing scale factors on the marginal utility of the original choice arguments. Assuming the scale factors only affect the marginal utility of the arguments to which they are related, $\dot{V}$ is diagonal with the vector

$$\bar{v} = - \begin{bmatrix} \frac{1}{r^2} \left(\frac{\partial^2 u}{\partial q^* \partial q^*} q^* + \frac{\partial u}{\partial q^*} \right) \\ \frac{1}{l_m^{\circ 2}} \left(\frac{\partial^2 u}{\partial l^*_m \partial l^*_m} l^*_m + \frac{\partial u}{\partial l^*_m} \right) \\ \frac{1}{l_w^{\circ 2}} \left(\frac{\partial^2 u}{\partial l^*_w \partial l^*_w} l^*_w + \frac{\partial u}{\partial l^*_w} \right) \end{bmatrix} \quad \text{on his main diagonal}$$

The diagonal matrix

$$\dot{r} = \begin{bmatrix} r & o & o \\ o & l_m^\circ & o \\ o & o & l_v^\circ \end{bmatrix}$$ represents the matrix

of scale factors.

In view of the similarity to (1), $\dot{r}^{-1}\ H\ \dot{r}^{-1}$ amounts to U. Consequently, the effect of a change of the scale factors on demand is simply:

$$\begin{bmatrix} Q_r \\ \\ \bar{\lambda}'_r \end{bmatrix} = - \begin{bmatrix} \frac{1}{\lambda}\ K\ \dot{V} \\ \\ -\bar{q}'_A\ \dot{V} \end{bmatrix}$$

An increase of the consumption of the reference group has a positive effect on consumption demand as far as $(\frac{\partial^2 u}{\partial q^*\ q^*}\ q^* + \frac{\partial u}{\partial q^*})$ is negative.

In the terminology of section 1.1, this is equivalent with $\frac{\partial^2 u}{\partial q \partial r}$ positive. In the opposite case, the reference effect influences consumption in a negative sense. The interpretation with respect to changed committed leisure is straightforward.

To obtain a system of demand equations suitable for empirical testing, further transformations are necessary. Introducing the Slutsky equation in (3) and using the logarithmic transformation: dz = z d ln z on the right hand variables, we obtain :

$$\begin{bmatrix} d\bar{q}^* \\ \\ d\lambda \end{bmatrix} = \begin{bmatrix} (K^*-\bar{q}^*_A\bar{q}^{*\prime})\ \dot{p}^*\ d\ \ln\ \bar{p}^* + \bar{q}^*_A\ A\ d\ \ln\ A \\ \\ \bar{\lambda}'_{p^*}\ \dot{p}^*\ d\ \ln\ \bar{p}^* + \lambda_A\ Ad\ \ln\ A \end{bmatrix} \qquad (4)$$

with K* the matrix of substitution effects on the basis of the fictive arguments and prices. Considering the relation $d\, prq^* = pr\, dq^* + q^* dpr$, it is easy to show that $a_q d\ln pq = \frac{pr}{A} dq^* + a_q d\ln pr$. Making an analogous transformation on $d\, w_i\, l_i^\circ\, l_i^*$, we get

$$\dot{a}\, d \ln \dot{p}\bar{q} = \frac{1}{A} \dot{p}^* d\bar{q}^* + \dot{a}\, d \ln \bar{p}^*$$

with $\dot{a} = \begin{bmatrix} a_q & o & o \\ o & a_m & o \\ o & o & a_w \end{bmatrix}$ the diagonal matrix of budget budget shares. Substituting (4) in the latter result and after integration, we proceed to

$$\dot{a} \ln \dot{p}\, \bar{q} = \bar{c} + S\ln\bar{p}^* - \bar{b}\bar{a}'\ln\bar{p}^* + \bar{b}\ln A + \dot{a}\ln\bar{p}^* + \bar{u} \quad (5)$$

where $S = \frac{1}{A} \dot{p}^* K^* \dot{p}^*$ is a matrix containing the substitution effects;

$\bar{b} = \dot{p}^* \bar{q}^*_A$ is the vector of income effects, while

$\bar{c}$ and $\bar{u}$ are the vectors of constants and disturbances respectively.

To make the model consistent with demand theory, the following restrictions on the parameters are effective:

$$\tau'\bar{b} = 1$$
$$[S_{ij}] = [S_{ji}]$$
$$\iota' S = \bar{o}'$$

Given the interpretation of the parameters and the restrictions on them, the analogy with the Rotterdammodel of THEIL (1967) and BARTEN (1966) is obvious.
Estimation will be left to section 2.2.2.

2. INTERDEPENDENT PREFERENCES : AN EMPIRICAL APPROACH

2.1. The data

Before we report on the empirical results, it is appropriate to comment on the data used. The data proceed from a budget study conducted by the Center for Population and Family Studies affiliated with the Belgian Ministry of Health and Family. A detailed description can be found in RENARD (1973). As the inquiry was originally set up to make a budget study among households having at most 4 children and 16 years of marriage, it is in no way representative for the Belgian population. A total of 582 households were subjected to an extensive survey. In order to get a sample as homogenous as possible, all interviews toke place in one city (Liège) within a short period (November 1970 till the 15th of January 1971). Next to the budgetary data, the survey contains detailed sociological information. For our purpose, the information on the relationships between the proper income and that of the social environment makes the data particularly worthwhile. Others' income being generally unknown, we imagine people value the income of the environment by means of the standard of living the environment reveals. We therefore assume others' income is a reasonable indication of the standard of living other people have.

Households were asked whether households of friends, colleagues, neighbours and brothers and sisters own a higher, equal or lower income than they do. In addition, information is available on the income relationship to that household, whose life style is especially appreciated by the household questioned. In the remainder of the article, we call the household thus mentioned the "Jones"-household. In view of the definition, the "Jones"-household is expected to have a particular influence on the household questioned. The empirical research will therefore heavily bear on the "Jones"-household.

However, two data problems remain. A first problem refers to the income relationship in the survey. What we need is the relationship between the income of the household questioned, nett of wife's earnings (YEXCL) on the one hand, and the environment's total income (YREF) on the other hand. The income relationship we virtually dispose of, compares environment's total income with total income of the household questioned, wife's earnings included (Y). Therefore, when the wife is actually participating, a transformation is required. Households with ex-ante total income equal to the income of the social environment (Y=YREF), have to be transferred to the category "environment has a greater income" (YREF > YEXCL). When actual income of a household is greater than that of the environment, the income relationship after transformation is a priori not evident since the environment's income level is unknown. When the latter occurs, the observation is put in the category YREF < YEXCL. More details on the transformation process can be found in appendix 1. The transformation thus applied affects the results of hypothesis testing in a particular sense. The number of observations in the category "YREF < YEXCL" and "wife participate" is artificially increased. This amounts virtually to an increased probability of hypothesis rejection. Anyhow, when the coefficients turn out to be significant, we can have every confidence in the hypothesis tested.

As mentioned above, the "Jones"-household fills an important part in testing our hypothesis. However, only a minority (about 30 %) of the households questioned admit the existence of a "Jones"-household. This second problem is two-sided. First, the generality of the social interaction phenomenon may have one's doubts. No conclusions are drawn concerning the overall character of the reference process, although the phenomenon is given full evidence by social scientist. In this paper, we are mainly interested in explaining variations in demand behavior taking the environment's standard of living into consideration. From that view, the phenomenon being possibly marginal does not matter at all. The second aspect may be more serious because it may affect the research methodology considerably. Assuming the same variables simultaneously affect the presence of a "Jones"-household and demand behavior, explaining demand behavior in section 2.2.2. by simple regression analysis would produce biased estimates. In fact, a sample selectivity bias would be in order, analogous to the one mentioned in labor economics in explaining labor supply. As HECKMAN (1974) argues, the analysis of labor supply in the market while ignoring the participation decision induces biased wage parameters. The problem is overcomed by making full use of both participation and hours information simultaneously by applying Tobit analysis. Considering the problem at hand, assuming demand behavior and the presence of a "Jones"-household being simultaneously affected by the same variables (e.g. household income), the use of simple regression analysis would be inappropriate in section 2.2.2. In order to gain insight into the seriousness of the problem, the presence of a "Jones"-household is first studied. We analyse whether economic and sociological variables are significant in explaining the existence of a "Jones"-household. The dependent variable being dichotomous - e.g. presence or absence - a logit analysis is carried out. Results are reported in appendix 2. The results are important because none of the variables considered has a significant impact on the presence of a "Jones"-household. The result is considerable with respect to wife's wage rate and household income, nett of wife's earnings, since both are used in explaining demand behavior. We conclude the use of simple regression analysis to be justified.

2.2. Empirical results

2.2.1. The participation decision

We now verify whether wife's labor supply can be explained more efficiently by adding social environment factors to the explanatory economic variables, commonly used in empirical studies. A particular hypothesis is tested. Our argument is that people continuously compare their proper welfare to that of others. The available income being insufficient to attain the environment's standard of living households are willing to increase wife's labor supply in order to get the standard of living aimed at. The impact other people have on one's demand behavior is called the reference effect. The analogy with the relative income theory is obvious since the buffer role Duesenberry assigns to savings is now transferred to wife's labor supply. We first consider the reference effect in a simple equation model explaining wife's participation decision. In section 2.2.2 the reference effect is imbedded in a system of demand equations.

As mentioned earlier, the reference effect is introduced in the model by means of a variable covering the income relationship between the household's available income - i.e. nett of wife's earnings - and the environment's income. The dependent variable being dichotomous qualitative (participation or not), a qualitative response model is used. Table 1 reports on the results of logit analysis. Apart from the impact the "Jones"-household has on wife's particpation decision, the impact of friends and family is analysed too.

The coefficients of variables commonly used are in general in agreement with previous results (e.g. BOWEN and FINEGAN (1969). Household income (YEXCL), wife's age (AGE2, AGE3, AGE4) and children (CHILD2, CHILD3, CHILD4) affect participation negatively. Schooling (SCH2, SCH3, SCHMW), the evolution of household income (PY) and wife's wage rate (WAGE) have a positive effect on the participation decision. In order to allow for a reference effect conditional on wife's schooling degree, three reference variables (YREFNS, YREFHS, YREFS) are introduced. In view of BECKER's (1965) production-consumption theory, we expect, ceteris paribus, the reference effect to be less pronounced when the wife has a low educational level. This is explained by the high opportunity costs caused by foregone household production when the wife participates on the labor market. The reference effect for wifes with a high educationel level may be less strong too. For this category, factors as job satisfaction and tastes for market work dominate, giving minor impact to the reference effect. This virtually amounts to a reference effect expected to be the strongest for wifes with a medium educational level (YREFHS).

All reference coefficients, except one, confirm prior theoretical reasoning. According to the positive reference coefficients, the available income being insufficient to attain the environment's standard of living, wifes are stimulated to participate on the labor market. Moreover, the coefficients are highly significant. The results do however not reveal any clear-cut impact of the educational level on the reference effect. In view of the variance-covariance matrix of the estimated coefficients as represented in appendix 3, the reference coefficients do not differ significantly.

2.2.2. Wife's labor supply within a system of demand equations

We refer to demand system (5) discussed in section 1.2. Considering husband's time allocation as fixed, we obtain the following two equations model:

$$a_q \ln pq = c_1 + b_1 \ln A + (S_{12} - a_w b_1) \ln w_w l_w^{\circ} + (a_q + S_{11} - a_q b_1) \ln pq_f + u_1$$
$$a_w \ln_w l_w = c_2 + b_2 \ln A + (a_w + S_{22} - a_w b_2) \ln w_w l_w^{\circ} + (S_{21} - a_q b_2) \ln pq_f + u_2 \qquad (6)$$

where the fictive price pr has been replaced by pq_f.
This virtually amounts to a reduction of the environment or the reference group to a simple reference household with pq_f being the consumption expenditures of that household.

In order to obtain a sum-constrained model, analogous to the Rotterdammodel, we rewrite (6) as

Table 1. Wife's labor force participation: results of logit analysis

VARIABLES	REFERENCE GROUP					
	a.friends		b.brothers and sisters		c."Jones"-household	
	coefficient	asymptotic t-ratio	coefficient	asymptotic t-ratio	coefficient	asymptotic t-ratio
dependent						
participation = 1 no participation = 0						
independent						
constant	-.801	2.344	-.118	.386	.100	.175
income						
PY	.122	.465	.246	1.132	.958	2.485
YEXCL	-.193E-5	2.783	-.139E-5	2.172	-.136E-5	1.369
Wife's schooling						
SCH2	.464	1.466	.149	.598	.070	.137
SCH3	.134	.332	-.270	.807	1.627	1.987
SCHMW	.129	.685	.141	.827	.399	1.399
Wife's age						
AGE2	-.056	.255	-.211	1.056	-.190	.592
AGE3	-.320	1.193	-.436	1.800	-.884	2.188
AGE4	-1.477	2.887	-.965	2.512	-.523	.887
Presence and age of children						
CHILD2	-.335	2.057	-.377	2.600	-.511	2.303
CHILD3	-.467	2.888	-.603	4.164	-.578	2.519
CHILD4	-.088	.402	-.445	2.346	-.067	.193
Income relationship						
YREFNS	1.337	5.856	.603	3.590	.340	.923
YREFHS	1.241	4.342	.599	2.370	.930	2.196
YREFS	1.126	3.568	.701	2.358	-.966	1.399

Table 1. (cont.)

VARIABLES	REFERENCE GROUP					
	a.friends		b.brothers and sisters		c."Jones"-household	
	coefficient	asymptotic t-ratio	coefficient	asymptotic t-ratio	coefficient	asymptotic t-ratio
Wife's wage						
WAGE	.017	3.249	.018	3.651	.009	1.144
N(number of observations)	375		381		174	
R^2	.33		.20		.27	

Income
PY : dummy variable: 1:present income is lower than the income 3 years ago; 0:present income is greater than or equal to the income 3 years ago.
YEXCL : household income nett of wife's earnings.

Wife's schooling
SCH1 : basis dummy variable excluded to avoid multicollinearity; 1: primary or secondary (until age of 15) level; o : otherwise.
SCH2 : dummy variable; 1:secondary (until age of 18) level; o : otherwise.
SCH3 : dummy variable; 1:post-secondary or university level; o : otherwise.
SCHMW : dummy variable; 1:wife owns higher degrees than husband; 0:otherwise.

Wife's age
AGE1 : basis dummy variable excluded to avoid multicollinearity; $1{:}<25$; 0:otherwise.
AGE2 : dummy variable; $1{:}25 \leq 34$; 0:otherwise.
AGE3 : dummy variable; $1{:}35 \leq 44$; 0:otherwise.
AGE4 : dummy variable; $1{:}\geq 45$; 0:otherwise.

Presence and age of children
CHILD1 : basis dummy variable excluded to avoid multicollinearity; 1:no children; 0:presence of children.
CHILD2 : dummy variable; 1:children in age category: $0 \leq 2$; 0:otherwise.
CHILD3 : dummy variable; 1:children in age category: $3 \leq 11$; 0:otherwise.
CHILD4 : dummy variable; 1:children in age category: ≥ 12; 0:otherwise.

Income relationship
YREFNS: dummy variable; 1:YREF> YEXCL and wife has primary or secondary (until age of 15) level: 0:othewise.
YREFHS: dummy variable; 1:YREF> YEXCL and wife has secondary (until age of 18)level; 0:otherwise.
YREFS : dummy variable; 1:YREF> YEXCL and wife has post-secondary or university level; 0:otherwise.

Table 1. (cont.)

Wife's wage

WAGF : wife's wage rate.

$$a_q \ln pq - \frac{1}{2}(a_q \ln pq + a_w \ln w_w l_w - \ln A) = c_1' + b_1 \ln A + (S_{12} - a_w b_1) \ln w_w l_w^\circ +$$

$$(a_q + S_{11} - a_q b_1) \ln pq_f + u_1'$$

$$a_w \ln w_w l_w - \frac{1}{2}(a_q \ln pq + a_w \ln w_w l_w - \ln A) = c_2' + b_2 \ln A + (a_w + S_{22} - a_w b_2) \ln w_w l_w^\circ +$$

$$(S_{21} - a_q b_2) \ln pq_f + u_2' \qquad (7)$$

A sum-constraint model is useful since estimation can be confined to a single equation. Because our model is no longer specified in terms of differences, as is the case with the Rotterdam-model, the term $\frac{1}{2}(a_q \ln pq + a_w \ln w_w l_w - \ln A)$ has to be understood as an approximation error. Due to the restrictions on the parameters mentioned above, the transformation only affects the intercepts, the latter being $c_1' = \frac{1}{2}(c_1 - c_2) = -c_2'$. An identification problem however arises since the original intercepts (c_i) are no longer identified.

Observations on the reference household's absolute consumption level (pq_f) not being available, we use the transformation

$$\ln pq_f = \ln \text{YEXCL} + \delta X \qquad \text{implying } -1 < \delta X \leq 1 \qquad (8)$$

As defined previously, YEXCL is household income, nett of wife's earnings. X is a dummy variable with X equals 1 if the reference household owns a greater income than the household questioned (YREF > YEXCL). In the opposite case, i.e. the income of the reference household being equal or less than the proper income (YREF $\leq$ YEXCL), X equals 0. δ is a parameter to be estimated introducing the reference effect in the model.

With (8) and after re-arranging terms, we finally get

$$a_q \ln pq - \frac{1}{2}(a_q \ln pq + a_w \ln w_w l_w - \ln A) - a_q \ln YEXCL =$$

$$c_1' + b_1(\ln A - a_q \ln YEXCL - a_w \ln w_w l_w^\circ) + S_{XX}(\ln YEXCL - \ln w_w l_w^\circ) +$$

$$S_{XX}\delta X + \delta(1-b_1)a_q X + u_1' \qquad (9a)$$

$$a_w \ln w_w l_w - \frac{1}{2}(a_q \ln pq + a_w \ln w_w l_w - \ln A) - a_w \ln w_w l_w^\circ =$$

$$c_2' + b_2(\ln A - a_q \ln YEXCL - a_w \ln w_w l_w^\circ) + S_{WX}(\ln YEXCL - \ln w_w l_w^\circ) +$$

$$S_{WX}\delta X + \delta b_2 a_q X + u_2' \qquad (9b)$$

The model being non-linear in its parameters, linearisation is applied because the appropriate computer software was lacking.

Table 2 shows the regression results of equation (9a) with respect to the "Jones"-household. The results with respect to the households of friends and brothers and sisters are analogous. Four regressions have been considered. Regression 1 involves an estimation of the reference effect without making any inference to the impact children or wife's educational level may have on the reference effect. Regression 2 allows a reference effect conditional on wife's educational level. It virtually amounts to a replacement of expression (8) by $\ln pq_f = \ln YEXCL + \delta_1 X_1 + \delta_2 X_2 + \delta_3 X_3$.

The dummy variables X_1, X_2 and X_3 equal one when the "Jones"-household's income exceeds the existing income of the household questioned and the wife has respectively a low (primary or secondary until the age of 15), medium (until the age of 18) or high (post-secundary or university) educational level. The corresponding parameters δ_1, δ_2 and δ_3 represent the reference parameters. Regression 3 and 4 involve analogous transformations. Regression 3 considers the reference parameters conditional on the presence of children. The dummy variables X_1 and X_2 equal one when the "Jones"-household's

Table 2. Wife's labor supply ; results of regression analysis ("Jones"-household)

Parameters (equation 9a)	regression 1 coefficient	regression 1 t-ratio	regression 2 educational level coefficient	regression 2 educational level t-ratio	regression 3 presence of children coefficient	regression 3 presence of children t-ratio	regression 4 age of children coefficient	regression 4 age of children t-ratio
c_1	-.448	-2.093	-.404	-1.888	-.135	-.625	.007	.029
b_1	.711	3.684	.668	3.443	.429	2.223	.312	1.418
S_{11}	-.045	-1.667	-.037	-1.321	-.063	-2.250	-.066	-2.129
δ	1.103	2.821	-	-	-	-	-	-
			educational level		children		pre-school children	
δ_1	-	-	low .794	2.169	absent .675	1.464	present .030	.312
δ_2	-	-	medium 1.104	3.182	present .447	1.456	absent .224	.914
δ_3	-	-	high 1.006	4.679				
R^2 equation 9a	.40		.41		.41		.26	
equation 9b	.33		.35		.35		.23	

income exceeds the existing household's income and children are respectively absent and present. Regression 4 takes children's age into consideration. X_1 and X_2 equal one with the "Jones"-household's income exceeding the existing household income and pre-school children respectively present and absent.

Given the aggregated character of demand considered (commodity demand and wife's leisure), inferior goods are improbable. The results confirm prior belief since the b coefficients are everywhere positive and significant. Compensated price effects (S_{11}) are negative and significant confirming demand theory. The δ-parameters, introducing the reference household's impact, vary within the range imposed; i.e. $-1<\delta\leq 1$. Although the upper limit is sometimes exceeded, the parameter does not significantly differ from one as can be concluded from the estimated variance-covariance matrix given in appendix 4. According to the hypothesis put forward in this article, we expect the δ-parameters with respect to commodity demand to be positive. Estimates come up to the expectations. The hypothesis can therefore not be rejected. Regression 2 shows the parameter δ_1 to be less strong than the parameters δ_2 and δ_3. The difference is significant. It amounts to a weakened impact of the environment on demand behavior when the wife has a low educational level. According to regression 3 and 4, the presence of children and especially preschool children reduces the reference parameter. Both results are in agreement with Becker's production-consumption theory, suggesting the opportunity costs caused by foregone household production are too high when the wife enters the labor market.

Table 3 reports on the wage and income elasticities and on the reference effects obtained. Wage elasticities of wife's leisure are everywhere negative amounting to a positive inclined labor supply curve. In general, the income elasticity of total expenditures exceeds 1, alluding total expenditures to be congruent with luxury goods. The reference effects confirm prior belief. The available income being insufficient to attain the standard of living of the "Jones"-household, households are, ceteris paribus, willing to decrease wife's leisure (i.e. increase labor supply) in order to get the consumption level aimed at. This is reflected by the positive reference effect with regard to commodity demand and the negative reference effect with regard to leisure.

Table 3. Wife's labor supply: income and wage elasticities and reference effects ("Jones"-household)

	regression 1	regression 2 educational level	regression 3 presence of children	regression 4 age of children
<u>wage elascities</u>				
$\frac{\partial \ln pq}{\partial \ln w_w l_w^\circ}$	.186	.162	.196	.190
$\frac{\partial \ln l_w}{\partial \ln w_w l_w^\circ}$	-.073	-.037	-.062	-.057
<u>income elasticities</u>				
$\frac{\partial \ln pq}{\partial \ln A}$	1.672	1.571	1.009	.734
$\frac{\partial \ln w_w l_w}{\partial \ln A}$	.503	.578	.993	1.197
<u>reference effects</u>		<u>educational level</u>	<u>children</u>	<u>pre-school children</u>
$\frac{\partial \ln pq}{\partial X}$ $\frac{\partial \ln w_w l_w}{\partial X}$	.202 -.149	low { .194 -.144	absent { .285 -.211	present { .016 -.012
		medium { .270 -.200	present { .189 -.140	absent { .119 -.088
		high { .246 -.182		

3. SUMMARY AND CONCLUSIONS

In this article, we discussed the impact of social environment on wife's labor supply. Social demonstration is accepted as a choice-affecting determinant in most social sciences. In the dominant stream of micro-economics, preferences interdependcy is neglected. Some authors had sporadically attention for the social interaction phenomena. Presumably, interdependency is advocated most strongly in Duesenberry's relative income theory. According to Duesenberry, welfare is a relative rather than an absolute concept. People compare the proper standard of living with the welfare others demonstrate.

In view of the theoretical and empirical work of social researchers and the relative connotation of welfare, we subscribed to the idea of social interaction as being an evident element of human behavior. We discussed the theoretical aspects of preferences interdependency in the framework of neoclassical demand theory by adding a reference variable to the scheme. The reference effect thus introduced was interpreted as a relative price effect.

Our main contribution concerned the empirical verification of a special case of social interaction. We applied social interaction to wife's labor supply. Our argument was that households are willing to increase wife's supply in order to attain the environment's standard of living. The availability of data including information on the environment's expenditures made hypothesis testing possible. The empirical results were successful since they did not reject the hypothesis.

Some qualifications are in order suggesting the necessity for further research. In view of the cross section data used, we assumed a static reference process. The analysis was partial since the reference household was considered to be exogenous. The sample referred exclusively to young families having no access to large savings. Wife's labor supply was the most obvious way to attain the consumption level desired.

Aside from hypothesis testing, our empirical findings are important in opening perspectives for further research. First, increasing participation of women is analysed from a new point of view, extending the traditional approach. Welfare being a relative concept is one thing. Factors intensifying the possibilities of welfare comparisons is an other. It remains highly questionable whether the excessive grow of female labor during the last decades can not be explained more efficiently by introducing external variables of sociological relevance in the analysis. With that respect we mention the increasing urbanization or the well spread means of communication both contributing to the demonstration mechanism. Moreover, we believe preferences interdependency being useful in explaining demand behavior in several respects. Further incorporation of social interactions in economic theory is therefore recommended. Apart from their impact on aggregate demand, a topic already studies by POLLAK (1976b), it would be interesting to study the policy implications on the tax structure and the income distribution to be recommended.

Appendix 1. Outline of the data with respect to the income relationship

Reference group		Number of observations					
		before transformation			after observations		
		YREF>Y(1)	YREF=Y	YREF<Y	YREF>YEXCL(2)	YREF=YEXCL	YREF<YEXCL
a. friends	NWW(3)	74	105	20	74	105	20
	WW	34	119	23	153	0	23
b. brothers and sisters	NWW	96	68	51	96	68	51
	WW	52	60	54	112	0	54
c. "Jones"-household	NWW	69	24	7	69	24	7
	WW	42	21	11	63	0	11

(1) environment's income exceeds household's total income

(2) environment's income exceeds household's income, nett of wife's earnings

(3) NWW : not working wife; WW : working wife

Appendix 2. Presence of a "Jones"-household: results of logit analysis

Variables	Coefficient	Asymptotic t-ratio
<u>dependent</u>		
presence "Jones"-household=1		
absence "Jones"-household=0		
<u>independent</u>		
constant	-.572	2.649
household income nett of wife's earnings	.191E-5	1.383
total household income	-.196E-5	1.520
husband's age (1)	.004	.077
wife's age (1)	.017	.300
husband's schooling level (2)	.060	1.273
wife's schooling level (2)	.010	.182
number of children	.001	.026
wife's labor force participation (3)	.088	.546
wife's wage rate	.001	.676
N (number of observations)	502	
R^2	.011	

(1) age: 1:<21; 2:21≤24; 3:25≤29; 4:30≤34; 5:35≤39; 6:40≤44; 7:45≤50; 8:>50.

(2) schooling level: 1:primary; 2:secondary (until age of 15); 3:secondary (until age of 18); 4:post-secondary; 5:university.

(3) participation: 1:participation; 0:no participation.

Appendix 3. Wife's labor force participation. Estimated variance-covariance matrix: results of logit analysis

Reference group		Estimated variance-covariance matrix		
a. friends		YREFNS	YREFHS	YREFS
	YREFNS	.52141E-1	.82524E-3	.75872E-3
	YREFHS		.81693E-1	.10245E-2
	YREFS			.99521E-1
b. brothers and sisters				
	YREFNS	.28166E-1	.78619E-3	.97588E-3
	YREFHS		.63953E-1	.21139E-2
	YREFS			.88500E-1
c. "Jones"-household				
	YREFNS	.13573	-.22194E-3	.62019E-2
	YREFHS		.17946	-.58003E-2
	YREFS			.47698

Appendix 4. Wife's labor supply. Estimated variance-covariance matrix: results of regression analysis ("Jones"-household)

<u>regression 2: educational level</u>			
	δ_1	δ_2	δ_3
δ_1	0.074926	0.095730	0.088066
δ_2		0.134133	0.117073
δ_3			0.120652
<u>regression 3: presence of children</u>			
δ_1	0.212981	0.135578	
δ_2		0.094316	
<u>regression 4: age of children</u>			
δ_1	0.919327E-2	0.368358E-2	
δ_2		0.602634E-01	

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