Evidence on addiction effects from households expenditure surveys : the case of Polish consumers

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Abstract

The Becker-Murphy model of addiction effect is tested using a classic cross section household expenditure surveys forming panel and pseudo-panel data instead of usually used specific surveys. Special instrumentations, using age cohorts, are proposed and compared with classic ones. Unlike the traditional price – income instrumentations the proposed one gives in most cases results conforming to the theoretical predictions, showing the existence of addiction, and giving the realistic estimates of the inter-temporal rate of substitution. Moreover, the estimated rates of time preference for tobacco and alcohol are close to each other both when estimated separately or in a system (SUR).

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Key words: Addiction, instrumentation, alcohol and tobacco, cross-section –panel data

Introduction

Tests of the rational addiction model have been conducted on two types of data: first, Becker-Grossman-Murphy(1994) and Baltagi (1999) use panels of American states for which there exist indicators of cigarette consumption, average retail prices (which differ between different states and periods), per capita household income and the cigarette prices in neighboring states (to estimate smuggling effects). Such a statistics does not allow to estimate the model for different populations, which has been made by Chalupka (1991) using a health American survey on 28 000 people conducted over 5 years and Clark-Etile (2000) on a British health survey. The survey used by Chalupka contains only two consecutive periods, so that the consumption in the third period have been approximated by the maximum consumption which was reported by the individual. Both types of data conclude to the existence of addiction effects but estimate with much imprecision a high rate of time preference, from 56 to 223% for Becker-Grossman-Murphy (certain estimations giving negative rates), –53 to +74% for Baltaji and even greater by Chalupka (for individuals less than 64 years old). On the another hand, the estimation of addiction models for only *one* good does not allow to compare different possibly addictive consumption (such as alcohol drinks, fat food or cultural goods) and to make sure that a-priori non addictive goods do not conform to the addictive scheme (which would make it more difficult to interprete the estimations obtained for smoking and drugs). Moreover, the results may depend on the characteristics of the different types of data sets used for the estimations.

We propose to estimate the addictive model on family budget surveys in order to make it possible to compare different expenditures, populations and countries. This estimation needs using panel data for at least three periods, or pseudo panels made from three consecutive cross-sections (see Echevin-Gardes, 2000, for a first attempt on French pseudo-

panel). Section 1 presents the model and the econometric methods. Section 2 describes the used data. Section 3 discusses the smoking and drinking behavior in Poland and section 3 discusses the empirical results.

1. Model Specification and Estimation

In the simple version of the Becker-Murphy model, the consumer is supposed to maximize the present value of her intertemporal additive utility $\Sigma_t\beta^{t-1}U(C_t,C_{t-1},Y_t,e_t)$ under the inter temporal budget constraint $\Sigma_t\beta^{t-1}(Y_t+P_tC_t)=A_0$ and C fixed in t=0. It gives rise for a quadratic utility to a dependency of current expenditures on past and future consumptions, as well as on current prices and current and future values of the variables e_t entering directly in the utility (and not through their effects on current consumption):

$$C_t = \theta\, C_{t-1} + \beta\theta\, C_{t+1} + \theta_1\, P_t + \theta_2\, e_t + \theta_3\, e_{t+1} + u_t$$ (Becker, 1996, p.89, equation 5.4)

Note that in this equation, all variables other than consumption and income which enter the utility function must also enter the consumption function in t and t+1 with the same parameters as e_t and e_{t+1}. This constraint does not appear in the various estimations we have cited, perhaps because all such determinants are constant in their data set. Perhaps also the authors consider, as usual, that these determinants enter directly the consumption function with lags which are chosen for empirical reasons. Note also that in the specification used by Becker-Murphy and Baltagi, the rate of interest is considered as equal to the rate of time preference (a restriction by Chalupka). In the Chalupka specification, consumption also depends on the past and future prices through the dependency of utility on the consumption stock.

We estimate Becker's equation with correlated errors but other determinants in only the present period. The correlation between the consumption variables and the error is corrected, as usual, by instrumenting past and future expenditures by present, previous and future prices,.

Then, we use two other, new types of instrumentation: *first*, we consider the *next or previous cohorts* $H^-_{h,t}$ and $H^+_{h,t}$ to individual h observed in period t (i.e. all households with head aged one year less or one year more than h) and instrument $C_{h,t-1}$ and $C_{h,t+1}$ by the predicted h's expenditure in t-1 or t+1 knowing the change of consumption between the cells constituted by households with head aged the same as h or one year less or more:

$$Et(C_{h,t-1})=C_{h,t}-\{\Sigma_{h\in Hh,t}[1/Card(H_{h,t}\backslash h)].C(H_{h,t}\backslash h)-\Sigma_{h\in Hh,t}[1/Card(H^-_h\backslash h_{,t-1})].C(H^-_h\backslash h_{,t-1}\}$$

with $H_h\backslash h$ the cohort defined by the same characteristics as h, without h.

$$E_t(C_{h,t+1})=\{C_{h,t}+\Sigma_{h\in Hh,t}[1/Card(H^+_{h,t}\backslash h)].C(H^+_{h,t}\backslash h)-\Sigma_{h\in Hh,t}[1/Card(H_h\backslash h_{,t-1})].C(H_h\backslash h_{,t-1})]\}$$

This allows to keep in the instrumented variable the specific effect α_h of the current consumption of individual h in t if $C_{h,t} = C(H_{h,t}) + \alpha_h + \eta_{h,t}$. By this instrumentation, we are thus able to estimate dynamic models on cross-sections. *Second*, we used the same type of instrumentation with the average expenditures of the same cohorts $H_{h,t-1}\backslash h$ $H_{h,t+1}\backslash h$ in the previous and future waves of the panel.

The autocorrelations of the errors are taken into account by Baltagi by Keane-Runkle forward filter or GMM estimators. For tobacco, we use a much simpler technique (see Hsiao, 1986) consisting to estimate a system of equations in first differences (to remove the specific effect α_h) written for each couple of periods t, t+1 and compare it to these two methods. Under usual assumptions of independence between individuals (no interdependence of preferences), no autocorrelation exists in each of the ($C_{h,t}$-$C_{h,t-1}$) equations between different individuals h and the correlation between two equations ($Cov(du_{h,t}, du_{h,t-1}) = -\sigma^2_u$ if there is no correlation between $u_{h,t}$ and $u_{h,t-1}$) is taken into account by Seemingly Unrelated Regression (or GLS under specific assumption on $\sigma_{h,t;h',t'}$).

3. The data

Household budget surveys have been conducted in Poland for many years. In the analyzed period, the annual total sample size was about 30 thousand households, which represent approximately 0.3% of all households in Poland. The data were collected by a rotation method on a quarterly basis. The master sample consists of households and persons living in randomly selected dwellings. To generate it, a two stage, and in the second stage, two phase sampling procedure was used. The full description of the master sample generating procedure is given by Kordos and Kubiczek (1991).

Master samples for each year contain data from four different sub-samples. Two sub-samples started to be surveyed in 1986 and ended the four years survey period in 1989. They were replaced by new sub-samples in 1990. Another two sub-samples of the same size were started in 1987 and followed through 1990. Over this four year period on every annual sub-sample it is possible to identify households participating in the surveys during all four years. The checked and tested number of households is 3736. However 3630 households remain in the data set after deleting households with missing values. The available information is as detailed as for the cross-sectional surveys : all typical socio-economic characteristics of households and individuals are present, as well as details on income and expenditures. A large part of this panel containing demographic and income variables is included into comparable international data base of panels in the frame of PACO project (Luxembourg) and is publicly available.

Prices and price indices are those reported by the Polish Statistical Office (GUS) for main expenditure items. They are quarterly observed and differentiated by 4 social categories : *workers, retired, farmers, and dual activity persons (farmers and workers)*. This distinction covers implicitly the geographical differentiation : workers and retired live mostly in large and average size cities, farmers live in the countryside and dual activity persons live mostly in the countryside and in small towns. Price variations are taken into account at the individual observation level.

Appendix 1 presents descriptive information on the Polish data. The period 1987-1990 covered by the Polish panel is unusual even in Polish economic history. It represent the shift from a centrally planned, rationed economy (1987) to a relatively unconstrained fully liberal market economy (1990). GDP grew by 4.1% between 1987 and 1988, but fell by .2% between 1988 and 1989 and by 11.6% between 1989 and 1990. Price increases across these pairs of years were 60.2%, 251.1% and 585.7%, respectively. Thus, the transitory years 1988 and 1989 produced a period of a very high inflation and a mixture of free-market, shadow and administrated economy.

3. Smoking in Poland

3.1. Trends of tobacco consumption in Poland 1923-1995

When compared to the evolution in Western Europe and USA where the expansion of tobacco consumption accelerated after the first World War, in Poland, like in other East European Countries, it started to rise exponentially after the second World War. Before the II world War the total increase between 1925 and 1938 was about 70% while after the war, between 1948 and 1992 the increase was of more than 400%.

Until the early fifties practically only men were concerned by smoking tobacco. Only very specific social categories of women (artists, social elite) were smoking. The woman's tobacco consumption started only in the early fifties partially as side effect of official propaganda in favour of emancipation of young and female. Attitude surveys showed that among young people smoking has always been a maturity attribute while, for older generations it has been rather an element of way of life more or less dominant in their social environment. In the mid eighties Poland became the country with one of the highest in the world cigarette per capita consumption with 3330 units per person over 15.

The exponential tobacco consumption trend was broken in the early eighties because of a general economic crisis at this period and serious tobacco supply and production problems. In the end of eighties tobacco consumption rises again and accelerates after the structural economic reforms in the nineties. In 1990 the Polish per adult and per year consumption is the highest in the world with 3650 cigarettes. Polish consumption trend is still rising while in all developed western countries it is decreasing.

3.2 Health and smoking

Three main types of diseases are considered as highly influenced by tobacco consumption.: heart diseases, respiratory tracks diseases, lounge cancers. Along the Polish epidemiological studies, in 1963 23,8% of men cancers were tobacco related while in 1989 this percentage was higher than 40%. Several factors other than consumption rise can explain this evolution:

The characteristics of tobacco used for cigarettes production, technology of production, characteristics of cigarettes (filters, paper, tobacco density), the way of smoking. Chemical analysis proved that cigarettes produced in Poland contained more toxic substances than those made in other countries and their absorption was greater because of poor quality of filters. The production norms for toxicity were considerably modified to fit to the international standards only in 1991.

3.3 The smokers' population general characteristics

Descriptive analysis proves that smoking is a totally accepted habit in contemporary Poland (1996) by more than 60% of the population do it although almost 50% have never smoked, 30% are everyday smokers, and less than 6% smoke occasionally. Among former smokers (15%) about 9% were regular ones and 6% occasional.

The proportion of smokers depends highly on sex and age. Man is much more frequently smoking than a woman. Very young and elderly are rarely smoking while the individuals between 30 and 44 are about 50% to do that. The share of those who used to smoke and stopped is slightly increasing with age. Smoking is more frequent in towns and cities than in the countryside. The proportion of everyday smokers decreases generally with the level of education and so does the share of those who stopped smoking . Marital status is an important smoking habit factor: married are less frequently smoking than divorced or

separated, lone persons smoke more often than widowed. An unemployed have more chance to smoke than a worker. Income level is not a very differentiating factor with respect to smoking.

3.4 Smoking probability and socio-economic characteristics

Household consumption data give the possibility to analyse households with tobacco consumption. The estimated probit function (table A2-2, appendix 2) for the whole population gives the highly positive and significant impact of sex (male) and alcohol consumption measured by alcohol budget coefficient. The probability of smoking variations with respect to the total expenditure is not very significant. It diminishes for average and high values and increases for the intermediate and low levels. Rising household's head age is decreasing the chances of smoking. Heads low education is the factor of the higher smoking probability, while intermediate and high education levels are associated with decreasing probabilities. Localization has no significant impact on smoking. Retired people have significantly lower probability to smoke than persons in activity.
However, the estimated probabilities do not concerns precisely smokers but households with smokers. An estimation of lone person households allows to analyze the well identified smokers. The estimates obtained isolating lone persons households (table A2-1, appendix 2) are not very different from ones computed for the whole population. The probability of smoking with respect to the total expenditure is decreasing for average values and increasing for high and low ones. The average education is the factor of the higher smoking probability, while low and high education levels are associated with decreasing probabilities. The effect of sex and alcohol consumption is highly positive and significant like for the total population. This is also the case of rising household's head age which diminishes the chances of smoking. Localization and household head's socio-economic category have no significant impact on smoking. Thus, the lone person population has only slightly different smoking profile especially as education and the total expenditure effects are concerned.
This similarity of results for smoking probabilities allows us, at this stage of this research, to use a normalize measure of number of smoking units in the family based on the average probability to smoke. Thus, the number of the smoker unites (NUS) for given family would be equal to :
$NUS=1 + 0.7 \times nA$, where nA number of adults.

4. Drinking in Poland

4.1. Trends of alcohol consumption in Poland

Describing and comparing the alcohol consumption is not an easy task because of existence of different patterns of drinking habits. Poland belongs to the group of Nordic type of alcohol consumption with high quantities of high degree drinks (vodkas and liquors) and beers drunk less regularly but in large quantities. The total pure alcohol consumption is not very high in Poland, especially when compared to countries with heavy wine or beer consumers (France, Luxembourg, Spain, Ireland, Belgium: see table A1-4). However this kind of information suffers from many drawbacks and imprecision.

The overall statistics of alcohol consumption shows very clearly, that the volume of consumed alcoholic beverages is not perhaps the best indicator of the addiction problems. Poland and other similar countries despite of relatively low per capita consumption do have very serious alcoholism. The main difficulty is to appreciate the real individual consumption which is usually bad reported (underestimated) in surveys and not corrected for individual

exports, imports and domestic production in macro-economic data. That is why the observed consumption figures must be very often completed by other sources of information describing more qualitatively the alcohol consumption patterns or using indicators based on individual longitudinal data.

Presented below figures come from two sources: Family Budget Survey (GUS)[1] panellised data informing about alcohol beverages *expenditure, volume and structure* in 1987-1990 period , and Health Survey (GUS) conducted along the lines of World Health Organisation recommendations describing the *frequency* of alcohol drinks use. In the section 1 we describe in detail these two aspects and sum up with a logistic estimation of drinking behaviour in Poland during the years 1987-1990.

During this period very important economic changes in the economy took place: very high inflation (1989, 1990), dramatic overall decrease in purchasing power (1990), consumption rationing and queuing(1987-1989). This exceptional evolutions and, especially changes caused by the real incomes decrease during the transition to the market economy (1990) has had a visible effect on consumption volume and structure.

Comparing the change in alcohol drinking behaviour with the general consumption evolutions over this particularly changing transition period will facilitate the identification of the specific addiction process presented in section 2 .

4.2. Frequency of drinking

In 1996 in 84% families declared having consumed the alcohol at least once a year even in small quantities (table A1.5). The difference between towns, cities and countryside is less than 1 percent point. On the other hand in about 25% cases alcohol is consumed at least once a week. There is almost no differences in this pattern among different types of households except for those of atypical structure, including more than 2 adults or composed of several families. In these cases the frequency of alcohol consumption is 4-5 percentage point higher than the average. Lone persons drink less often than average, but lone woman's frequency is largely superior to the man's one (60% versus 40% respectively).

The presence of children increase generally the frequency of alcohol consumption with an increasing tendency with child's age. Couples with children are 96% to drink at least once a year and 29% once a week (table A1-5). Lone mothers' families frequencies are respectively 82.5% and 23.5%. Lone fathers' once are lower than then family average per year (90%) but much higher proportion of them (39.4%) drinks at least once a week. The last proportion increases up to the 46% when the child is more than 15 years old. More generally the age of family adults plays an important role: average age adult presence in the households increases per week frequency of alcohol drinking by 4- 5 percent points (table A1-6). The increasing number of young children has generally a small decreasing effect on alcohol consumption frequency. Stronger effect is observed only for lone parents, especially for lone mothers. With three or more children below 15, they are 67.6% to consume alcohol at least once in the year to be compared to 86% for mothers having children all aged more than 15. Weekly frequency decrease is even more dramatic in this case.

Summing up it can be said that the alcohol is consumed the most frequently in the typical nuclear families with children, excepted relatively marginal case of lone fathers with exceptionally high rates. The average frequency does not change with the locality type but varies with the demographic characteristics of household members. The highest frequency is

[1] Polish National Statistical Office

observed among families with average age adults and high age children, the lowest among families of old age persons and having young children.

4.3 Alcohol consumption: the volume and structure

The budget share of alcohol beverages expenditures declared in the survey is between 2.7 and 1.8 from 1987 to 1990 for the observed individuals in the consumption panel (table A1-7). This is very probably very less than the real figure, but what is interesting is it's evolution over time and relative differences over socio-demographic family categories. The highest shares are observed among farmers and double active farmers (working both on the farm and as a wage earner) - the smallest ones among retired. The higher is the education the lower is the alcohol consumption budget share. The young people (under 30) spend relatively more than others , and the old age persons (70 and more) significantly less. Taking into account family structure shows a pattern of decreasing share with increasing number of children . The locality has a relatively small impact – only families living in the countryside have a significantly higher than the average alcohol expenditure share.

All family categories reduced considerably their alcohol expenditure both during the high inflation period (1989) and purchasing power loss 1990) . The most significant decrease is observed among retired, very old and young people, secondary level educated wage earners and families with children.

The alcohol beverages expenditure structure is dominated by vodka (71%) and high degree liquors consumption (11.2%) in 1987, and relatively low those of wines (10.5%) and beers (7.2%) (table A1-8). These proportions change dramatically with the level of education of family head. At university level they are respectively 49.8, 23.5, 20.2 and 6.5% - more equilibrated in the sense of higher expenditure on liquors, and especially wines. On the other hand in the very low educated families alcohol expenditures are concentrated essentially on vodkas (80%).

The structure change over the transition period (1987-1990) is similar for all types of families and represents a considerable shift from vodka and liquors to wine and beer consumption.

The main conclusion of this rapid review of consumption and expenditure patterns, interesting for our further study on addiction, is the strong link observed between alcohol consumption volume and structure, and family well being, its demographic composition and real income changes. At this stage of our study alcohol expenditure pattern seems to be very close to other not necessary consumption goods.

4.4 *Drinking probability and socio-economic characteristics*

In order to check the observed tendencies in alcohol consumption we estimated the probability of regularly drinking using classic logistic function on the Polish Consumption Panel data. Dependent variable was defined as the positive consumption of any alcohol drink during all years of the study. So, a household is considered as drinking alcohol if its annual alcohol expenditure in every of four years of observation is positive. More than 55% of households are in this case. This variable is regressed against classic socio-economic and demographic variables: position on the income distribution (quartiles), head's age, social category, education, family type by number of children and localisation.

The estimated parameters (table 1.3.1) are significant for income position, age, social category, and family type, and not significant for localisation and , education. Generally the probability of drinking is higher when the income position is higher, is decreasing when the

number of children is higher, is lower for wage earners and retired than for farmers and double active (farmers and wage earners).

5. Addiction model: estimation results

The estimations have been performed on all households and on sub-populations which consume a positive amount of food tobacco or alcohol on at least one period. Two types of alcohol consumption measures are used: expenditures on alcohol beverages and the quantity of pure alcohol consumed. The last one is obtained using the information on quantity of different types of alcoholic baverages consumed (beers, wines, liquors, vodkas) and their average percentage of pure alcohol.

The *first classic instrumentation* uses past, present and future prices (Ia) and household income (Ib), and is estimated on the first differences to cancel the specific effects. No selection bias appears. The coefficients (Table 1) of past and future tobacco consumptions are positive (with small significance), showing the existence of an addictive effect. The same estimations on levels give a little greater coefficients, which shows a small endogeneity effects on these three variables (as on income[2], as already shown in other studies, see Gardes, 1996). On the contrary, the rate of time preference β is the same for estimations on levels and first differences.

The estimation on alcohol expenditures (Table 2) are less convincing as regards addiction, the coefficients of future expenditures are negative and not significant. However, the same estimations on the *quantity* of pure alcohol consumed gives much better results: both coefficients are positive and significant. Thus, addiction appears on quantity consumed while it is hidden on expenditures statistics. The corresponding rate of time preference β is negative for expenditures but positive for quantities with expected relatively small value (5.7%) in the case of price-income instrumentation. The present price coefficient is generally negative but significant only for quantities.

The *second instrumentation* based on cohorts observed in the same year and corresponding to the household (aged one year less or more), gives similar but much more precise results, which would allow to compute the same estimation for sub-populations[3]. The implied rate of time preference β is very similar for the two commodities, around 25% for independent estimations and around 14% for the (see Table 3). This is a very encouraging result, as this instrumentation allows to estimate dynamic models on cross-sections without any retrospective questions. (often imprecisely responded, as shown by G.Duncan studies on the PSID)

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[1] If we assimilate the endogeneity effect to a virtual price effect : $\hat{a}(c.s.) = \hat{a}(t.s.) + E_p.P_v$, the virtual price deceases with income, which may be explained by a better situation of the rich as concern health problems (better tobacco quality and healthier use of it).

[3] A first test on sub-populations by age gives higher rates of time preferences for the aged, perhaps because of selection biases: remaining smoker after 60 means that one is more strongly addicted than those who have resigned (we would need longer panel to take this bias into account). Further estimations will be performed according to education, income class and the alcohol consumption

Table 1
Estimation Results for per U.C. tobacco expenditures

	First differences			*Levels*	
Model	*Ia*	*Ib*	*II*	*Ib*	*II*
C_{t-1}	*0.239* *(0.085)*	*0.211* *(.080)*	*0.323* *(0.021)*	*0.356* *0.080)*	*0.309* *(0.019)*
C_{t+1}	*0.102* *(0.076)*	*0.127* *(0.74)*	*0.245* *(0.021)*	*0.190* *(0.071)*	*0.259* *(0.019)*
β_t	*1.352* *(2.052)*	*0.659* *(1.224)*	*0.318* *(0.195)*	*0.871* *(0.662)*	*0.206* *(0.160)*
Mills Ratio	*-0.318* *(2.336)*	*-0.505* *(2.338)*	*-2.420* *(1.078)*	*21.391* *(4.952)*	*75.304* *(3.141)*
IV	*prices*	*prices income*	*cohort age*	*prices income*	*cohort age*

Population : Households head od which is aged 23 to 81, with positive expenditure on food at home and tobacco for one of the 4 years.
Instruments : Ia: past, present, future prices
Ib : past, present, future prices log income
II :age cohorts (generation)
Surveys : 1987-1990 panel. Estimation on 1988 and 1989 surveys.
Other explanatory variables : log of age and its square, proportion of children, years dummies ; consumption and income deflated by an equivalence scale. Standard errors under the coefficients.
Remark : A correction of variance biases due to the use of aggregate explanatory variables (see Moulton) is needed. This correction may increase the variances of all parameters.

Table 2
Estimation Results for alcohol expenditures and quantity of pure alcohol consumed (price, income instrumentation , panel data)

	Expenditures		*Quantities of pure alcohol*	
Model	*Ia*	*Ib*	*Ia*	*Ib*

C_{t-1}	*26.31* *(10.8)*	*21.62* *(3.71)*	*0.374* *(0.124)*	*0.256* *0.042)*
C_{t+1}	*-18.7* *(9.46)*	*-12.81* *(7.85)*	*0.234* *(0.108)*	*0.242* *(0.089)*
β_t	*-2.40*	*-2.68*	*0.598*	*0.057*
P_t	*-2.47* *(8.87)*	*-1.34* *(8.85)*	*-0.645* *(0.102)*	*-0.630* *(0.101)*
IV	prices	prices+ income	prices	prices +income

Population : non zero alcohol expenditures during the 4 years
Instruments : Ia: past, present, future prices
Ib : past, present, future prices log income
Surveys : 1987-1990 panel. Estimation on 1988 and 1989 surveys.
Other explanatory variables : age , localization, education, social group , family type, income quartile, years dummies. Student statistics or standard errors under the coefficients.

Table 3
Estimation Results for Tobacco, Alcohol Expenditures and Pure Alcohol Consumption (Instrumentation by generation, cross section data)

Expenditures	*Quantities of alcohol*	*tobacco*	*tobacco and alcohol estimated together (SUR)*
			Alcohol(quant) *tobacco*

C_{t-1}	*0.155* *(0.40)*	*0.153* *(0.041)*	*0.078* *(0.037)*	*0.149* *(0.033)*	*0.126* *(0.03)*
C_{t+1}	*0.127* *(0.04)*	*0.122* *(0.04)*	*0.063* *(0.038)*	*0.132* *(0.035)*	*0.110* *(0.019)*
β_t	*0.221*	*0.250*	*0.238*	*0.128*	*0.145*
P_t	*14.8* *(4.8)*	*-0.529* *(0.04)*	*14.88* *(1.699)*	*8.34* *(4.35)*	*11.05* *(1.50)*

Data: Survey 1988,
Populations : non zero alcohol expenditures (for alcohol equations)
non tobacco expenditures (for tobacco equation)
non zero alcohol or non zero tobacco expenditures for system estimation
Model instrumentation: by generation (age, education, income quartile,)
Other explanatory variables : age , localization, education, social group , family type, income quartile. Student statistics or standard errors under the coefficients.

Conclusions

1. The estimation of addictive effects on consumer surveys (panel and cross-section) gives similar results to those obtained on special surveys on smoking habits: with usual instrumentations on prices and income, both past and future expenditures (for tobacco) or quantities consumed (for alcohol) influence positively the present consumption, but the estimated rate of time preference is implausibly large, as in other studies.

2. Using quantities of pure alcohol instead of expenditures gives generally statistically better and closer to the theoretical predictions results then those using expenditures.

3. New instrumentation method based on age cohorts (by generation) is proved to be very efficient giving both for tobacco and alcohol, the estimation of the rate of time preference reasonable from the theoretical point of view.

4. Using the instrumentation by generation, the estimated rates of time preference for tobacco and alcohol are close to each other both when estimated separately or in a system (SUR).

5. The use of the proposed method can give the opportunity to estimate dynamic effects on cross-sections, and to compare the estimations on sub-populations differing in age, education or family structure[4].

[4] An estimation for sub-populations have been made by Chalupka, giving limited but interesting results.

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Appendix 1.

Means and standard deviations of variable used in the Polish panel analyses

Table A1-1

	1987	1988	1989	1990
real total per cu expenditure index (1987=100)	100	105.7	118.6	79.9
Relative food price index (pfood/ptotal)	0.961 (.013)	0.902 (.06)	0.992 (.19)	1.145 (.03)
Ln household total expenditure	10.65 (.45)	11.17 (.49)	12.25 (.79)	14.14 (.50)
Ln head's age	3.789 (.33)	3.809 (.32)	3.824 (.32)	3.842 (.32)
Consumer units number	2.500 (.98)	2.471 (.99)	2.432 (.986)	2.415 (.98)
Ln family size	1.140 (.59)	1.121 (.60)	1.095 (.61)	1.081 (.61)

Source :Polish Consumption Panel 1987-1990

Table A1-2
Average budget shares

Budget shares	1987	1988	1989	1990
Food	0,432	0,400	0,435	0,483
Alcohol	0.027	0.027	0.024	0.018
Tobacco	0.012	0.010	0.010	0.012
Clothes	0,129	0,141	0,145	0,096
Dwelling	0,110	0,112	0,125	0,097
Energy	0,033	0,039	0,022	0,039
Health and hygiene	0,026	0,024	0,020	0,026
Transp, and communic	0,050	0,062	0,063	0,066
Culture and entertain.	0,066	0,078	0,075	0,080
Other	0,028	0,025	0,020	0,031
Financial operations	0,087	0,081	0,057	0,050

Source :Polish Consumption Panel 1987-1990

Table A1-3
Relative prices evolution of tobacco and alcohol

	1987	1988	1989	1990
Relative tobacco price	0.919	0.854	0.719	0.717
Relative alcohol price	1.011	1.062	1.023	0.755

Source :Polish Consumption Panel 1987-1990,

Table A1-4
Per adult (>15), pure (100%) alcohol consumption

	1980	1985	1990	1994
Germany	12.7	14	13.8	---
Australia	12.9	11.7	10.5	9.8
Austria	13.8	12.1	12.6	12.5
Belgium	14	13.2	12.4	---
Canada	11.1	10.7	9.2	---
Denmark	11.7	12.3	11.6	12.0
Spain	16.4	14.6	13.6	12.0
USA	10.5	9.9	---	---
Finland	7.9	8	9.5	8.2
France	20.6	18.0	16.7	15.3
Greece	---	11.2	10.6	10.8
Hungary	14.9	14.7	13.9	12.9
Ireland	9.6	8.6	9	11.2
Italy	13.2	12.1	10.9	10.3
Luxembourg	16.8	14.6	14.7	15.3
Norway	5.3	5.2	5	4.7
New Zealand	11.8	10.8	10.1	9.4
Poland	**11.7**	**9.7**	**8.3**	**8.9**
Portugal	10.0	13.1	9.8	---
Sweden	6.7	6.1	6.4	6.3
United Kingd.	8.9	8.8	---	9.3

Source: OECD, for Poland GUS statistics

Table A1-5
Alcohol consumption frequency by household type and locality

Household's type and locality	Total	Consume at least once a year	Consume at least once a week
Total	100	84.1	25.7
One family	100	91.1	26.6
Lone persons	100	54.8	17.7
Multifamily	100	80.0	31.9
Towns and cities	100	84.2	26.1
One family	100	91.6	27.6
Lone persons	100	58.1	17.1
Multifamily	100	82.3	28.7
Countryside	100	83.8	24.9
One family	100	90.0	24.8
Lone persons	100	45.0	20.1
Multifamily	100	71.2	29.3

Source: GUS , Health Survey

Table A1-6
Alcohol consumption frequency in one family households
by demographic characteristics

Household's type and locality	Total	Consume at least once a year	Consume at least once a week
Total	100	91.1	26.6
Couples with no children	100	82.8	20.5
Couples with children	100	96.1	29.0
Youngest child < 15	100	79.0	11.6
15-24	100	86.5	21.3
Lone mother	100	82.5	23.5
Youngest child < 15	100	79.0	11.6
15-24	100	86.5	21.3
Lone father	100	90.2	39.4
Youngest child < 15	100	92.6	36.8
15-24	100	98.3	45.9

Source: GUS , Health Survey

Table A1-7
Alcohol consumption frequency in one family households
by parent's generation group

Household's type and locality	Total	Consume at least once a year	Consume at least once a week
Total	100	91.1	26.6
Couples with no children	100	82.8	20.5
Mother's age			
young	100	93.9	22.4
average		90.5	24.7
old		48.7	15.7
Couples with children	100	96.1	29.0
Mother's age			
young	100	97.1	27.0
average	100	96.2	28.7
old	100	92.2	38.9
Lone mother	100	82.5	23.5
Mother's age			
young	100	78.3	11.5
average	100	83.5	16.9
old	100	81.7	36.1
Lone father	100	90.2	39.4
Father's age			
young	100	-	-
average	100	96.0	44.9
old	100	83.0	31.1

Source: GUS , Health Survey

Table A1-8
Budget shares of alcohol beverages 1987-1990 in Poland in (%)

	1987	1988	1989	1990
Social Category				
Wage earners (WE)	2.40	2.46	2.25	1.74
Farmers (F)	3.73	3.56	3.1	2.33
Double active(WE+F)	3.41	3.54	3.08	2.36
Retired	1.96	2.01	1.86	1.25
Education				
University level	2.01	1.85	1.52	1.32
Secondary	2.31	2.57	2.25	1.70
Basic and vocational	2.82	2.78	2.55	1.86
No diploma	2.72	2.99	2.67	2.05
Heads age				
20-29	3.14	3.44	3.00	2.30
30-39	2.75	2.71	2.44	1.90
40-49	2.64	2.50	2.39	1.81
50-59	2.70	2.85	2.56	1.83
60-69	2.44	2.50	2.15	1.44
70 and more	1.98	1.93	1.81	1.37
Family type				
Couple no children	3.02	2.88	2.56	1.80
Couple 1 child	2.93	2.88	2.72	2.09
Couple 2 children	2.47	2.47	2.29	1.70
Couple 3 children	2.72	2.45	2.25	1.77
Couple 4 and +ch	2.24	2.22	2.43	1.59
Lone father	2.00	5.44	5.71	3.17
Lone mother	1.15	1.51	1.56	1.15
Other families	2.62	2.81	2.44	1.86
Locality				
Large city	2.13	2.22	1.95	1.49
Small city	2.31	2.26	2.26	1.56
Small town	2.02	2.03	2.02	1.39
Countryside	2.98	3.02	2.67	2.02
Total	**2.66**	**2.69**	**2.43**	**1.81**

Source: GUS , Family Budget Surveys

Table A1-9
Alcohol expenditure structure 1987-1990 (%) by education level

	1987	1988	1989	1990
Total				
Vodkas	71.0	71.0	70.6	66.4
Liquors	11.2	9.8	8.3	6.8
Wines and meads	10.5	11.2	14.2	16.0
Beers	7.2	8.0	6.9	10.8
Total	100	100	100	100
University level				
Vodkas	49..8	52.4	57.2	49.7
Liquors	23..5	17..5	15.0	11.1
Wines and meads	20..2	19.7	19..5	24.5
Beers	6..5	10.4	8.4	14.7
Total	100	100	100	100
Secondary level				
Vodkas	64.7	68.4	63.1	62.4
Liquors	15.5	12.9	11.9	8.8
Wines and meads	12.4	11.7	18.7	18.2
Beers	7.4	7.03	6.3	10.6
Total	100	100	100	100
Basic and vocational				
Vodkas	73.2	72.3	73.2	67.9
Liquors	9.8	8.8	7.1	6.2
Wines and meads	9.7	10.7	12.7	15.3
Beers	7.3	8.2	7.0	10.9
Total	100	100	100	100
No diploma				
Vodkas	80.2	82.3	76.7	79.3
Liquors	7.0	3.0	3.9	1.9
Wines and meads	7.7	7.4	7.3	10.9
Beers	5.2	7.3	7.3	8.0
Total	100	100	100	100

Source: GUS , Family Budget Surveys

Appendix 2.

Table A2-1

Probability of smoking, (probit function, lone persons only)

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square
INTERCPT	1.5486	0.9337	2.7507	0.0972
SEX (m)	2.0228	0.4397	21.1588	0.0001
total expenditure1	-0.6678	0.5144	1.6854	0.1942
Total expenditure2	-0.4422	0.3770	1.3761	0.2408
Total expenditure3	-0.6453	0.3621	3.1755	0.0747
Total expenditure4 (ref)				
Total expenditure5	0.0869	0.3948	0.0485	0.8258
head's age1 (ref)				
head's age2	-0.7982	0.8715	0.8388	0.3597
head's age3	-1.4985	0.8574	3.0546	0.0805
head's age4	-2.1701	0.8861	5.9976	0.0143
large city (ref)				
Average city	-0.0523	0.3356	0.0242	0.8763
small city	-0.0700	0.4714	0.0221	0.8819
countryside	-0.3491	0.3227	1.1706	0.2793
EDUcation level (high)	0.1734	0.3098	0.3135	0.5756
EDUcation level (medium)	0.4370	0.4008	1.1889	0.2756
EDUcation level (low)	-0.5545	0.3848	2.0765	0.1496
EDUcation level (basic) (ref)				
head farmer	-0.4474	0.5568	0.6458	0.4216
head retired	-0.0563	0.3550	0.0251	0.8740
head worker or worker and farmer (ref)				
bugdet coefficient of alcohol	7.2930	4.9749	2.1490	0.1427

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	558.004	487.404	.
SC	562.022	559.739	.
-2 LOG L	556.004	451.404	104.600 with 17 DF (p=0.0001)
Score	.	.	96.178 with 17 DF (p=0.0001)

Association of Predicted Probabilities and Observed Responses

Concordant = 78.0%	Somers' D = 0.564
Discordant = 21.6%	Gamma = 0.566
Tied = 0.5%	Tau-a = 0.273
(40824 pairs)	c = 0.782

Table A2-2

Probability of smoking, (probit function, whole population)

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square
INTERCPT		1.2516	0.2474	25.5891	0.0001
.					
SEX (m)		0.7314	0.0914	63.9797	0.0001
total expenditure1		0.2013	0.1729	1.3561	0.2442
total expenditure2		-0.0154	0.1346	0.0131	0.9088
total expenditure3		0.0761	0.1302	0.3414	0.5590
total expenditure5		-0.0613	0.1428	0.1841	0.6679
head's age1					
head's age2		0.0292	0.1641	0.0316	0.8589
head's age3		-0.5373	0.1541	12.1508	0.0005
head's age4		-1.2658	0.1911	43.8850	0.0001
large city (ref)					
average city		0.1543	0.1460	1.1170	0.2906
small city		-0.0780	0.1841	0.1796	0.6717
countryside		-0.0796	0.1283	0.3854	0.5347
EDUcation level (high)		-0.3531	0.1223	8.3404	0.0039
EDUcation level (medium)		-0.1033	0.1221	0.7157	0.3975
EDUcation level (low)		-0.2085	0.1595	1.7090	0.1911
EDUcation level (basic) (ref)					
head farmer		0.0532	0.1261	0.1780	0.6731
head retired		-0.5245	0.1417	13.6993	0.0002
head worker or worker and farmer (ref)					
bugdet coefficient of alcohol		12.0052	1.8412	42.5162	0.0001

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	3912.549	3465.892	.
SC	3918.746	3577.438	.
-2 LOG L	3910.549	3429.892	480.657 with 17 DF (p=0.0001)
Score	.	.	485.577 with 17 DF (p=0.0001)

Association of Predicted Probabilities and Observed Responses

Concordant	= 72.8%	Somers' D	= 0.460
Discordant	= 26.8%	Gamma	= 0.462
Tied	= 0.4%	Tau-a	= 0.163
(2329901 pairs)		c	= 0.730

Table A2-3
Probability of drinking in Poland 1987-1990 (logistic function)

Variable	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square
INTERCPT	1.2293	0.2790	19.4114	0.0001
Per CU Tot Expend. Q1	(reference)			
Per CU Tot Expend Q2	-0.3942	0.1053	14.0224	0.0002
Per CU Tot Expend. Q3	0.3081	0.1030	8.9532	0.0028
Per CU Tot Expend Q4	0.6927	0.1103	39.4420	0.0001
Head's age <30	(reference)			
Head's age 30-40	-0.0735	0.1240	0.3513	0.5534
Head's age 40-60	-0.6091	0.1190	26.1797	0.0001
Head's age 60 and	-1.0409	0.1695	37.7300	0.0001
Live in the large city	(reference)			
Live in a small city	0.2425	0.1270	3.6465	0.0562
Live in a small town	0.1182	0.1623	0.5306	0.4664
Live in the country	0.1613	0.1132	2.0307	0.1541
University level educ.	-0.1944	0.2220	0.7673	0.3811
Secondary level educ.	0.0387	0.1800	0.0463	0.8297
Primary school level	0.1745	0.1602	1.1870	0.2759
No diploma	(reference)			
Head wage earner (WE)	-0.4085	0.1256	10.5832	0.0011
Head farmer (F)	(reference)			
Head double-active (WE+F)	0.3209	0.1404	5.2198	0.0223
Head retired	-1.0556	0.1410	56.0508	0.0001
Couple no children	(reference)			
Couple 1 child	-0.0689	0.1543	0.1995	0.6551
Couple 2 children	-0.1748	0.1480	1.3940	0.2377
Couple 3 children	-0.4125	0.1757	5.5122	0.0189
Couple 4 and + children	-0.4867	0.2177	4.9984	0.0254
Lone parents	-1.4858	0.2374	39.1635	0.0001
Other families	-0.3195	0.1090	8.5990	0.0034
Survey's quarter(1)	-0.3451	0.1083	10.1637	0.0014
Survey's quarter(2)	-0.0960	0.1084	0.7846	0.3757
Survey's quarter(3)	-0.6545	0.1084	36.4685	0.0001
Survey's quarter(4)	(reference)			

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	4984.610	4414.112	.
SC	4990.807	4569.037	.
-2 LOG L	4982.610	4364.112	618.498 with 24 DF (p=0.0001)
Score	.	.	582.571 with 24 DF (p=0.0001)

1 = 2027 0 = 1603

Table A2-4
Individual average prices for alcohol drinks 1987-1990 (%)
by education level

	1987	1988	1989	1990
Total				
Vodkas	19.2	31.5	114.3	451.5
Liquors	18.6	29.7	102.5	392.5
Wines and meads	5.86	10.3	45.3	190.8
Beers	1.6	2.6	8.8	56.8
University level				
Vodkas	19.6	31.7	118.6	455.7
Liquors	23.7	31.0	144.7	484.9
Wines and meads	6.3	10.5	44.8	215.1
Beers	1.6	2.9	10.1	71.5
Secondary level				
Vodkas	19.4	30.8	112.1	468.9
Liquors	17.5	31.3	104.2	425.2
Wines and meads	6.4	11.4	55.5	208.8
Beers	1.5	2.4	8.9	56.3
Basic and vocational				
Vodkas	19.1	31.7	114.6	446.4
Liquors	18.3	28.9	97.5	374.3
Wines and meads	5.7	10.1	42.7	184.2
Beers	1.6	2.7	8.6	55.7
No diploma				
Vodkas	19.3	31.4	114.5	454.4
Liquors	21.0	27.4	111.2	224.9
Wines and meads	4.9	8.4	38.6	162.6
Beers	1.6	2.9	10.4	57.7

Source: GUS , Family Budget Surveys

Table A2-5
Pure Alcohol Consumption Structure 1987-1990 (%)
by education level

	1987	1988	1989	1990
Total				
Vodkas	71.6	72.0	73.1	73.3
Liquors	10.4	9.4	8.5	7.2
Wines and meads	9.5	9.4	9.8	10.8
Beers	8.5	9.2	8.7	8.7
Total	100	100	100	100
University level				
Vodkas	53.9	56.3	62.6	62.6
Liquors	20.2	16.8	11.9	10.9
Wines and meads	17.7	15.9	15.3	15.9
Beers	8.2	11.0	10.3	10.6
Total	100	100	100	100
Secondary level				
Vodkas	66.0	70.4	68.9	70.1
Liquors	14.6	11.8	12.8	9.0
Wines and meads	10.3	8.6	10.4	11.8
Beers	9.3	9.2	8.0	9.1
Total	100	100	100	100
Basic and vocational				
Vodkas	73.7	72.7	74.6	74.1
Liquors	8.9	8.7	7.4	6.9
Wines and meads	8.9	9.4	9.2	10.4
Beers	8.5	9.3	8.8	8.6
Total	100	100	100	100
No diploma				
Vodkas	81.4	83.8	77.7	84.2
Liquors	5.0	1.9	4.0	1.9
Wines and meads	7.7	7.3	10.3	8.1
Beers	5.9	7.0	7.9	5.9
Total	100	100	100	100

Source: GUS , Family Budget Surveys