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Polish Households' behavior in the Regular and Informal Economies[1]

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Abstract

This paper analyzes characteristics of the informal economy in Poland in the context of transition, using a specific survey carried out in the framework of the classic Labor Force Survey, conducted by the Polish National Statistical office (GUS), in 1995. The participation probabilities of three types of informal activities (working, buying and hiring) are discussed. Their interdependencies are analyzed in the light of the hypothesis of network or neighborhood effects. The impact of a household's participation in informal markets on its regular consumption is estimated by imputing the probability of its informal activity in the consumption surveys and panels. Such participation does significantly influence more than half of household's expenditure on goods and services. Moreover, the participants of the informal economy distinguish themselves by higher individual full prices (integrating both monetary and non-monetary constraints and resources).

Key words: Informal economy, consumer behavior, cross-section-panel estimation
JEL codes: D12 H26 J49 C31 C32

Ce papier analyse les caractéristiques de l'économie informelle en Pologne dans le contexte de la transition en utilisant une enquête originale effectuée par l'office statistique polonais GUS au sein de l'enquête classique sur l'emploi en 1995. Dans un premier temps les probabilités de participation dans trois types d'activités informelles (travail, embauche, achat) sont discutées en particulier en relation avec l'hypothèse de présence des effets de réseau ou de voisinage. Ensuite on analyse l'impact de la participation à l'économie informelle sur la consommation de ménages en imputant la probabilité de participation aux activités informelles dans l'enquête et dans le panel de consommation. On constate que la probabilité de participation influence significativement les dépenses de plus de la moitié des ménages. De plus, les ménages participant à l'économie informelle se distinguent par un niveau plus élevé des prix complets individuels (qui intègrent des contraintes et des ressources à la fois monétaires et non monétaires).

Mots clés: L'économie informelle, comportement de consommation, estimation en coupe transversale et en panel
codes JEL : D12 H26 J49 C31 C32

Introduction

During the transition period, as experienced by Poland after the liberalization of foreign and domestic markets on the 1st January 1990, the old type of informal market activities gradually disappeared as the official markets got stronger. However, new informal activities were created simultaneously due to the appearance of constraints on households or firms. For instance, subsistence constraints are likely to have appeared for households in 1989 and 1990, which might have obliged households to seek new sources of revenue and to minimize food prices by operating in black markets. The gradual definition of the limits and organization of official markets may also have created new legal constraints for firms, which may then have used unofficial channels to weaken their transaction costs. It is particularly important to analyze the behavior of households in informal markets during this period, as a means of predicting whether the informal economy will disappear soon after first appearing during a transition, or whether it is likely to persist as a permanent structure (see Dupaigne-Hénin, 2001). Three reasons may drive households into the black market: first the search for cheaper commodities in monetary terms. Second, rationing, which is essentially the same as the first cause, commodities being cheaper on the black market when the sum of monetary and the virtual prices arising from constraints and non-monetary resources is taken into account. Third, the participation in one area of the informal economy, for instance by working unofficially, may create social interactions which lowers the cost of other unofficial activities, like buying goods on the black market (see Fortin-Lacroix-Montmarquette, 2000). Therefore, by considering both the participation of a household in informal markets and its official labor supply and consumption, we are able to answer two questions. First, does the participation in various informal market activities which are interdependent give rise to a multiplier effect? This is a question posed by Fortin-Lacroix-Montmarquette (2000) for working and buying activities. Second, is informal consumption driven mainly by a minimizing behavior, whereby households search for lower prices, minimizing the risk of participating in black markets, or rather by the appearance of subsistence constraints due to the transition? In the latter case, informal markets should disappear rapidly as the subsistence constraints faced by households during the transition phase.

This paper also presents some essential facts about informal markets in Poland during the transition and proposes a statistical matching method to measure the income effect of informal activities on regular expenditures. In Section 1, we present some historical and methodological comments of how the hidden economy was measured in Poland at the macro and micro levels, during the transition period. In Section 2, we define and estimate the participation probabilities including several types of informal economic activities: working, buying consumer goods and services or unregistered hiring. We also analyze the socio-economic profiles of the participating households and interactions between different types of informal activities. Our data source in this part is an original, large-scale informal economy survey conducted together with classic Labour Force Survey (Extended LFS) in Poland in 1995 (see Appendix 2 for details). In Section 3, we estimate the impact of informal market participation probabilities on the regular consumption patterns, using the extended LFS survey, matched statistically with the 1995 Household Budget Survey (HBS) and with the consumption panel derived from the 1994-1996 time-series data of the HBS (see Appendix 2 for details). The specific consumption behavior characteristics of participants in informal markets are analyzed by estimating the cross-section and panel of the Almost Ideal DS-QAIDS models, for the 1994-1996 period.

1. Measuring the Determinants and Effects of Informal Market Participation within the Context of Transition

Informal economic activity is a natural market reaction in the presence of governmental (or institutional) interventions and regulations (Fortin 2002). In an economy where the market is not fully regulated (as in centrally planned economies and to a lesser extent transition economies) different types of rationing can also be a cause of strong informal sectors. Economic agents try to avoid the implied constraints or extra costs through different types of participation in the informal economy. Thus, the size and evolution of the informal sector depends on the characteristics and extent of state or institutional restrictions.

By comparing the size of the informal economy across different types of countries (developed, developing and countries in transition) using the same methodology (DYMIMIC macroeconomic model, Schneider (2007)) it is possible to obtain an idea of the relative importance of informal markets in various countries in the world, with respect to their economic status. The average size of informal economies in transition countries (39% of PIB) is higher than in the most developed countries (14%), but lower than in the developing countries (42%). Among transition countries there is also great heterogeneity. The estimated share of Poland's informal economy in 2004/2005 was 27% of GDP, below the average for all transition countries, but higher than in Central European transition countries: (Hungary (25%), the Slovak Republic (18%) and the Czech Republic (18%).

In Poland, the informal economy has always existed, as in other transition countries. But its character and nature changed dramatically during the transition period.

In the pre-transition period, the formal-informal duality of the economy was based mainly on multiple economic disequilibria resulting from the coexistence of generalized rationing with administered prices and almost free, informal market sectors with equilibrium prices for the same goods and services. A specific role was played by dual (formal and informal) foreign currency regulations. They acted as an equilibrium factor on the supply-constrained official consumer market by giving the opportunity of access to the unconstrained consumer market. The use of time by queuing was another informal adjustment factor both for working and non working people. Indeed formal working time in state enterprises was often shared with informal private activities like working informally or queuing. The labor market was constrained on the demand side by quasi-permanent workforce shortages for employers, generating various forms of formal and informal adjustments like multi-employment situations for employees. The peculiar characteristics of informal markets within the centrally planned Polish economy are described in detail in Starzec 1983, and explained within the framework of a disequilibrium model in Charemza (1982, 1990).

The transition from a centrally planned to a market economy changed the character and nature of disequilibria and constraints, generating new forms of formal-informal duality in the economy. Vanishing shortages in goods and services markets were replaced by new disequilibria, especially in the labor market with the emergence of unemployment and its associated, specific social protection (contributions and benefits). At the same time, the liberalization of the economy, and the rapid growth of the private sector were accompanied by large-scale public finance reforms. The most important ones were the introduction of progressive income tax, of Value Added Tax (VAT), the individualization of social contributions and old age pension reform. These changes created the new conditions for informal economic development, similar to those observed in traditional market economies. The opening of borders expanded considerably informal, international commercial activities (smuggling) and informal labor migration (see CASE, 2007). Thus, the most important effect

of the transition from an administrated economy of shortage to a market economy with state regulation was a shift from a situation of consumption constraints to one of employment constraints, each with corresponding informal market behaviors. The transformation of informal markets was similar in several central European countries (Hungary, Czech Republic, Slovakia), but differed for Russia (Kurkchiyan, Marina. 2000) and the former Soviet Union Republics, where both the pre-transition and post-transition situations have been institutionally and politically more specific, and extremely heterogeneous (e.g. for Georgia see Bernabè, Stampini (2008)). When compared to other Central European countries, Poland's specificity has been related to the peculiar situation of the agricultural sector both before and during the transition. Under central planning, Poland was characterized by a relatively open economy and the presence of a very large private sector in agriculture (90% of output). During the transition period, agriculture became potentially the most important part of the informal labor market because of its high unemployment levels (GUS 1996) and the characteristics of the tax regime (*lump sum* taxation).

Several sources of information must often be combined to obtain the most plausible image of the informal market reality. The macroeconomic evaluation methods try to correct the GDP aggregates for unregistered activities (Schneider, 2007) whereas microeconomic approaches try to correct the individual income and expenditure distribution for informal market participation effects. Moreover, the microeconomic approach is essentially oriented to the question of the cost-benefit utility maximization problem of tax evasion (Cowell, 1985, 1990), and more generally to an individual's economic and social reasons for participating in informal markets.

The classic micro-economic question of the trade-off between participating in formal or informal labor markets was formalized by Fortin and Lacroix (1992), in a structural model maximizing an individual's expected utility. However, the hidden nature of the informal economy and the resulting lack of specific individual information make the estimation of a structural model very complex. Most econometric applications use it in a reduced form.

Another difficulty lies in taking into account the risks of control, the cost of legal penalties and moral stigma in evaluating informal market participation when active policies exist to sanction underground activities. Fortin *et al*, 2004 discussed this problem and proposed an econometric model for informal market participation in this context.

Similarly the role of social interactions (Mansky, 2000), network effects or neighborhood effects (Fortin *et al* 2002) in the informal activities are discussed in the literature but are difficult to deal with in empirical research because of identification problems and the lack of specific data. More recent work on the role of social interactions uses experimental data (Fortin *et al* 2007) with somewhat debatable empirical results, because they are based on artificially composed groups of taxpayers, and are difficult to extrapolate to the entire population.

Our approach is based on the same microeconomic background analyzing the causes and interactions between different informal behaviors. We analyze informal market participation decisions, taking advantage of an original survey specifically devoted to the study of informal activities, conducted in Poland in 1995 during the transition period (see GUS, 1996). In particular, we analyze the differences and links between various types of underground activities (buying, hiring and working) and discuss the existence of network effects (Section 1). Then we propose an original method to investigate the links between consumer behavior and informal market participation, based on statistically matched data for consumption and informal activities (Section 2). This analysis allows the identification of the specific consumption patterns of informal market participants.

1.1 General Characteristics of Informal Market Participation in Poland, in 1995 [2]

Informal Work

Within the transition context, the central question lies in analyzing informal work patterns in Poland as a dysfunction of the labor market, but also as a collateral phenomenon of unemployment and tax evasion. How do people explain the reasons of participating in the informal labor market (Table 1)? In 1995, most of them (63%) indicated insufficient income or the inability of finding an official job (39%). Too high taxes also motivated almost 25% of people moonlighting, but only 10% feared losing their means tested benefits if working in the official market. Generally the male-female distribution of responses to these questions is similar, except for persons indicating the financial advantage of working without a contract, which was more frequent for women that for men. Younger and better educated people cite tax evasion more frequently as a reason for working without a formal contract, than do others who stressed more the need for extra income. Generally, the income constraint appears as the main reason for moonlighting.

The most frequent types of hidden activities are agriculture and gardening (25%), construction and home fitting (14.2%), car repairs and transport (12%) and so-called neighborhood services (13%). The majority of moonlighters are aged between 25 and 44 (52%). Participation in the informal labor market is found in all education groups, but most frequently concerns people with vocational and primary school education (38%).

Almost all socio-demographic groups are concerned by informal work. However, activities of the hidden economy are observed more frequently among low-skilled workers and jobs which do not need high qualifications. It seems that these activities are mainly caused by insufficient income and dysfunctions in official labor markets. Similarly, hiring moonlighters appears to reflect the search for low cost labor, a kind of golden opportunity rather than a systematic choice for tax evasion. As stressed by Kalaska and Witkowski (1996), informal work "is a form of survival of both employers and those employees who have no chances in the official market".

In the post-transition period surveyed in (2004), a similar study (GUS, 2005) showed relatively few changes in attitudes and opinions towards the informal activities. However, the shift from transition to post-transition period weakened significantly the economic constraint, and strengthened the tax burden effect, as reasons for informal labor market participation. Indeed, the lack of alternatives to informal work and the heavy tax burden were declared more often in 1995 than in 2004 as causes for taking up an informal work, whereas insufficient incomes were a less frequent motivation of informal activities in 2004 than in 1995. However, their respective ranks among the main motivations of participating in the informal labor market remained the same. Moreover, the differences in opinions observed in 1995 were almost unchanged in 2004, whatever the sex, age, education group or the locality.

Informal Market Participation

The analysis of informal labor market participation can be enlarged to the other underground activities: buying and hiring, following the explicit responses in the available

[2] Based on the Extended Labor Force Survey (ELFS) 1995. See Appendix A1 for details.

survey. We define “informal market participation” as a positive response by anyone involved in one of the three informal activities (working, buying, or hiring).

We consider that a household participates in parallel activities if at least one of its members does so. In Table 2, we present some general statistics about household’s participation in the different types of underground activities. Almost 22% households are present in at least one of the informal markets through one of its members: 15% in buying, 7.4% in working and 6.8% in hiring.

Almost 18% of households were present in the informal labor market. About 1.6% of households combined both working *and* hiring. 2.5% were buying *and* working and more than 5% were buying *and* hiring informally. This interdependence of certain informal activities will be discussed later in this section.

Table 1
Opinions on the Reasons for Taking up Unregistered Employment in 1995
(as % of the total).*

Specification	Total	Men	Women	Urban	Rural
Insufficient income	63.0	61.6	64.2	63.1	62.7
Inability to find an official job	38.9	38.6	39.3	35.6	44.6
Higher incomes without a contract	16.2	18.1	14.5	17.2	14.6
Family or personal situation	8.7	6.7	10.4	8.9	8.2
Too high taxes	24.2	26.8	21.8	26.0	21.1
High social security contributions	16.0	17 2	15.0.	16.8	14.7
Unwillingness to hold a permanent job (flexibility)	1.3	1.5	1.2	1.2	1.5
Fear of losing certain benefits	10.3	10.7	10.0	10.9	9.3
Other	0.1	0.1	0.1	0.1	0.1

**several responses possible*
Source: GUS Extended Labor Force Survey (1995), Kalaska, Witkowski, 1996.

Table 2
Frequencies of the Different Forms of Participation in the Informal Economy

Nature of informal activities	Nb obs	Mean	Std Dev
Households			
Buying in informal markets	10390	0.154	0.361
Working in informal markets	10390	0.074	0.262
Hiring in informal markets	10390	0.068	0.252
Participating (at least in one out of three)	10390	0.217	0.412
Working or hiring in informal markets	10390	0.179	0.383
Working and hiring in informal markets	10390	0.016	0.125
Buying and working in informal markets	10390	0.025	0.157
Buying and hiring in informal markets	10390	0.053	0.224

Source: Computed from GUS Extended Labor Force Survey (1995)

Socio-Economic Profiles and Participation Probabilities

The definition of participation here is the participation declared by any person in the household, in any informal activity (buying, working, hiring) permanently or occasionally. We consider that the household's situation and needs determine the demand for informal market goods, services and activities. Another hypothesis following the same logic is to consider that one informal activity induces another, which can be done by the same person or any other member of the same household.

Overall the probability of a household's participation increases with the number of children. It is also higher in the countryside in families of farmers or when persons have a dual activity along with working on a farm. Unemployment of the head of the household is a strong factor increasing the probability of informal participation, while age reduces it. University education increases considerably and significantly the probability of participation, while other education categories have no significant impact (Appendix Table B1).

The socio-economic profiles of participants change if various types of informal activities (working, buying, hiring) are taken into account (see Appendix table B1).

a. As expected, unemployment increases significantly the probability of doing unregistered work, but reduces informal buying.

b. Male heads of household have a higher probability of working or hiring without formal contracts than females, but a lower probability of buying in the informal market.

c. Living in a area where unemployment is lower than the national average is related to a higher probability of hiring and a lower probability of working informally (which seems natural). In contrast, in areas of higher than average unemployment, the probability of working informally is significant and higher than in the areas with average unemployment.

d. There is no significant difference in the probability of participating in any informal activity with respect to the age, except for people over 60 for whom informal work is significantly lower than for others. This is related very probably to their generally lower participation in the labor market.

e. The probability of participation does not vary for inhabitants of cities and towns, except for informal hiring, which rises significantly with the size of conurbation. However, living in the countryside raises very significantly the chances of participating in all informal activities.

f. Similarly, farmers or people with dual occupations (farmers and wage earners) have a higher and significant probability of participating in all informal activities than do wage earners. The self-employed have a higher probability of working informally, but not buying nor hiring.

g. The education level has a small influence on participation behavior: high school education reduces the probability of working informally, whereas university education increases the probability of buying in informal markets.

h. The family situation has a small impact on informal activities: participation rises with the number of children with the most significant outcomes for informal work. Buying and hiring informally are more probable for families with 3 children than for smaller ones.

Generally, the probability of all kinds of informal activities occurring is highest in rural areas. Working without a formal contract is most frequent among the unemployed or in the areas with relatively high unemployment. Informal hiring activities are more probable in cities but also among families with several children. The high probability of informal buying is related to the head of household's education and the presence of a large family.

In short, the relationships with respect to the informal activities appear to depend on a household's income or labor market situation, its rural or urban environment. But, they are age independent, excepting the fall in the "natural" labor supply by the elderly.

The Interdependence of Buying, Working and Hiring in Informal Markets

Following Fortin *et al*, 2002, we examine the existence of interdependence of various informal activities, by enlarging the analysis to the three types of informal market activities: working, buying and hiring without formal contracts, in the context of the Polish transition economy. We test the hypothesis of interdependence using a recursive bivariate probit model of the probability of buying goods and services informally, combined with other informal activities (working or hiring without formal contracts) by including them as regressors in the buying equation. We estimate three models combining (a) working and buying, (b) hiring and buying, (c) working or hiring and buying using seemingly unrelated regressions allowing for the correlation of residuals.

In order to take into account the possible endogeneity of dependent variables used as regressors, we use the following estimation procedure. Firstly, we include the regional unemployment variables only in the equation of the probability of working (or hiring) supposing that there is little interdependence between them and the informal buying. Secondly, we instrument the dependent variable of the first equation (probability of working, hiring and buying or hiring) by simple probit method and put the instrumented value as a regressor into the buying equation.

The system is composed of the two equations corresponding to each type of informal activity (with social and economic determinants as explanatory variables). This system is estimated by maximum likelihood with exogeneity constraints obtained by excluding some of the explanatory variables from one equation. The summary results of the three models estimated in terms of marginal effects are presented in the Table 3. The full results are given in Appendix B, Tables B2-B4.

- (1) The marginal effect of working in the informal market (i.e. shifting from 0 to 1, where 1 is working informally) raises the probability of also buying informally by 0.45. More generally, any participation in the informal labor market (working or hiring) increases the probability of buying by 0.48. These effects are particularly high, when compared with the average probability of participating in the informal consumer market which is 0.15.
- (2) The closest relationship is observed between hiring and buying informally. The marginal effect obtained (0.50) means that hiring informally increases the probability of buying informally by 50 percent.

The estimated high marginal effects confirm the presence of social network or neighborhood effects which raise the probability of households participating in other informal markets when they are already active in one informal market. Moreover the results show a strong interdependency among various informal activities, suggesting that participating in any one of them can be a significant determinant explaining households' behavior.

We develop this conclusion in the next section, taking into consideration the influence of the informal market participation on households' consumer behavior in regular markets.

Table 3
Probability of Buying, Working and Hiring in Informal Markets
Recursive bivariate probit model
marginal effects

variable	dy/dx Work+buy	dy/dx Hire+buy	dy/dx Hire or work+buy
Working in informal markets (instrumented)	0,451*	0,499*	0,484*
Head of household unemployed	-0,106	-0,044*	-0,095*
Inactive	-0,075*	-0,019	-0,026*
Head of household aged less than 30	0,030*	0,018	0,029*
Head of household aged 30-39	0,033*	0,013	0,032*
Head of household aged 40-60	0,091*	0,022	0,070*
University level education	0,068*	0,056*	0,096*
High school level education	0,030	0,015	0,053*
Primary school level education	0,019	0,010	0,026
Farmers	0,179*	-0,010	0,022
Dual activity (farmers+wage earners)	0,076*	-0,009	0,013
Pensioners	0,057*	0,022*	0,029*
Self-employed	-0,009	-	-0,031
One child	-0,003	0,004	-0,013
Two children	-0,014	-0,006	-0,030*
Three children or more	-0,029*	0,003	-0,041*

** Significant at the 90% level.See Appendix B Tables B2-B4 for detailed estimation results.*
Source: Computed from GUS Extended Labor Force Survey (1995).

2. Participation in Informal Markets and Household Expenditures in Regular Markets

We conclude from Section 2 that a household's participation in the informal labor market may create a positive network effect on hiring labor services, or purchasing goods in the black market. Both of these expenditures may influence regular consumption because of substitution between regular and informal expenditures. Thus, both modes of participating in informal institutions may change expenditure in regular markets. Indeed, if informal activities influence regular consumption, then the estimation of regular demand as recorded in Household Budgets surveys may be biased whenever these informal activities are not taken into account. Moreover, considering them as potential explanatory variables may reduce part of the endogeneity biases which appear in cross-section estimations, and which are caused by the existence of permanent, latent (unobserved) variables (see Gardes *et al*., 2005, for the biases of income elasticities computed on cross-sections). We try to deepen analysis of this question by proposing an approach combining microeconomic consumer behavior analysis based on typical household budget data, with information about the participation in informal markets contained in the Labor Force survey: integrating an index of unofficial activities in

the equation for regular consumption may greatly improve cross-section estimates of all variables which are correlated, in the cross-section dimension, to these unofficial activities. The result would be cross-section estimates closer to time-series estimates, which would solve the puzzle discussed in Gardes *et al.* (2005).

In order to test for this dependency, we have imputed the probability of participating in informal markets for each household from the Family Expenditures surveys. For this analysis we use two statistically matched surveys: (i) the extended *Labor Force Survey* 1995 (ELFS 1995) containing specific information on informal economy participation (used in the previous section); and (ii) the *Household Budget Survey (HBS* 1995) with the associated four-year panel data (1993-1996) (see Appendix 2 for more details). First, demand systems are estimated for both time-series (panel) and cross-section data, including the information on the participation in informal markets. Second, the income elasticities are compared between sub-populations with different participation probabilities. This comparison can indicate to what extent the use of informal markets is an economic constraint rather than a "golden opportunity" simply allowing goods and services to be bought at lower price level.

2.1. Specification, Econometric Methodology and Data-base Construction

The first step consists in setting up an appropriate data-base. We use a regression based matching procedure to impute the informal market participation probabilities from ELFS 1995 into the 1994-96 Panel of Household Budget Surveys and the 1995 Household Budget Survey (HBS). The estimated model of participation in the informal economy based on the 1995 ELFS Survey (see Section 1 and Table B1 in the Appendix B) is applied to predict the participation probabilities of each household in the panel and the survey (HBS), using similar household characteristics. These predicted probabilities are added as explanatory variables in the demand systems analysis. Our hypothesis is that the households participating and not participating in informal markets may behave differently, with respect to their socio-economic characteristics, when facing a change in income, relative prices or other determinants of their consumption. We test this hypothesis estimating an Almost Ideal Demand System and a Quadratic Almost Ideal Demand System (QAIDS), on panel and cross-section expenditure data with the imputed information about informal market participation. The estimation of the Quadratic Almost Ideal Demand System QAIDS has been made using the convergence algorithm proposed by Banks *et al.* (1997): for the linear Almost Ideal Demand System specification we have

$$w_{iht} = \alpha_i + \pi_i \, part + \Sigma_j \gamma_{ij} \ln p_{jt} + \beta_i \ln [m_{ht}/a(p_t)] + Z_{ht}.\delta_i + u_{iht} \qquad (2.1a)$$

For the Quadratic specification (2.1b)

$$w_{iht} = \alpha_i + \pi_i \, part + \Sigma_j \gamma_{ij} \ln p_{jt} + \beta_i \ln [m_{ht}/a(p_t)] + \{[\lambda_i/b(p_t)] \ln [m/a(p)]\}^2 + Z_{ht}.\delta_i + u_{iht,}$$

$$\text{with: } \ln a(p_t) = \alpha_0 + \Sigma_j \alpha_i \ln p_{it} + 0.5 \, \Sigma_i \Sigma_j \gamma_{ij} \ln p_{it}.\ln p_{jt} \quad \text{and} \quad b(p_t) = \Pi_i \, p_{it}^{\beta i}$$

where w_{iht} is the budget share for good i, individual h and period t, p_{it} the price of good i, m_{ht} is household's total income in period t, *part* the imputed probability of the household's members participation in informal activities and Z_{ht} all other socio-economic variables. Because of the possible endogeneity due to measurement errors of the income variable, it is instrumented by the total expenditure, the head of household's age and his/her social category.

As the estimated parameters α_i, β_i, γ_{ij} bring non-linearity into the equation, a *first step* consists in estimating equation (2.1b), using a Stone price index $a(p_t) = \prod_i p_{it}^{\overline{w}_i}$ with $\overline{w}_i$ the average budget share of good i for individuals and periods (that is, imposing $\alpha_0 = \gamma_{ij} = 0$ and $\alpha_i = \overline{w}_i$ in the true price index $a(p_t)$). Price elasticities can be corrected to take into account the difference between the exact price index $a(p_t)$ and the Stone index, as described by Pashardes (1990). In the *second step*, the β_i estimated are used to compute $b(p_t)$. At each step, $b(p_t)$ is updated and the system is linear in its parameters. This procedure ensures that the quadratic specification which is estimated corresponds to the integrable QAIDS system.

Blundell and Robin (1999) proved the consistency and asymptotic efficiency of this iterative procedure compared to the maximum likelihood estimate. The estimation is made under the sole additivity assumption, as homogeneity is not accepted by the data, except for clothing (note that the results are similar when homogeneity is constrained). The "between" and "within" parameters are estimated by pooling the three surveys with quarter and period dummies, to take into account all institutional changes. The convergence process is rather low, b(p) converging at the 75th iteration.

2.2. The Effect of Informal Market Participation on the Consumer Behavior

The Almost Ideal Demand System model (2.1a) is estimated on the 1995 Polish Household Budget Survey for 10 aggregated consumption items, considered as a demand system with budget constraint (Appendix B, Table B5). Then, a panel sample covering the period 1994-1996 is used for a system estimation (Appendix B, table B6). The final estimation (Appendix B, Table B7) is performed using the same panel sample applying the quadratic version of the model (QAIDS). This leads to three conclusions:

(a) The estimated coefficients of the probability of participation in the informal economy are very close for the separate, equation-by-equation, demand system and between transformed data estimates, except for the item Culture and Education (traditionally a poorly defined category). For six groups of commodities out of eleven, the estimated probability of participating in the black market has a significant effect on regular expenditures in all types of estimation (see Tables B6 and B7 in Appendix B). The effect is clearly positive for Food, Alcohol and Tobacco, Transport and Communication, with values from 10% to 30% of the budget share, with an average probability of 0.3. The coefficient is negative for all other product groups, especially for three services: Health, Education and Cultural expenditures (note that, under the additivity restriction, the coefficients for all groups sum to 0). Such a negative effect of participation in the informal economy corresponds to a substitution between informal and regular expenditures: expenditures for goods or services in informal markets substitute for official expenditures. This substitution may be important for the three services which have the larger negative coefficients. A positive effect may be due to the influence of latent variables both on participation in informal markets and on the regular expenditures. Suppose, for instance, that the household is relatively poor in its reference population. This relative position tends to increase its food expenditures, compared to the normal effect of its current income (see Gardes, 2007, for the theory and an empirical analysis of this relative income effect). On the other hand, relative poverty increases the tendency of participating in informal markets, so that a positive relationship appears between these two variables.[3]

[3] The income from the informal labor market may also increase the consumption in excess of the share explained by official income declared by the household, when a household does not include its unofficial income in its

Therefore, income effects computed independently of a household's relative income position would under-estimate its food consumption and artificially create a positive effect of the probability of participating. Conversely, luxury goods such as culture or health expenditures may be over-estimated. In a sense, the inclusion of this probability among the determinants of household expenditure controls for relative income effects. It is important to take into account both variables – relative income and black market participation – but this requires modeling explicitly the relative income effects, which is a difficult task.

Table 4
AI Demand System Cross-Section Estimates of the Change in Budget Shares, According to the Probability of Participating in the Informal Economy

Expenditure groups	Income elasticity	Participation probability	Average budget share
Food	0.64723	0.181289 (5.028)	0.448
Alcohol and tobacco	0.65111	0.011839 (1.015)	0.034
Clothing	1.49340	-0.045741 (-2.177)	0.064
Dwelling (charges)	0.87026	-0.008299 (-0.241)	0.184
Dwelling (equipment)	2.19828	0.018621 (1.008)	0.032
Health	1.08289	-0.087720 (-5.857)	0.042
Hygiene	0.97142	-0.004439 (-0.642)	0.034
Education	0.91242	-0.066810 (-7.172)	0.018
Culture	1.73049	-0.093797 (-5.255)	0.047
Transport and communication	1.86568	0.084119 (0.606)	0.078

1. Student (robust) statistics in parenthesis.
2. Income instrumented by total expenditure and socio-demographic variables.
3. Income elasticities computed at the average level of budget share.
Source: Computed from GUS Household Budget Survey (1995).
Number of observation: 31857.

(b) The comparison of the total expenditure elasticities (estimated by QAIDS) for two sub-populations – participating or non-participating households – is given in Table 4. Half of the commodity groups have different time-series elasticities for the two sub-populations, but the order between the elasticities of the participating or non-participating households is not the same for cross-section and time-series elasticities. Moreover, those commodities which are characterized by a large positive influence of participation (estimated in the constant) do not have a higher income elasticity (in the "within dimension") in the participating population. Perhaps the three types of participation do not have similar effects concerning the income elasticity.

income declaration, but the specification on instrumented total expenditure theoretically excludes such an under-estimation.

Table 5
Income Elsticity According to the Household's Participation in the Informal Economy

	Participating > Non-Participating	Participating < Non-Participating
Cross-section Elasticity	Dwellings (charges)	Clothing, Dwelling (equipment)
Time-series Elasticity	Clothing, Transport and Communication	Food, Miscellaneous

Source: Computed from GUS Household Budget panel (1994-1995) (4809 observation per year).

The explanation of the order between time-series elasticities, which are theoretically unbiased by the existence of permanent latent variables (the cross-section elasticities can be biased in this case), cannot rely on relative income considerations: a continuous increase of households' income may not provoke a substitution between unofficial and official commodities, thus no endogenous bias may appear in the time-series income elasticities. The order of these time-series elasticities may perhaps be partly explained by varying consumer behavior between rural and non-rural households. It can be also observed that participating households have higher income-elasticities for commodities which are already highly elastic (clothing, dwelling charges, transport and communication), as if the supplementary income from informal activities or savings due to smaller prices on the black market are principally spent on groups of luxury commodities.

It should be noted that it is highly plausible that the different types of participation in the informal sector differ between the rich and the poor: the former may buy unofficial goods and hire employees in the informal sector, while the latter may also buy goods (but different types of commodities) and sell their work informally. So, it may be important to differentiate these three types of participation to analyze consumption patterns and the constraints faced by the population.

(c) Another interesting feature of these statistics lies in the revealed choice conditions through the computation of shadow prices, corresponding to rationing constraints or the existence of non-monetary resources. Such hidden determinants have been proved to explain the frequent biases in cross-section elasticities, compared to time-series. These shadow prices are defined by changing consumption, through price effects, in exactly the same amount as the change which is attributed to some latent variable. They measure, in price terms, the influence of this unobserved latent variable. For instance, optimizing under a rationing constraint (or conditionally on a definite amount of time spent in the consumption activity) lowers the optimal expenditure for the constrained commodity by exactly the same amount as that which is driven, through some calibrated direct price elasticity, by a price increase of a certain value for this commodity (see Appendix in Gardes *et al*., 2005; details and a more general model can be found in Gardes, 2008). Table 6 presents these shadow prices for participating and non-participating households. Shadow prices are negatively related to a household's income, when it participates in the informal economy. In contrast, they are positively related to income for non-participating households. This means that full prices (integrating these shadow prices) are greater for the poor among participating households, and vice-versa for rich non-participating households, which may create an incentive for the poor to gain from their

participation in informal markets. The analysis thus shows an important economic determinant of the participation in the informal economy, and explains why this participation is more frequent among poor households.

Table 6
Shadow Prices for Participating and Non-Participating Households

Commodity group	Budget share	Participating households	Non-participating households
Food	0.448	-2.45	-0.47
Alcohol-Tobacco	0.034	-2.98	*
Clothing	0.064	-0.64	0.99
Dwelling (charges)	0.184	0.63	0.09
Dwelling (equipment)	0.032	0.27	0.88
Transport and Communication	0.078	-0.004	0.26
Health	0.076	0.19	-0.15
Culture and education	0.065	0.12	0.26
Miscellaneous	0.019	0.68	-1.17
Weighted Mean		-0.91	0.68

Source: Computed from GUS Household Budget panel (1994-1995) (4809 observation per year)

Conclusion

The use of the survey describing at the individual and household levels different types of informal activities (working, buying, hiring) makes it possible to explore many new aspects of the mechanics of underground economies. The characteristics of participants in informal markets differ when considering various types of underground activities, but generally they are related to constrained employment. Firstly, the rural population appears as the main actor in informal markets, probably because of the income constraints, and also because labor markets are less developed in the countryside. Secondly, age and education levels do not seem to influence informal participation, which may indicate that such participation is more distributed over the whole population in Poland than in other countries. Thirdly, the average regional unemployment rate is positively related to informal participation, even when the influence of a household's regular activity has already been taken into account. It may indicate the existence of a network effect: a larger supply of informal goods and services increases a household's exposure to informal activities, thus giving rise to greater household participation in informal markets. Last, single men and women are more active in the informal economy, while large families seem to be less prone to participating in informal markets than families with only one or two children. It is possible that some supplementary cost of participating in the informal economy exists for larger families compared to smaller ones.

The analysis of the characteristics of participants in informal markets thus confirms that working, buying and hiring in informal markets are *mutually dependent*. This is particularly the case of working and buying or hiring and buying, through "network effects", whereby any contact with the underground economy facilitates other entries. We test the importance of these dependencies using a set of bivariate estimations. The probability of buying informally increases by 0.45 when a household shifts from not working informally to working informally. More generally, the shift in probability of participating in informal labor markets (working or hiring) from 0 to 1 increases the probability of buying by 0.48. These effects are particularly high, when compared with the average participation in informal consumer markets of 0.15. This confirms the interest in testing a structural model such as proposed by Fortin *et al*, 2002, in order to analyze the dependencies between various informal market participations and the potentially associated social stigma.

We analyze the possible existence of this network effect also indirectly, comparing the cross-section and time-series differences of income elasticities observed for participating and non-participating households. This analysis, based on a matching method combining a labor force survey and a family budget survey, in fact shows that a household's consumer behavior does depend (either negatively or positively) on the commodity group, and on informal market participation by the household. Moreover, the difference between the cross-section and the time-series estimates of the income effect is lowered by the presence of a participation probability among the explanatory variables, which is an important indication that this participation acts as a proxy for a lot of latent variables which cause the endogeneity biases in the cross-section estimates. It may be important to take into account an imputed participation rate to be able to estimate income-elasticities on the cross-section lowering the endogeneity bias. The shadow prices indicating the presence of constraints or non-monetary resources (such as those proceeding from a hidden time constraint) seem to depend on a household's participation in the informal economy. This indicates that those participating households may face different economic costs which explain their participation in informal markets.

References

BANKS J., BLUNDELL R., LEWBEL A., [1997], "Quadratic Engel Curves and Consumer Demand", *Review of Economic Studies*, 89, 4, 527-539.

BERGER K, [1996], "Gospodarstwo domowe w gospodarce rynkowej - wyniki badania Ankietowego", dans : *Szara Gospodarka w Polsce,* GUS-ZBSE, Warszawa

BERNABÈ S., STAMPINI M, [2008], "Labour Mobility during Transition: Evidence from Georgia" *Discussion Paper 206/2008,* Katholieke Universiteit Leuven.

BERNABÈ S. [2002], "Informal employment in countries in transition: a conceptual framework ". *Discussion Paper*. Centre for Analysis of Social Exclusion, London School of Economics and Political Science, London, UK.

BLUNDELL R., ROBIN M. **[**1999], "An Iterated Least Squares Estimator for Conditionally Linear Equations Models", *Journal of Applied Econometrics* 14, 209-232.

CASE [2006] "Unregistered Employment in Poland", CASE Report , Poland

CHAREMZA W. [1990], "Parallel markets, excess demand and virtual prices: An empirical Approach ", *European Economic Review* 34, 331-339.

CHAREMZA W., QUANDT R.E. [1982], "Models and estimation for centrally planned markets in disequilibrium, *Review of Economic Studies* 49, 109-116.

COWELL F. A [1985], "Tax evasion with labour income". *Journal of Public Economics*, 26(1), p. 19-34.

COWELL, F. A. [1990], "Tax Sheltering and the cost of evasion" *Oxford Economic Papers, 42, p.231-243.*

DIAYE M.A., GARDES F., STARZEC C. [2008], "Garp violation, Economic Environment Distortions and Shadow Prices: Evidence from Household Expenditure Panel Data", forthcoming in *Les Annales d'Economie et de Statistique*.

DUPAIGNE M., HÉNIN P.Y. [2001], "A Dynamic Macro Model of the Informal Economy", *Working paper* Cepremap-CERGE, septembre.

FEIGE, EDGAR L. [1997], "Underground Activity and Institutional Change:Productive, Protective and Predatory Behaviour in Transition Economies," dans *Transforming Post-Communist Political Economies*. National Academy Press,Washington, D.C.

FORTIN B. [2002], « Les Enjeux de l'Economie Souterraine », *Présentation à la Société Royale du Canada, Université Laval, 1 novembre.*

FORTIN, B., JOUBERT N., LACROIX G. 1[(2004], « Offre de travail au noir en présence de la fiscalité et des contrôles fiscaux « , *Économie et Prévision*, N° 164–165, 145–164.

FORTIN B., JOUBERT N., LACROIX G. [2002], « Fiscalité, effets de voisinage et offre de travail au noir», *Working Paper* 02-14, GATE, Université Lumière Lyon 2.

FORTIN, B., G. LACROIX G. [1994], "The Marginal Cost of Public Funds in the Presence of an Irregular Sector : An Empirical Investigation", *The Journal of Public Economics,* 55,407–431.

FORTIN B., G. LACROIX , C. MONTMARQUETTE [2000], "Are Underground Workers More Likely to be Underground Consumers ?",*The Economic Journal*, Vol. 110, 466, 838–860.

FORTIN B., G. LACROIX G., VILLEVAL M.-C. [2007], "Tax Evasion and Social Interactions", *Journal of Public Economics*, 91, 2089-2112.

GARDES, F. [2007], "Looking For Another Relative Engel's Law", *Working Paper*. CES, April.

GARDES, F. [2008], "Riemanian Consumers", *Working Paper*. CES, May.

GARDES F., G. DUNCAN G., GAUBERT P., GURGAND M, STARZEC C. [2005]," Panel and Pseudo-Panel Estimation of Cross-Sectional and Time Series Elasticities of Food Consumption, the Case of US and Polish Data", *Journal of Business and Economic Statistics,* April 2005, Vol. 23, N° 2 , p.242-253.

GARDES F., GAUBERT P., LANGLOIS S. [2000], "Pauvreté et Convergence de Consommations au Canada" *Canadian Journal of Sociology and Anthropology* , p. 1-31.

GUS [1996], Szara Gospodarka w Polsce, GUS-ZBSE, Warszawa.

GUS [2005], "Praca nierejestrowana w Polsce w 2004", *Informacje i opracowania statystyczne* Warszawa

KALASKA M., WITKOWSKI J. 1996, "Praca nierejestrowana w Polsce w 1995 roku-wyniki badania ankietowego", in : *Szara Gospodarka w Polsce*, GUS-ZBSE, Warszawa.

KAUFMANN D., KALIBERDA A. [1996]. "An 'Unofficial' Analysis of Economies in Transition: An Empirical Framework and Lessons for Policy." Development Discussion Paper 558, Harvard Institute for International Development: Cambridge, MA..

KORDOS J., KUBICZEK A. [1991], "Methodological Problems in the Household Budget Surveys in Poland", GUS, Warsaw.

KOSTRUBIEC S. (ed), [1999], "Praca nierejestrowana w Polsce w 1998 roku;" GUS, Warszawa.

KURKCHIYAN, M.. [2000]. "The Transformation of the Second Economy into the Informal Economy," in *Economic Crime in Russia*. Alena V. Ledeneva and Marina Kurkchiyan eds. The Hague: Kluwer Law International

LACROIX, G., FORTIN B. [1992], "Utility-Based Estimation of Labor Supply Function in the Regular and Irregular Sectors*", The Economic Journal*, 102, p. 1407–1422.

LEMIEUX, T., FORTIN B., FRÉCHETTE P.[1994], "The Effect of Taxes on Labor Supply in the Underground Economy", *American Economic Review* (84:1), p. 231-254.

MANSKI, C.F. [1993] "Identification of Endogenous Social Effects: The Reflection Problem," *Review of Economic Studies*, 1993a, 60, p. 531-542.

MANSKI, C.F. [2000]. "Economic Analysis of Social Interactions". *Journal of Economic Perspectives* 14(3), p.115-36.

MUNDLAK Y., [1978], "On the Pooling of Time Series and Cross Section Data", *Econometrica* 46, p. 483-509.

OECD [1997], "Framework for the Measurement of Unrecorded Economic Activities in Transition Economies." OECD: Paris OCDE/GD(97)177.

RAJEWSKI Z., ZIENKOWSKI L. [1996], "Szara gospodarka w systemie rachunkow narodowych", in : *Szara Gospodarka w Polsce*, GUS-ZBSE, Warszawa.

ZIENKOWSKI L. [1996], "Szacunek rozmiarow szarej gospodarki (synteza)", in : *Szara Gospodarka w Polsce*, GUS-ZBSE, Warszawa.

SCHNEIDER, F. [2007], "Shadow Economies and Corruption all over the World: New Estimates for 145 Countries", *Economics: The Open Access, Open Assessment E-Journal* N° 2007-9

STARZEC K., [1983], « L'économie polonaise vue à travers des circuits parallèles », *Consommation*, N° 4.

APPENDIX A
Data Sources

Unregistered Economy Survey (*Extended* Labor Force Survey (ELFS), GUS 1995

The new phenomenon of informal employment as a collateral consequence of emerging and increasingly dramatic unemployment was the main motivation for a special study conducted by the Polish Statistical Office (GUS) in 1995. One of the most important points of interest was the probable over-estimation of the scale of formal unemployment due to the evaluation of the number of formally unemployed persons working in unregistered activities, induced both by tax evasion in the new private sector and by the possible combining of unemployment benefit with informal work. A large scale survey was launched with questions on hidden market activities as a part of the regular Labor Force Survey (LFS). LFS is a household based survey. Ordinary dwellings are selected in a two-step sampling method. The working status questions apply to household members aged 15 and more. A specific questionnaire was elaborated and presented to half of the households selected for the quarterly LFS. A principle was adopted in using this study relating to the sub-sample of persons finishing their cooperation with GUS, after having participated in three consecutive waves of the LFS. In total over 11000 households took part in the study, and the information about 25,600 persons living in Poland was collected. Only 546 persons refused to take part in the survey. The survey was performed in August 1995.

The main features of the hidden economy survey were:

-Its nationwide character: thanks to the modular character of the survey matched with the LFS study, all information is representative for the whole population and by applying appropriate weights, national estimates can be obtained.

-Common core variables with the LFS study: in addition to specifically “hidden market” questions, all socio-economic information on households is taken from the LFS study.

-The demand and supply sides of the phenomenon: information was collected on both the demand for informal work and supply of labor in the hidden economy, by asking corresponding questions of workers and persons running a private business.

-Informal work characteristics: the distinction was made between persons working only in the hidden sector and those combining work in the formal and hidden ones.

-Different types of informal jobs were distinguished.

Detailed characteristics of all types of activities in the informal sector are given: hidden market consumption characteristics, reasons for taking an informal job, as well as incomes and expenditures in hidden markets.

Table A1
Descriptive Statistics

Variable	Mean	Std. Dev.
Head of household unemployed	.0383061	.1919434
Head of household working	.360924	.4802916
Head of household male	.6842156	.4648499
Head of household female	.3157844	.4648499
County (Wojewodztwo) with unemployment below the national average.	.4475457	.4972649
County (Wojewodztwo with average unemployment	.2980751	.4574347
County (Wojewodztwo with unemployment above the national average	.240231	.4272442
Head of household aged less than 30	.0787295	.2693291
Head of household aged 30 - 39	.2102021	.4074717
Head of household aged 40 - 60	.4159769	.4929133
Head of household aged more than 60	.2950914	.4561058
City > 100000 inhabitants	.2963426	.4566659
City 20000-99999 inhabitants	.2056785	.404216
City 2000 -19999 inhabitants	.125794	.331633
Countryside	.3721848	.4834106
University level education	.114052	.3178897
High school level education	.2454283	.4303616
Primary school level education	.5891242	.4920164
No diploma	.0513956	.2208139
Wage earners	.453513	.4978582
Farmers	.0897016	.2857676
Dual activity (farmers+workers)	.0459095	.209299
Pensioners	.3637151	.4810912
Self-employed	.0149182	.1212314
No children	.1663138	.37238
One child	.4366699	.4959969
Two children	.2142445	.4103169
Three children or more	.1827719	.386498

,
Number of observations:10390
Source: Extended Labor Force Survey (ELFS), GUS 1995)

The Polish Household Budget Surveys (HBS) and Panels

Household budget surveys have been conducted in Poland for many years. In the period analyzed, the total annual sample size was about 30,000 households, which represents 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, a two phase) sampling procedure was used. The full description of the master sample generating procedure is given by Kordos *et al.* (1991).

Master samples for each year contain data for four different sub-samples. Two sub-samples started to be surveyed in 1986 (1992, 1996) and ended with the four-year survey period in 1990 (1996, 2000). They were replaced by new sub-samples in 1990 (1993, 2000). Another two sub-samples of the same size were started in 1987 (1993, 1997) and followed through to 1990 (1996, 2000).

For this four-year period for every annual sub-sample, it is possible to identify households participating in the surveys in all four years. The checked and tested number of households is 3707 and 3052 for the earlier and later panels respectively. 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.

The period 1987-1990 covered by the Polish panel is unusual even in Polish economic history. It represents the shift from a centrally planned, rationed economy (1987) to a relatively unconstrained fully liberal market economy (1990). 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. The 1993-1996 panel reflects the main transition period, the 1997-2000 period corresponds to the post-transition, high economic growth period, with relatively low inflation, decreasing unemployment and a generally improved socio-economic situation in the context of an almost totally liberalized economy.

In our estimations, we use both a three year period 1994-1996 of the 1993-1996[4] panel, and cross-section data for 1995 containing the same variables. The number of households (our observation unit) in the panel is 4809, and about 32000 in 1995 survey. For descriptive statistics see Table A2.

[4] The year 1993 was not used because of the absence of some variables in the version we had.

Table A2
Descriptive Statistics
(Household Budget Survey -HBS- 1995)

Variable	Mean	Std. Dev.
total income	1226,055	1163,859
total expenditure|	1120,649	909,641
average head's age	48,664	14,563
head of household aged less than 30	0,101	0,301
head of household aged 30-40	0,226	0,418
head of household aged 40-60	0,436	0,496
head of household aged more than 60	0,237	0,425
number of adults in household	2,423	1,409
number of children	0,769	1,146
city 250000 and more	0,350	0,477
city 50000 -250 000 |	0,186	0,389
city less than 50000	0,126	0,331
countryside (less than 2000)	0,338	0,473
workers|	0,440	0,496
farmers|	0,065	0,247
dual activity (farmers+workers)	0,053	0,223
Pensioners	0,346	0,476
Self-employed	0,137	0,296
number of children=2	0,141	0,348
number of children=3	0,166	0,372
number of children=4	0,059	0,235
number of children more than 4	0,026	0,160
university and post secondary diploma	0,119	0,324
secondary school	0,282	0,450
primary school	0,576	0,494
no diploma	0,023	0,151
food budget share	0,448	0,151
alcohol and tobacco budget share	0,034	0,044
clothing budget share	0,064	0,077
dwelling budget share	0,184	0,131
furniture budget share	0,032	0,067
health budget share	0,042	0,056
hygiene budget share	0,034	0,025
culture budget share	0,018	0,036
education budget share	0,047	0,068
transport and communication budget share	0,078	0,090
miscellaneous	0,019	0,046

Number of observations:31857
Source: GUS, Household Budget Survey 1995

APPENDIX B
Estimation Reasults

Table B1

Probability of Participating (Buying, Working or Hiring) in Informal Markets:
Logistic Function Estimates (Data on Households)
Summary table

Variable	Participating(1)	Working(2)	Buying(3)	Hiring(4)
INTERCEPT	-0,429	0,227	0,211	0,369
Head of household inactive	-0,491	0,106 (ns)	0,097	0,186
Head of household unemployed	0,372	0,127	0,193	0,715
Head of household working	reference	reference	reference	reference
Head of household male	-0,319	0,072	0,069(ns)	0,121 (ns)
Head of household female	reference	reference	reference	reference
Local unemployment below the national average	-0,145	0,073	0,065 (ns)	0,105
Local unemployment equal to average unemployment	reference	reference	reference	reference
Local unemployment above the national average	0,038 (ns)	0,079	0,075 (ns)	0,117
Head of household aged less than 30	reference	reference	reference	reference
Head of household aged 30 - 39	-0,050 (ns)	0,114	0,119 (ns)	0,171 (ns)
Head of household aged 40 - 60	-0,113 (ns)	0,113	0,117 (ns)	0,168 (ns)
Head of household aged more than 60	-0,117 (ns)	0,147	0,137	0,203
City > 100 000 inhabitants	reference	reference	reference	reference
City 20 000-99 999 inhabitants	-0,043 (ns)	0,098 (ns)	0,089 (ns)	0,257
City 2000-19 999 inhabitants	0,057 (ns)	0,109 (ns)	0,106 (ns)	0,256
Countryside	0,422	0,089	0,081	0,217
University level education	-0,046 (ns)	0,193	0,160	0,292 (ns)
High school level education	-0,300	0,175	0,148 (ns)	0,234
Primary school level education	-0,124 (ns)	0,160	0,135 (ns)	0,204
No diploma	reference	reference	reference	reference
Wage earners	reference	reference	reference	reference
Farmers	0,842	0,104	0,090	0,112
Dual activity (farmers+wage earners)	0,328	0,135 (ns)	0,115	0,130
Pensioners	0,209	0,107 (ns)	0,101	0,159
Self-employed	0,560	0,219	0,298 (ns)	n
No children	reference	reference	reference	reference
One child	-0,762	0,136	0,112 (ns)	0,207 (ns)
Two children	-0,282	0,087	0,083 (ns)	0,119 (ns)
Three children and more	-0,152	0,089	0,087 (ns)	0,120

1 Log likelihood = -5719.4899, LR chi2(21)= 670.58, Prob > chi2 =0.0000, Number of obs= 10390,
2 Log likelihood = -3623.511, LR chi2(21) =497.20, Prob > chi2=0.0000, , Number of obs= 10390
3Log likelihood = -4270.665, LR chi2(21) =422.64, Prob > chi2=0.0000, , Number of obs= 10390
4 Log likelihood= -1841.554, LR chi2(20) =1675.70, Prob> chi2 =0.0000, Number of obs =10235
(ns) not significant
Source: Computed from GUS Extended Labor Force Survey (1995), 10039 obs.

Table B2
Probability of Buying and Working in Informal Markets
Recursive bivariate probit model

	Coef.	Robust St. Error	z	P>|z|
Working equation |				
Head of household unemployed	0,538	0,074	7,290	0,000
Inactive	-0,037	0,057	-0,650	0,519
Local unemployment below the national average.	-0,145	0,039	-3,750	0,000
Local unemployment above the national average	0,067	0,043	1,560	0,118
Head of household aged less than 30	-0,147	0,063	-2,320	0,021
Head of household aged 30 - 39	-0,225	0,063	-3,590	0,000
Head of household aged 40 - 60	-0,549	0,079	-6,980	0,000
City 20000-99999 inhabitants	-0,048	0,050	-0,950	0,344
City below 20000 inhabitants	0,007	0,057	0,130	0,899
Countryside	0,135	0,046	2,940	0,003
University level education	-0,363	0,099	-3,680	0,000
High school level education	-0,396	0,090	-4,420	0,000
Primary school level education	-0,202	0,082	-2,460	0,014
Farmers	0,086	0,059	1,460	0,143
Dual activity (farmers+wage earners)	-0,023	0,075	-0,310	0,757
Pensioners	0,004	0,059	0,070	0,948
Self-employed	0,391	0,124	3,150	0,002
One child	0,295	0,059	5,020	0,000
Two children	0,403	0,065	6,240	0,000
Three children or more	0,564	0,068	8,350	0,000
Constant	-1,022	0,116	-8,840	0,000
Buying equation				
Working in informal markets (instrumented)	1,963	0,578	3,400	0,001
Head of household unemployed	-0,656	0,141	-4,660	0,000
Inactive	-0,341	0,054	-6,280	0,000
Head of household aged less than 30	0,126	0,068	1,860	0,063
Head of household aged 30 - 39	0,140	0,071	1,970	0,048
Head of household aged 40 - 60	0,366	0,097	3,770	0,000
University level education	0,269	0,095	2,830	0,005
High school level education	0,128	0,090	1,420	0,155
Primary school level education	0,082	0,076	1,070	0,283
Farmers	0,621	0,057	10,840	0,000
Dual activity (farmers+wage earners)	0,291	0,068	4,270	0,000
Pensioners	0,241	0,056	4,290	0,000
Self employed	-0,039	0,161	-0,250	0,806
One child	-0,015	0,052	-0,290	0,775
Two children	-0,061	0,065	-0,940	0,350
Three children or more	-0,134	0,084	-1,580	0,114
constant	-1,559	0,141	-11,060	0,000
rho	0,088	0,024		

Log pseudolikelihood = -7922.7008 , Wald chi2(36) = 785.11 Prob > chi2 = 0.00, Number of obs =10390, ,Wald test of rho=0: chi2(1) = 13.243 Prob > chi2 = 0.0003
Source: Computed from GUS Extended Labor Force Survey (1995) 10039 obs.

Probability of Buying and Working in Informal Markets
Recursive bivariate probit model
marginal effects

variable	dy/dx	St. Error,	Average
Working in informal markets (instrumented)	0,451	0,133	0,123
Head of household unemployed	-0,106	0,014	0,038
Inactive	-0,075	0,011	0,361
Head of household aged less than 30	0,030	0,017	0,210
Head of household aged 30 - 39	0,033	0,017	0,416
Head of household aged 40 - 60	0,091	0,026	0,295
University level education	0,068	0,026	0,114
High school level education	0,030	0,022	0,245
Primary school level education	0,019	0,017	0,589
Farmers	0,179	0,020	0,090
Dual activity (farmers+wage earners)	0,076	0,020	0,046
Pensioners	0,057	0,014	0,364
Self employed	-0,009	0,035	0,015
One child	-0,003	0,012	0,437
Two children	-0,014	0,014	0,214
Three children or more	-0,029	0,018	0,183

y =Pr(buying)=1;, dy/dx is for discrete change of dummy variable from 0 to 1 at the average point, Number of obs:10390
Source: Computed from GUS Extended Labor Force Survey (1995), 10390 obs.

Table B3
Probability of Buying and Hiring in Informal markets
Recursive bivariate probit model

variable	Coef,	Robust St, Error	z	P>|z|
Hiring equation				
Head of household unemployed	-0,823	0,247	-3,340	0,001
Inactive	-1,180	0,097	-12,170	0,000
Local unemployment below the national average.	0,141	0,048	2,940	0,003
Local unemployment above the national average	0,056	0,053	1,070	0,286
Head of household aged less than 30	-0,026	0,085	-0,310	0,754
Head of household aged 30 - 39	-0,002	0,084	-0,020	0,985
Head of household aged 40 - 60	0,318	0,105	3,030	0,002
City 20000-99999 inhabitants	0,222	0,100	2,230	0,026
City below 20000 inhabitants	0,462	0,100	4,600	0,000
Countryside	0,741	0,082	9,040	0,000
University level education	-0,216	0,131	-1,650	0,099
High school level education	-0,261	0,111	-2,360	0,018
Primary school level education	-0,169	0,098	-1,730	0,084
Farmers	1,092	0,061	17,880	0,000
Dual activity (farmers+wage earners)	0,499	0,076	6,560	0,000
Pensioners	0,402	0,091	4,410	0,000
One child	0,299	0,078	3,840	0,000
Two children	0,421	0,085	4,940	0,000
Three children or more	0,298	0,091	3,280	0,001
Constant	-2,334	0,159	-14,680	0,000
Buying equation |				
Hiring on informal markets (instrumented) |	2,165	0,354	6,120	0,000
Head of household unemployed	-0,214	0,103	-2,090	0,037
Inactive	-0,085	0,067	-1,270	0,205
Head of household aged less than 30	0,076	0,066	1,160	0,245
Head of household aged 30 - 39	0,056	0,065	0,860	0,388
Head of household aged 40 - 60	0,094	0,077	1,220	0,224
University level education	0,221	0,088	2,510	0,012
High school level education	0,066	0,082	0,800	0,422
Primary school level education	0,044	0,075	0,580	0,559
Farmers	-0,045	0,132	-0,340	0,734
Dual activity (farmers+wage earners)	-0,040	0,089	-0,450	0,655
Pensioners	0,094	0,059	1,600	0,110
One child	0,017	0,048	0,350	0,729
Two children	-0,025	0,056	-0,450	0,654
Three children or more	0,012	0,059	0,200	0,842
constant	-1,335	0,104	-12,860	0,000
rho	0,764	0,016		

Log pseudolikelihood = -5601.4322, Wald chi2(34)=1329.77 Prob > chi2=.0000Wald test of rho=0: chi2(1)=712.593 Prob > chi2 = 0.0000, Number of obs =10390
Source: Computed from GUS Extended Labor Force Survey (1995,) 10390 observations

Probability of buying and hiring on informal markets
Recursive bivariate probit model
*marginal effects**

variable	dy/dx	St. Error,	Average
Hiring on informal markets (instrumented)	0,499	0,082	0,073
Household's head Unemployed	-0,044	0,019	0,033
Inactive	-0,019	0,015	0,358
Household's head age less than 30	0,018	0,016	0,210
Household's head age 30 – 39	0,013	0,015	0,417
Household's head age 40 – 60	0,022	0,019	0,298
University level education	0,056	0,024	0,115
High school level education	0,015	0,020	0,245
Primary school level education	0,010	0,017	0,589
Farmers	-0,010	0,029	0,091
Double active (farmers+wage earners)	-0,009	0,020	0,047
Pensioneers	0,022	0,014	0,369
One child	0,004	0,011	0,438
Two children	-0,006	0,013	0,216
Three children or more	0,003	0,014	0,185

y =Pr(achat=1),, dy/dx is for discrete change of dummy variable from 0 to 1 at the average point
Number of obs:10390
Source: Computed from GUS Extended Labor Force Survey (1995)

Table B4

Probability of Working or Hiring Versus Buying on Informal Markets

Recursive bivariate probit model

variable		Robust		
Working or hiring equation	Coef,	Std, Error	z	P>|z|
Head of household unemployed	0,356	0,072	4,910	0,000
Inactive	-0,390	0,057	-6,890	0,000
Local unemployment below the national average.	-0,091	0,035	-2,590	0,010
Local unemployment above the national average	0,057	0,040	1,450	0,148
Head of household aged less than 30	-0,104	0,061	-1,700	0,088
Head of household aged 30 - 39	-0,161	0,060	-2,660	0,008
Head of household aged 40 - 60	-0,261	0,075	-3,490	0,000
City 20000-99999 inhabitants	0,006	0,048	0,130	0,900
City below 20000 inhabitants	0,121	0,054	2,240	0,025
Countryside	0,309	0,043	7,180	0,000
University level education	-0,371	0,089	-4,180	0,000
High school level education	-0,416	0,080	-5,210	0,000
Primary school level education	-0,205	0,073	-2,830	0,005
Farmers	0,664	0,054	12,390	0,000
Dual activity (farmers+wage earners)	0,233	0,068	3,440	0,001
Pensioners	0,133	0,057	2,310	0,021
Self-employed	0,508	0,125	4,060	0,000
One child	0,336	0,054	6,240	0,000
Two children	0,471	0,059	8,010	0,000
Three children or more	0,562	0,062	9,010	0,000
constant	-1,041	0,106	-9,850	0,000
Buying equation				
Hiring or working	2,101	0,388	5,410	0,000
Head of household unemployed	-0,547	0,111	-4,930	0,000
Inactive	-0,116	0,064	-1,820	0,068
Head of household aged less than 30	0,120	0,066	1,820	0,068
Head of household aged 30 - 39	0,138	0,067	2,070	0,039
Head of household aged 40 - 60	0,286	0,079	3,610	0,000
University level education	0,363	0,096	3,770	0,000
High school level education	0,216	0,091	2,380	0,018
Primary school level education	0,114	0,077	1,490	0,137
Farmers	0,090	0,123	0,730	0,463
Dual activity (farmers+wage earners)	0,053	0,080	0,660	0,511
Pensioners	0,125	0,057	2,170	0,030
Self-employed	-0,143	0,158	-0,910	0,364
One child	-0,055	0,052	-1,060	0,288
Two children	-0,134	0,066	-2,030	0,042
Three children or more	-0,189	0,077	-2,450	0,014
constant |	-1,654	0,130	-12,700	0,000
rho |	0,414	0,018		

Log pseudolikelihood = -8403.3828, Prob > chi2=0.0000, Wald chi2(36)=1123.63, Nb. of obs=10390

Wald test of rho=0:chi2(1)= 396.875,Prob>chi2=0.0000, Number of obs =10390

Source: Computed from GUS Extended Labor Force Survey (1995)

Probability of working or hiring and buying on informal markets
Recursive bivariate probit model
marginal effects

variable	dy/dx	Std. Err.	Average
Working *or* hiring	0,484	0,089	0,179
Head of household unemployed	-0,095	0,013	0,038
Inactive	-0,026	0,014	0,361
Head of household aged less than 30	0,029	0,016	0,448
Head of household aged 30 - 39	0,032	0,016	0,240
Head of household aged 40 - 60	0,070	0,020	0,210
University level education	0,096	0,029	0,416
High school level education	0,053	0,023	0,295
Primary school level education	0,026	0,017	0,206
Farmers	0,022	0,031	0,126
Dual activity (farmers+wage earners)	0,013	0,019	0,372
Pensioners	0,029	0,014	0,114
Self-employed	-0,031	0,031	0,245
One child	-0,013	0,012	0,589
Two children	-0,030	0,014	0,090
Three children or more	-0,041	0,016	0,046

y =Pr(achat=1),, dy/dx is for discrete change of dummy variable from 0 to 1
at the average point, Number of obs:10390
Source: Computed from GUS Extended Labor Force Survey (1995)

Table B5

Panel AI Demand System, Estimates of the Change in Budget Shares for the Probability of Participation in Informal Markets

	Income Elasticity	Specifiction	Parameter	Likelihood
Food	0.6035	B	0.19772	
			(2.7542)	
	0.70354	W	0.216550	
			(15.43)	
	0.8663	QGLS	0.19392	282.90317
			(2.9178)	
Alcohol and tobacco	1.0814	B	0.03736	
			(1.74516)	
	0.6554	W	0.0102	
			(2.69)	
	1.1336	QGLS	0.038445	68.213459
			(1.99720)	
Clothing	1.0719	B	-0.05575	
			(1.48440)	
	1.19621	W	0.00281	
			(4.06)	
	1.1513	QGLS	-0.05221	104.66421
			(1.53260)	
Dwelling (charges)	0.7847	B	-0.05002	
			(0.8158)	
	0.90667	W	-0.0205	
			(-18,07)	
	0.8645	QGLS	-0.03783	69.384424
			(0.6985)	
Dwelling (equip)	2.1186	B	-0.01947	
			(0.67645)	
	2.348	W	0.0046	
			(0.81)	
	1.4644	QGLS	-0.030226	96.776936
			(1.21118)	
Health	1.055	B	-0.09882	
			(4.10473)	
	1.1525	W	-0.0339	
			(-7.29)	
	1.006	QGLS	-0.10067	69.719117
			(4.91130)	
Hygiene	1.0370	B	0.009655	
			(0.85566)	
	0.8222	W	-0.0107	
			(4.87)	
	0.8925	QGLS	0.008448	42.117644
			(0.85041)	
Education	1.1159	B	-0.01160	
			(0.60331	
	0.99828	W	0.0109	
			(3.17)	

	0.6575	QGLS	-0.004322	105.40015
Culture			(-0.24917)	
	1.7616	B	-0.15015	
		.		
			(4.6641)	
	1.312	W	-0.0525	
			(-8.41)	
	1.1516	QGLS	-0.13177	89.267688
			(4.3626)	
Transp. &com.	1.9853	B	0.10087	
			(2.6459)	
	1.81	W	0.0259	
			(3.36)	
	2.822	QGLS	0.06490	675.89938
			(1.6998)	

B= between estimates, W= within estimates, QGLS = Quasi Generalized Least Squares estimates
1.Student (robust) statistics in parenthesis
2.Income instrumented by total expenditure and socio-demographic variables.
3.Income elasticities computed at the average level of budget share
Source: Computed from GUS Household Budget panel (1994-1995) (4809 observation per year)

Table B6
Total Expenditure Elasticities
Panel QAIDS (system) estimates

	Participation coefficient	Non-participants	Partici pants	Participation coefficient	Non-participants	Partici pants
	Between estimates			Within estimates		
Food	-0.011 (.054)	0.604 (.020)	0.683 (.067)	$-0.2x10^{-7}$ ($5x10^{-7}$)	0.490 (.0271)	0.307 (.083)
Alcohol + tobacco	0.030 (.017)	0.999 (.006)	0.992 (.021)	ns	0.401 (.090)	-0.099 (.285)
Clothing	-0.019 (.028)	1.397 (.059)	0.967 (.209)	ns	1.058 (.091)	1.911 (.279)
Dwelling (charges)	-0.033 (.047)	0.890 (.040)	1.352 (.188)	ns	1.300 (.059)	1.414 (.244)
Dwelling (equipment)	$0.66x10^{-4}$ (.023)	1.871 (.059)	1.256 (.319)	ns	2.160 (.147)	2.249 (.386)
Transport and com.	0.94 (.031)	1.597 (.051)	1.843 (.175)	ns	1.594 (.077)	2.124 (.232)
Health	-0.020 (.022)	1.145 (.049)	1.019 (.223)	ns	1.266 (.071)	0.948 (.284)
Culture Education	-0.047 (.020)	0.897 (.039)	0.881 (.206)	ns	0.955 (.042)	1.011 (.231)
Miscellaneous	0.028 (.017)	1.757 (.102)	2.306 (.350)	$-0.8x10^{-8}$ ($.75x10^{-8}$)	2.164 (.158)	1.454 (.420)

Qaids Specification: $w_{iht} = \alpha_i + \Sigma_j \gamma_{ij} \ln p_{jt} + \beta_i \ln [m_{ht}/a(p_t)] + \{[\lambda_i/b(p_t)] \ln [m/a(p)]\}^2 + W_{ht}.\gamma_t + u_{iht}$ *with* $\ln a(p_t) = \alpha_0 + \Sigma_j \alpha_i \ln p_{it} + 0.5 \Sigma_i \Sigma_j \gamma_{ij} \ln p_{it}.\ln p_{jt}$ *and* $b(p_t) = \Pi_i p_{it}^{\beta i}$
Logarithm of total Expenditures instrumented.
Other determinants : logarithmic age of the head, proportion of children in the family, relative logarithmic prices, education and location dummies, quarter dummies for each year. The true price index is approximated by a Stone price index.
Estimation Method : by convergence, 75_{th} iteration estimated on pooled cross-sections, on the integrability parameter b(p). Additivity constrained.
ns : Not significant
Source: Computed from GUS Household Budget panel (1994-1995) (4809 observation per year)