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Informal Markets, Domestic Production and Demand Elasticities: A Case Study for Turkey

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Abstract

In this article, the size of informal economy is measured using an estimation of demand system including both monetary incomes and incomes from domestic production based on cross-sectional data covering 2003–2006 period in Turkey. Combining these two sources of income allows the computation of proxies of full prices at the individual level. The estimation of this demand system including resources from domestic production increases significantly the evaluated size of informal economy by one third. The full price elasticities estimated with respect to these proxies can be decomposed into time and monetary components. Estimates of the elasticities with respect to monetary prices and time-costs are significantly negative for all types of expenditures, so that economic policies can be efficiently applied to a taxation of monetary values using the estimates of those elasticities over sub-populations rather than elasticities computed on macro-data. Time-cost elasticities are shown to be larger in absolute value than their monetary price counter-part while for income effects the time-ressource elasticities are lower in absolute value than the monetary income ones. These results are important for public policy concerning informal work, showing a large difference in the substitution effect between time and money among household participating or not participating in informal activities.

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1. Introduction

The common thought is that income and price elasticities estimates in macroeconomic time-series suffer from lack of information compared to estimates on micro-economic data and cannot therefore be computed for different types of households. Also, such estimates of demand elasticities could be biased because they depend both on the permanent and the transitory nature of household total income. Similarly, price elasticity estimations may differ between households because the social classes do not participate in the same manner in the formal markets, informal or domestic activities. Furthermore, each household may decide to use differently incomes coming from different sources such that incomes from self-employment or wages. As a consequence, individuals may have different propensities while purchasing different types of goods. For instance, self-employment income may be preferred for the luxuries while regular wage income are spent for necessary goods (such is the treatment of durable vs. non-durable consumptions by Lyssiotou et al., 2004. Thus, the revenues from the informal and domestic production may also have a different effect on the household choices.

This paper has three-fold objectives. The aims are to measure the size of informal economy and to identify how earnings from informal activities and domestic production affect the estimated values of income and price elasticities and to investigate for which consumption group households are more likely to engage in informal activities. For this purpose, we use the full price model framework proposed by Gardes (2014). The advantage of this model is that allows to overcome aforementioned problems by eliminating the problem of lack of prices data in households surveys which allows, in turn, to estimate full income and full price elasticities using a complete system scheme. To this end, we use the method proposed by Aktuna-Gunes et al. (2014) to estimate the under reporting part of household income on micro cross-sectional data estimating a set of consumption functions (without prices) by using both the typical, purely monetary approach, and the full expenditures (money plus time) concept obtained by matching the classic family budget with the time use surveys. The current paper calculates consistent demand elasticities using micro data in a complete demand system framework (with full prices) in order to better investigate the possible differences in elasticity in price and income, once informal earnings and domestic production has been incorporated in the analysis. This analysis allows identifying which consumption groups have relatively more influence on informal activity participation decision.

The structure of paper is as follows: Section 1 presents the construction of full price and the specification of informal economy estimation model using full prices based on the demand approach extended to informal sector activities. Section 3 describes our sample and provides descriptive statistics for Turkey from the Household Budget Surveys between 2003 and 2006 and Time Use Survey for 2006 with short description of the matching procedure. Section 4 reports the empirical results and section 5 offers concluding remarks.

2. The model

2.1 The Full Price Concept

In case of complementary factors (market goods and time) used to produce domestic commodities named here activities, Becker's full price for i can be written:

$$p_{ih}^{B} = p_i + \omega_h \tau_{ih} \tag{1}$$

with τ_{ih} the time use necessary to produce one unit of that activity and ω the opportunity cost of time. Suppose that a Leontief technology allows the quantities of the two factors to be proportional to the activity:

$$\begin{aligned} x_{ih} &= \xi_{ih} z_{ih} \\ t_{ih} &= \theta_{ih} z_{ih} \end{aligned} \qquad \text{so that } t_{ih} = \tau_{ih} x_{ih} \text{ with } \tau_{ih} = \frac{\theta_{ih}}{\xi_{ih}}$$

This case corresponds to an assumption of complementarity between the two factors in the domestic technology[1], which allows calculating a proxy for the full price of activity i by the ratio of full expenditure (monetary expenditure and the value of time defined as time use per unit of the commodity multiplied by the opportunity cost of time ω) over its monetary component:

$$p_{ih}^{f} = \frac{\left(p_{it} + \omega_{ht}\tau_{ht}\right) x_{ih}}{p_i x_{ih}} = \frac{p_{it} + \omega_{ht}\tau_{ht}}{p_i} = 1 + \frac{\omega_{ht}\tau_{ht}}{p_i} = \frac{1}{p_i} p_{ih}^{B} \tag{2}$$

Under the assumption of a common monetary price p_i for all households in a survey made during the same period, this ratio contains all the information on the differences of full prices between households deriving from their opportunity cost for time ω_h and the coefficient of production τ_{ih}. If the monetary price p changes between households or periods, the full price can be computed as the product of this proxy p_{ih}^{B} with p_i: $p_{ih}^{B} = p_i p_{ih}^{f}$. With these definitions, it is possible to measure the full prices, observing only monetary and full expenditures by equation (1).

The market wage net of taxes have been used to calibrate the opportunity cost of time (see, e.g., Gardes and Starzec, (2015) for discussion on this subject).

2.2 The Demand System

Following the methodology based on the analysis of the household consumption behavior proposed by Pissarides and Weber (1989), Lyssiotou et al. (2004), Fortin et al. (2009) and Aktuna-Gunes et al. (2014), it is supposed in this paper that income sources other than self-employment and wage incomes have been perfectly reported since in Turkey the tax is deduced from these incomes. On the contrary, self-

[1] An alternative hypothesis based on the substitutability between the two factors is discussed in Alpman and Gardes, 2016.

employment income and wage worker incomes can be under reported. The true value of income (Y*) is thus divides into three sources denoted *a, s, r* which respectively correspond to other income sources, wages and self-employment income. The proportions of wage and self- employment incomes vary a lot between 2003 and 2006, from 25.1%-50.7% in 2003 to 21.4-58.9% in 2006.

The total (true) income is thus supposed to be a weighted sum of these three sources:

$$Y_h^* = \sum_{m=a,s,r} \theta_m Y_{mh} \tag{3}$$

This equation implies that the true income must be equal to the sum of the observed incomes (Y_a, Y_s, Y_r) multiplied by their corresponding factors (θ_a, θ_s, θ_r), where we suppose θ_r, $\theta_s \geq 1$ (i.e., under reporting[2]) and $\theta_a = 1$ (correct observation of the other incomes). It allows us to calculate the size of the underground economy and the saving tendencies with respect to the under reporting part of declared incomes by an estimation of θ_r and θ_s. In order to impose the constraints on the θ_r and θ_s parameter, Fortin et. al (2009) propose to express it by $(1+e^k)$ where k is a parameter estimated by the model. The true values of self-employment and wage income thus write $Y_r^*=(1+e^k)Y_r$ and $Y_s^*=(1+e^l)Y_s$.

Finally, the sum of each source of income can be determined as a ratio of the reported total income: $y_m = Y_m/Y$, where Y is the sum of other sources as fees, government transfers, etc. as well as wages and self-employment incomes. Following the model proposed by Aktuna-Gunes et al. (2014; based on Banks et al. [1997]), we consider all goods and services with full price values in a quadratic demand system:

$$\begin{aligned} w_{ih} = \alpha_i + \sum_j \alpha_{ij} Z_{jh} + \sum_{n=1}^{3} \lambda_{in} (y_{r,s})^n + \beta_{1i} \left[\ln Y_h + \ln\left(\sum_{m=a,s,r} \theta_m y_m \right) \right] \\ + \beta_{2i} \left[\ln Y_h + \ln\left(\sum_{m=a,s,r} \theta_m y_m \right) \right]^2 + \sum_j \gamma_{ij} \log p_{jh}^f + e_{ih} \end{aligned} \tag{4}$$

where w, π, Z, represent respectively the budget share, the full prices and the household characteristics vector (which allows us to take into account the heterogeneity of preferences), and y_m the tree components of income.. We cannot expect that the individuals from different social groups have the same reaction in consumption and saving choices with respect to the different types of incomes especially when there is uncertainty about these revenues. In accordance with Lyssiotou et al. (2004), we thus introduce in each equation the powers of incomes r and s ($\sum^3_{n=1} \lambda_{in} (y_{r,s})^n$) in order to reflect the relative importance of self-employed and wage incomes in the total household's income. The purpose of this expression

[2] According to the research conducted by Republic of Turkey Social Security Institution in 2011, 75% among wage workers declared a minimum wage lower than their actual wage rate. The disposable income of regular employee represents 42.8%, 54.5%, 57%, 58.9% in total GDP respectively for the years between 2003–2006.

is to diminish any possible confusion between consumption heterogeneity and the phenomenon of the under-reported part of self-employed and wage earners' income.

The Demand System (4) is estimated with a pre-determined Stone price index. All parameters $(\alpha, \beta, \gamma, \lambda, \theta)$ of equation (4) are identified. The demand system is estimated under additivity, symmetry and homogeneity constraints. The negativity is verified for all the estimated own full price elasticities.

The correction proposed by Pashardes (1993) for linearized Almost Ideal Demand System is used to calculate the price elasticities in this case.

2.3 Income Elasticity

Two separate optimizations are supposed to exist for monetary and for time allocation. In this case the budget shares for full expenditure could not be computed as the average of their respective shares due to the nonlinearity of demand functions.

With w_{im}, w_{it}, w_{is} respectively monetary, time and full budget shares for commodity i, the full income elasticity E_{if} is computed in terms of estimated monetary and time elasticities (Gardes, 2014):

$$E_{if} = E_{im} \frac{w_{im}}{w_{if}} \cdot \frac{1}{1+d} + E_{it} \frac{w_{it}}{w_{if}} \cdot \frac{d}{1+d} \tag{5}$$

where d is the derivative of the temporal income over the monetary income. This d in our estimation corresponds to $d = 0.761(Y_t/Y_m)$.

The second problem is the quality effects which are likely to exist in full prices and expenditure data (Gardes, 2014): An increase (in the cross-section dimension i.e. between two households) of the full price for commodity (activity) i may result either from the difference (between the two agents) of the opportunity cost ω or from the difference of their time allocated to activity i. Both causes may increase the quality of this activity, by means of an increased productivity (which can be supposed to be positively related to ω) or of the time devoted to i. This endogenous quality appears in the same form as in Deaton's technique to estimate price-elasticities on local prices after removing the quality incorporated in unit values (which is the ratio of expenditures over quantities consumed). In our matched dataset, local prices are replaced by the individual full prices for each household. These quality effects are corrected by a procedure inspired by Deaton's method (1988; see also Gardes [2014]) where similar households are supposed to have the same production function for domestic activities, and therefore the same full price for these activities.

2.4 Price Elasticity

Full price elasticities are computed by means of price coefficients and of the demand system parameters as follows:

$$E_{x_i / p_j^f} = \frac{\hat{\gamma}_{ij}}{\overline{w}_i} + \overline{w}_j - \delta_{ij} \tag{6}$$

where δ_{ij} is the Kronecker index. Therefore, following Becker (1965) and De Vany (1974), full price elasticities can be directly obtained as follows:

$$E_{x_i/p_j} = E_{x_i/p_j^f} \frac{p_j x_j}{p_i^f x_j} \tag{7}$$

$$E_{x_i/t_j} = E_{x_i/p_j^f} \frac{w\tau_j x_j}{p_i^f x_j} \tag{8}$$

3. The Dataset

We use two household surveys: the Time Use Survey (TUS) and the Household Budget Surveys (HBS) from Turkish Statistical Institute (TURKSTAT). The Household Budget Surveys have been conducted on a total of 2 160 monthly and 25 920 annually samples households in 2003 and on a total of 720 monthly and 8640 annually samples households in 2004, 2005 and 2006. In the 2006 Time Use Survey, approximately 390 households were selected each month giving a total of 5070 households over the whole year. Within these households 11 815 members aged 15 years and over were interviewed and were asked to complete two diaries – one for a weekday and one for a day on the weekend – recording all of their daily activities within 24 hours at ten-minute intervals. This 2006 Time Use Survey is matched independently with the four Family Budget Surveys realizing a repeated cross-section of monetary and time expenditure data.

3.1 Statistical Matching and Valuation of Time

We combine the monetary and time expenditures into a unique consumption activity at the individual level. We proceed with the matching of these surveys by regression on similar exogenous characteristics in both datasets as age, matrimonial situation, possession of cell phone, home ownership, number of household members, geographical location separately for the head of household and the wife[3].

More precisely, we estimate 8 types of time use at Time Use Survey (TUS) which are also compatible with the available data from Household Budget Survey (HBS) as follows:

- Food Time (TUS) with Food Expenditures (HBS)
- Personal Care and Health Time (TUS) with Personal Care and Health Expenditures (HBS)
- Housing Time (TUS) with Housing Expenses (HBS)
- Clothing Time (TUS) with Clothing Expenditures (HBS)
- Education Time (TUS) with Education Expenditures (HBS)

[3] The imputation of the time use data on the household expenditure survey was carried out using the Tobit regression on households with a positive time use score for their activities observed in time use survey. The correction for selection bias was made by the usual two step Heckman procedure.

- Transport Time (TUS) with Transport Expenditures (HBS)
- Leisure Time (TUS) with Leisure Expenditures (HBS)
- Other Time (TUS) with Other Expenditures (HBS)

The food time consists only of cooking because it is not possible to separate eating and purchasing activity from Personal Care in the time use survey. Care time consists of personal care, commercial-managerial-personal services, helping sick or old household person and eating activity. Housing time corresponds to home care, gardening and pet animal care, replacement of house-constructional work, repairing and administration of household. Clothing time consists of washing clothes and ironing. Education Time includes study (education) and childcare. Leisure Time corresponds to voluntary work and meetings, social life and entertainment such as culture, resting during holiday, sport activities, hunting, fishing, hobbies and games, mass media like reading, TV/Video, radio and music. Other Time includes employment searching times.

3.2 Valuation of time

Given that individuals spend their time in the production of goods and services and that time has a cost, we consider the full expenditure of households as the sum of their monetary expenditure plus the opportunity cost of the domestic production time. Two possible opportunity cost methods for the valuation of time spent on domestic activities could be used: the first method implies imputing the average household's wage net of taxes for working and non-working individuals[4]. The second method imputes the same minimum wage rate for all households. In this paper, the monetary value of time expenditures is calculated using the minimum wages for each year deflated on the base year 2003[5].

4. Empirical Results

4.1 The size of informal Economy

We estimate the complete demand system (4) by integrating full prices, using the Generalized Method of Moments (GMM) with, first monetary expenditure from formal labour, then extended monetary income (from formal and informal work) and finally extended full income (including the monetary value of domestic activities).[6]

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[4] which supposes that domestic time use is perfectly exchangeable with market labor. The underlying wage rate of households that do not work is estimated by a two-steps Heckman procedure with a probit equation for participation.

[5] The opportunity cost may rather be between these two values (see the discussion in Gardes and Starzec, 2014 and Gardes, 2014).

[6] Estimations of the model for full expenditure and exclusive monetary expenditure from the pooled cross-sectional data covering the period of investigation 2003-2006, for self-employed and wage earners are available on request (Aktuna-Gunes et al., 2014). The

The size of informal economy for different types of incomes (self-employment, wages) both for monetary and full expenditure approaches is computed by scaling up the under-reporting parameters *k* and *l* with share of self-employers and wage-earners' income that contributes to the GDP. The results are presented in Table I.

Table I:
The Size of Informal Economy with Full Prices (2003-2006)

Year	Under reporting Parameters		2003	2004	2005	2006	Average
	k	*l*					
Size of informal economy for monetary expenditure estimation (SE)[a]	1.58 *** (0.316)	-	39,64%	41,96%	40,89%	33,76%	39,07%
Size of informal economy for monetary expenditure estimation (WE)[b]	-	0.48** (0.149)	24,34%	26,16%	27,36%	28,27%	26,53%
Size of informal economy for full expenditure estimation (SE)[a]	1.91 ** (0.852)	-	47,92%	50,73%	49,43%	40,82%	47,22%
Size of informal economy for full expenditure estimation (WE)[b]	-	0.58*** (0.248)	29,41%	31,61%	33,06%	34,16%	32,06%

***p<0.01, **p<0.05, *p<0.1
a: Self Employers; b: Wage Earners
Standard errors in parenthesis
Sources: Household Budget Surveys (2003, 2004, 2005, 2006) and Time Use Survey (2006)

The corresponding size of informal economy for the monetary expenditure approach based on self-employed under-reporting decreases in the period considered (2003-2006) from 39.6% to 33.8%. The full expenditure approach yields larger shares, also diminishing from 47.9% to 40.8% of GDP in the same period. On the contrary the under-reporting in incomes from wages rises from 24.3% to 28.3% between 2003 and 2006 for the monetary expenditure approach and from 29.4% to 34.2% for the full expenditure approach. Both estimations of informal economy using monetary and full expenditures are around two third of the GDP, slightly higher in 2004-2005 when compared to 2003 and 2006. We can conclude that domestic activity leads to a significant increase in the under reporting-income ratio and thus in the size of the informal sector (around +20%) both for self-employers and wage-earners. The change in this size observed in 2006 is due to the decrease of the proportion in income of independent workers and the increase of the proportion of wage-earners' income in GDP: by -14.4% and +16.1% respectively.

4.2 Demand Elasticities

The elasticities for eight commodity groups are calculated on the basis of the proxies of full prices. One of the goals of this paper is to provide consistent parameters estimates reflecting the consumption behavior when informality exists.

The first three columns of Tables II and III represent standard monetary, time and full income elasticities while the last three ones underneath illustrate the impact of the informality on the results. Income elasticities have been computed, first using

exogeneity of instruments is tested by the Stock-Yogo test which rejects the presence of weak instruments.

usual households' monetary incomes, second these incomes augmented by the monetary value of their domestic production, and finally adding incomes from informal activities.

Extended monetary elasticities indicate that only food, housing are necessary while the group of other expenditures is also necessary for standard monetary income estimates. Therefore, once the domestic activities are included into income, full elasticity results imply more inelastic demand for, personal care and health, leisure.

Table II:
Income Elasticities

Commodity Groups	Monetary	Time	Full	Extended Monetary	Extended Time	Extended Full
Food	0.866 (0.0163)	0.774 (0.0011)	0.938 (0.0201)	0.815 (0.0293)	0.729 (0.0039)	0.884 (0.0238)
Housing	0.971 (0.0111)	0.826 (0.0090)	1.064 (0.0071)	0.910 (0.0192)	0.796 (0.0019)	1.001 (0.0181)
Personal Care+Health	1.123 (0.0134)	0.977 (0.0026)	0.961 (0.0104)	1.208 (0.0125)	0.982 (0.0030)	0.983 (0.0104)
Clothing	1.285 (0.0215)	0.735 (0.0010)	1.312 (0.0084)	1.211 (0.1873)	0.671 (0.0176)	1.233 (0.1547)
Education	1.034 (0.0085)	0.984 (0.0104)	1.045 (0.0039)	1.357 (0.0319)	1.152 (0.0242)	1.306 (0.0403)
Transport	1.296 (0.0176)	1.053 (0.0083)	1.163 (0.0049)	1.397 (0.0129)	1.066 (0.0013)	1.214 (0.0112)
Leisure	1.251 (0.0223)	0.980 (0.0195)	0.924 (0.0355)	1.312 (0.0171)	0.992 (0.0234)	0.938 (0.0259)
Others	0.789 (0.0262)	1.188 (0.0260)	1.045 (0.0162)	1.069 (0.0159)	1.170 (0.0210)	1.088 (0.0134)

Sources: Household Budget Surveys (2003, 2004, 2005, 2006) and Time Use Survey (2006). Standard Errors in Parenthesis. Variances were corrected for generated regressors by bootstrap. Extended income includes incomes from informal labor. Full income includes the monetary value of domestic production.

The addition of income from domestic production diminishes this volatility by 32% for formal monetary income and 43% including monetary incomes. On the contrary they increase by 34% when comparing extended monetary income elasticities to the monetary income elasticities (+29% including informal incomes). That shows that informal activities implies different types of expenditures compared to formal work. Also, domestic production tends to equalize the distribution of income across the different consumptions.

The full and extended full income elasticity results for Turkey deserve particular attention. Income elasticities using extended full prices for personal care and health, education, transport, leisure, others are larger than those estimated without informal incomes. The main idea that can be gleaned from this result is that households are more likely to spend their informal earnings in these groups of commodities.

This may also be indicated by the level of own-price elasticities reported in Table III. Monetary and extended monetary estimations show indeed that households are more sensitive to price variation for necessary goods (food, housing and clothing). These results are in line with the fact that households participating to the informal economy have stronger reactions to prices. However, the monetary price elasticities are less elastic than the time ones, although this tendency changes

for the estimation on extended income. Households may be more likely to compensate the loss due to monetary prices changes, by increasing domestic activities and decreasing monetary expenses. In this case, education, transport, personal care with health, leisure and other expenditures would be less elastic. Compensation by time spent in domestic activities for these groups of commodities is low. This result is thus coherent with our income elasticity findings. It shows that households use domestic production to overcome constraints on their monetary resources.

Table III:
Decomposition of Compensated Own-Price Elasticities

Commodity Groups	Monetary	Time	Full	Extended Monetary	Extended Time	Extended Full
Food	-0,237	-0,611	-0,849	-0,631	-0,217	-0,849
	(0,0088)	(0,0019)	(0,0079)	(0,0271)	(0,0068)	(0,0132)
Housing	-0,246	-0,603	-0,850	-0,666	-0,183	-0,850
	(0,0066)	(0,0095)	(0,0031)	(0,0146)	(0,0022)	(0,0083)
Personal Care+Health	-0,100	-0,747	-0,847	-0,199	-0,648	-0,847
	(0,0066)	(0,0062)	(0,0031)	(0,0062)	(0,0069)	(0,0037)
Clothing	-0,211	-0,761	-0,972	-0,552	-0,419	-0,972
	(0,0042)	(0,0059)	(0,0020)	(0,0608)	(0,0011)	(0,0345)
Education	-0,046	-0,994	-0,991	-0,108	-0,882	-0,991
	(0,0319)	(0,0091)	(0,0045)	(0,0545)	(0,0028)	(0,0327)
Transport	-0,156	-0,766	-0,922	-0,329	-0,593	-0,922
	(0,0033)	(0,0092)	(0,0022)	(0,0046)	(0,0013)	(0,0036)
Leisure	-0,045	-0,657	-0,703	-0,082	-0,620	-0,703
	(0,0076)	(0,0085)	(0,0072)	(0,0090)	(0,0102)	(0,0080)
Others	-0,093	-0,769	-0,862	-0,178	-0,684	-0,862
	(0,0030)	(0,0046)	(0,0110)	(0,0096)	(0,0044)	(0,0048)

Sources: Household Budget Survey (2003, 2004, 2005, 2006) Time Use Survey (2006)
Standard errors in parenthesis. Variances were corrected for generated regressors by a specific bootstrap. Extended income includes incomes from informal labor. Full income includes the monetary value of domestic production.

The propensity to participate in informal activities may depend, either on the poverty status of the household, or on low prices for goods bought in the informal economy. Households having relatively low income or price elasticities for those commodities which are necessary (thus characterized by low income elasticities) may be inclined to participate more in informal activities because of the subsistence problem shown by their low elasticities. This implies that, the estimation of income and price elasticities for sub-populations (or by household using local non-parametric methods) may be useful to predict the participation of households types to informal activities.

5. Conclusion

The full price approach solves the problem of the availability of price information in microeconomic data. In this work aggregated commodity groups were analyzed from two different perspectives: first, we measure monetary and full expenditures allowing to take into account the domestic production through the incorporation of time use in family expenditures and its participation in informal activities. Second,

the enlarged version of Lyssiotou et al. (2004) model allows the estimation of the size of the informal economy by estimating of a complete demand system using proxies of full prices. Neglecting informal activities results in an underestimation of total output by 47.2% and 32.1% using full expenditure respectively for self-employed and wage earners (39.1% and 26.5% respectively for monetary expenditure only). This estimation show that informal activities exits also for formal wage earners in Turkey.

Full price elasticities were decomposed into monetary price and time elasticities. Time elasticities are greater in absolute value than monetary ones, which shows that the substitution between monetary and time resources is not uniform across the consumption structure. On the contrary, households working on informal markets are characterized by a greater sensibility to monetary prices than those which work only on the official labour market. This may be due to the substitution between time and monetary resources which could be greater when working both on the official and informal markets. This result has a prominent consequence in terms of economic policy: taxation directly influences households' expenditures by means of the effect of changes in monetary incomes and prices, while no usual economic policy applies to the allocation of time across domestic activities: taxation of wages may only change the official labour supply together with an effect for the allocation of private time across domestic activities which is difficult to estimate (see Gardes [2014] for an estimation of the elasticities of consumption over the opportunity cost of time). Therefore, if informal activities increase the effect of monetary resources over consumption (compared to changes in time allocation), it makes taxation policies more efficient, because taxation influences both the allocation of monetary income and the household's participation to informal labour markets. Economic policies thus recover some efficiency when they are applied considering the potential participation of households to the hidden economy.

Additional to this estimation, we can estimate demand elasticities for the sub-populations, such as the self-employed and wage earners (see,e.g, Aktuna-Gunes et al. [2014] for detailed results on sub-populations). Thus, this model allows the estimation of informal activities for different sub-populations which may be used in specific public polices targeting informality, poverty and inequality issues.

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Appendix:

Table IV:
Descriptive Statistics (Expenditures and Consumption Variables)

Budget Shares	Variable	N	Mean	Std Dev	Minimum	Maximum
MONETARY EXPENDITURES	Food	34413	0.3139	0.1528	0	1.0000
	Personal Care (with Health)	34413	0.0782	0.0756	0	0.8362
	Housing	34413	0.3336	0.1398	0	1.0000
	Clothing	34413	0.0586	0.0703	0	0.5893
	Education	34413	0.0117	0.0465	0	0.8323
	Transport	34413	0.0799	0.0982	0	0.8723
	Leisure	34413	0.0586	0.0570	0	0.8859
Budget Shares	Variable	N	Mean	Std Dev	Minimum	Maximum
FULL EXPENDITURES	Food	34413	0.1600	0.0744	0.0154	0.7459
	Personal Care (with Health)	34413	0.1441	0.0427	0.0071	0.6846
	Housing	34413	0.1716	0.0896	0.0261	0.9040
	Clothing	34413	0.0327	0.0375	0.0004	0.4431
	Education	34413	0.0097	0.0282	0.0001	0.7469
	Transport	34413	0.0825	0.0619	0.0070	0.7838
	Leisure	34413	0.2678	0.0796	0.0177	0.8674
Household income share :	Variable	N	Mean	Std Dev	Minimum	Maximum
MONETARY	Self employment / Total Income	34413	0.2682	0.4073	0	1.0000
	Wage / Total Income	34413	0.4689	0.4225	0	1.0000
Household income share :	Variable	N	Mean	Std Dev	Minimum	Maximum
EXTENDED MONETARY	Self employment / Total Income	34413	0.2906	0.4235	0	1.1278
	Wage / Total Income	34413	0.5433	0.4734	0	1.1219
Household income share :	Variable	N	Mean	Std Dev	Minimum	Maximum
EXTENDED FULL	Self employment / Total Income	34413	0.2956	0.4287	0	1.1352
	Wage / Total Income	34413	0.5446	0.4746	0	1.1423

Household income:	Variable	N	Mean	Std Dev	Minimum	Maximum
	Total Monetary Income*	34413	800.55	374.59	119.280	3503.10
	Total Monetary Income+Informal Income**	34413	1774.68	902.03	240.288	9745.43
	Total Full Income+Full Informal Income***	34413	1825.93	917.10	241.620	10684.08

**Total Monetary Income: Monetary income from working in the labor market*
***Informal Income: Estimated from equation (4) using monetary expenditures*
****Full Informal Income: Estimated from equation (4) using full expenditures*

Table V:
Descriptive Statistics (Socio-economic Variables)

Demographic characteristics:	Variable	N	Mean	Std Dev	Minimum	Maximum
	No. of children	34413	1.4072	1.4372	0	13
	Children smaller than age of 16	34413	0.6440	0.4788	0	1
	Number of households members	34413	4.3325	1.9661	1	23

Occupation dummies:	Variable	N	Mean	Std Dev	Minimum	Maximum
	Husband in white collar occupation	34413	0.2075	0.4055	0	1
	Husband in blue collar occupation	34413	0.3681	0.4823	0	1
	Husband in other types of occupation	34413	0.4241	0.4942	0	1
	Husband with out contract	34413	0.0314	0.1745	0	1
	Husband worker at the company (under	34413	0.5379	0.4985	0	1
	Husband wage worker	34413	0.5210	0.4995	0	1
	Husband formal worker	34413	0.5290	0.4991	0	1
	Wife in white collar occupation	34413	0.0298	0.1700	0	1
	Wife in blue collar occupation	34413	0.0505	0.2191	0	1
	Wife in other types of occupation	34413	0.9233	0.2659	0	1
	Wife with out contract	34413	0.0156	0.1242	0	1
	Wife worker at the company (under 10 v	34413	0.2061	0.4045	0	1
	Wife wage worker	34413	0.0550	0.2279	0	1
	Wife formal worker	34413	0.0522	0.2224	0	1

Regional location dummies:	Variable	N	Mean	Std Dev	Minimum	Maximum
	Area (urban = 1)_Dummy	34414	0.6651	0.4719	0	1

Durables and luxury goods :	Variable	N	Mean	Std Dev	Minimum	Maximum
	Car	34413	0.2622	0.4398	0	1
	Television	34413	0.9775	0.1481	0	1
	Good heating system (includes central he	34413	0.1754	0.3803	0	1
	Cabel TV	34413	0.0373	0.1895	0	1
	Computer	34413	0.1213	0.3265	0	1
	Internet	34413	0.0426	0.2020	0	1
	Refrigerator	34413	0.9797	0.1409	0	1
	Deep freezer	34413	0.0411	0.1986	0	1
	Dish machine	34413	0.2219	0.4155	0	1
	Oven	34413	0.0496	0.2171	0	1
	Clima	34413	0.0385	0.1924	0	1
	Cell phones	34413	0.6761	0.4679	0	1

Housing:	Variable	N	Mean	Std Dev	Minimum	Maximum
	Home ownership	34413	0.6673	0.4711	0	1
	Owing house-resting debt	34413	0.0271	0.1624	0	1

Table VI: Results of Self Employment for Monetary Expenditure Based on the Complete Demand System; All Population (GMM) 2003-2006

Variables	Food	t- ratio	Pc+Health	t- ratio	Housing	t- ratio	Clothing	t- ratio	Education	t- ratio	Transport	t- ratio	Leisure	t- ratio
Constant	24.27391	6.25	2.257977	1.19	18.80546	3.90	0.58871	0.49	0.216534	0.98	0.024431	0.02	2.737177	2.12
2003	-		-		-		-		-		-		-	
2004	-0.40827	-6.76	0.037563	1.55	-0.11442	-2.08	0.044333	2.88	0.010848	3.48	0.055612	2.74	0.03008	1.82
2005	-0.03954	-1.37	0.031155	3.82	0.119515	5.58	0.009577	1.88	-0.00163	-1.60	0.023678	3.48	0.030596	5.50
2006	-0.25349	-5.84	0.002037	0.26	-0.02741	-0.80	0.019118	1.94	0.003224	1.68	0.014075	1.09	0.006037	0.57
Number of households members	0.022113	4.83	-0.00726	-3.24	-0.02492	-4.93	-0.00282	-1.98	-0.00078	-2.79	-0.0067	-3.53	-0.00555	-3.62
Home ownership	0.052861	4.71	-0.01803	-3.72	-0.00186	-0.19	-0.00441	-1.40	-0.00136	-1.72	-0.01167	-2.79	-0.0106	-3.20
Husband in white collar occupation	0.172647	5.37	-0.00415	-0.27	0.083627	2.36	0.001115	0.11	-0.00412	-1.99	-0.01296	-1.01	0.002538	0.24
Husband in blue collar occupation	0.192601	6.27	0.017928	1.19	0.152495	3.83	0.005384	0.56	-0.00111	-0.61	-0.00454	-0.36	0.016018	1.56
Wife in blue collar occupation	-0.12797	-3.69	-0.01699	-0.98	-0.07682	-2.08	-0.00529	-0.48	-0.00007	-0.03	-0.00233	-0.16	-0.00641	-0.54
Wife in white collar occupation	-0.25524	-4.89	-0.00525	-0.23	-0.13052	-2.64	0.015658	1.06	0.00831	2.39	0.024395	1.24	0.008256	0.52
Wife worker at the company (under 10 worker)	0.339502	6.71	-0.0576	-2.95	0.007589	0.19	-0.04767	-3.83	-0.00979	-3.81	-0.06622	-4.07	-0.03946	-2.97
Area (urban = 1)	-0.30155	-7.45	0.113411	7.78	0.222445	6.33	0.044899	4.85	0.014464	7.04	0.064267	5.28	0.07434	7.50
Husband wage worker	-0.1534	-2.17	0.234035	7.78	0.386199	4.59	0.127337	6.79	0.027751	6.43	0.179113	7.29	0.156177	7.60
Wife wage worker	-0.03142	-0.99	0.061801	4.17	0.048456	1.61	0.026465	2.76	0.00402	1.85	0.045285	3.55	0.020819	2.04
Husband with out contract	-0.01624	-0.21	0.221245	6.59	0.486511	4.86	0.13611	6.54	0.029004	6.24	0.171558	6.26	0.164472	7.19
Computer	-0.10364	-4.33	-0.02144	-1.84	-0.12747	-4.46	-0.01218	-1.64	0.005288	3.06	-0.00393	-0.40	-0.0022	-0.28
Car	0.005434	0.39	0.000756	0.11	-0.00844	-0.56	0.002432	0.58	-0.00018	-0.19	0.069203	12.19	0.004728	1.04
Good heating system	-0.09763	-5.70	0.005823	0.87	0.028374	2.00	0.009918	2.28	0.00437	3.91	0.008768	1.52	0.006399	1.38
Number of rooms in the house	0.015125	1.68	-0.00432	-1.04	0.015079	1.75	0.000061	0.02	-0.00026	-0.49	-0.00399	-1.13	-0.00005	-0.02
Children under than 16 years old	-0.07046	-3.60	0.037755	4.89	0.071188	3.90	0.028283	5.75	0.005597	5.10	0.03148	4.82	0.027281	5.17
yr	-17.2272	-5.31	-5.39331	-3.13	-19.8602	-3.85	-2.44508	-2.26	-0.1722	-0.86	-3.00981	-2.11	-3.45851	-2.94
yr^2	31.06959	3.19	25.3528	4.97	69.98399	4.26	13.60385	4.28	1.786873	2.99	17.40005	4.13	16.81772	4.85
yr^3	-13.5456	-1.96	-20.1576	-5.84	-50.4423	-4.41	-11.2943	-5.26	-1.63369	-3.96	-14.5758	-5.10	-13.4833	-5.75
Y	-5.65383	-6.05	-0.47894	-1.05	-4.44109	-3.84	-0.13272	-0.46	-0.04065	-0.76	0.01878	0.05	-0.62874	-2.02
Y^2	0.335709	6.01	0.026509	0.97	0.261863	3.83	0.007292	0.43	0.002471	0.77	-0.00239	-0.11	0.037114	2.00
Full Price	0.019172	1.22	-0.04846	-37.69	-0.09752	-7.33	-0.03289	-75.20	-0.02225	-14.94	-0.03163	-46.65	-0.03425	-40.53

Under-reporting Self-employment (Yr)	Parameter	t ratio
k (under reporting ratio for *yr*)	1.58	5.00

Stock-Yogo weak ID test (endogenous regressor: income)	(Critical values)2SLS relative bias	>5%	>10%	>20%
Minimum eigenvalue statistic -F(17, 26173) = 15,36		21,31	11,49	6,36

Table VII: Results of Wage Earners for Monetary Expenditure Based on the Complete Demand System; All Population (GMM) 2003-2006

Variables	Food	t- ratio	Pc+Health	t- ratio	Housing	t- ratio	Clothing	t- ratio	Education	t- ratio	Transport	t- ratio	Leisure	t- ratio
Constant	-1.8069	-5.20	0.900295	6.32	1.837153	6.92	0.575209	2.72	0.269428	4.30	1.115957	5.32	1.428934	7.84
2003	-		-		-		-		-		-		-	
2004	0.04136	7.06	-0.01531	-6.12	0.002285	0.51	0.010465	2.96	0.001906	1.92	-0.02348	-6.37	0.004417	1.48
2005	0.126657	19.25	-0.00694	-2.62	0.043986	9.06	-0.00191	-0.54	-0.00627	-7.45	-0.01678	-4.41	0.019141	6.35
2006	0.057124	8.56	-0.00547	-3.98	0.014313	2.77	-0.02057	-5.21	-0.00793	-7.95	-0.01207	-3.01	-0.0238	-7.04
Number of households members	0.014977	12.55	0.001812	3.66	-0.02015	-21.71	-0.00045	-0.61	-0.00044	-2.46	0.002397	3.38	-0.0022	-3.50
Home ownership	0.003051	0.71	0.000028	0.01	-0.00747	-2.27	-0.0033	-1.31	-0.00087	-1.17	0.011958	4.26	-0.00766	-3.59
Husband in white collar occupation	-0.05035	-5.98	0.011505	3.15	-0.04337	-6.41	-0.0313	-5.80	-0.00785	-5.37	0.021307	3.98	-0.02846	-6.00
Husband in blue collar occupation	-0.05311	-7.08	0.013304	4.16	-0.02355	-3.98	-0.0364	-7.46	-0.00796	-6.54	0.013352	2.88	-0.02882	-6.81
Wife in blue collar occupation	-0.01739	-1.78	-0.00525	-1.17	-0.00082	-0.11	-0.00689	-1.17	-0.00073	-0.44	-0.00003	-0.01	-0.00252	-0.48
Wife in white collar occupation	0.011253	0.80	-0.0037	-0.57	-0.02602	-2.52	-0.00111	-0.14	0.004073	1.48	0.01388	1.46	0.004565	0.68
Area (urban = 1)	-0.07911	-16.25	0.022326	10.48	0.122093	29.78	0.004579	1.52	0.005432	7.43	-0.00745	-2.58	0.03523	13.55
Husband wage worker	-0.00141	-0.04	-0.09835	-6.37	-0.16667	-5.29	-0.31242	-11.41	-0.07475	-10.26	-0.1383	-6.54	-0.30912	-12.86
Wife wage worker	0.001073	0.09	0.024864	4.66	-0.01014	-1.16	0.016423	2.39	0.002638	1.36	0.00735	1.00	0.007689	1.30
Husband with out contract	-0.30168	-6.21	0.038487	1.85	-0.30565	-7.70	-0.37325	-11.20	-0.08098	-9.50	0.09378	3.16	-0.33303	-11.31
Computer	0.003514	0.51	-0.00768	-2.64	-0.02936	-5.88	-0.00617	-1.58	0.007917	6.21	-0.00395	-0.87	0.008479	2.60
Car	-0.01106	-2.60	-0.01264	-6.96	-0.03049	-9.51	0.00618	2.47	0.001454	2.01	0.0658	23.88	0.003761	1.80
Good heating system	-0.01332	-2.52	-0.01026	-4.47	0.047201	12.26	0.000402	0.14	0.002653	2.78	-0.00967	-2.77	-0.00153	-0.65
Number of rooms in the house	-0.01226	-5.12	-0.00035	-0.35	0.010967	5.90	0.003082	2.16	0.000422	1.14	0.000397	0.27	0.001817	1.49
Children under than 16 years old	0.038035	7.07	-0.02475	-10.80	0.035846	8.62	0.013346	4.00	0.001171	1.34	-0.03581	-10.38	0.006065	2.11
ys	6.691449	7.64	-1.83276	-4.71	5.68805	7.99	5.812538	10.34	1.254789	8.88	-3.20174	-5.60	4.984522	10.10
ys^2	-19.1817	-8.73	6.353886	6.46	-14.3414	-8.05	-13.0892	-9.36	-2.73523	-7.99	10.49505	7.17	-10.8084	-8.81
ys^3	12.86966	9.28	-4.58748	-7.38	9.044316	8.06	7.72424	8.79	1.578404	7.45	-7.41968	-7.96	6.214941	8.07
Y	0.570774	6.49	-0.18068	-5.00	-0.38528	-5.74	-0.14992	-2.82	-0.05883	-3.71	-0.2538	-4.77	-0.32775	-7.19
Y^2	-0.03483	-6.29	0.011321	4.98	0.024698	5.87	0.011246	3.41	0.004139	4.16	0.015817	4.71	0.022331	7.88
Full Price	-0.05615	-23.23	-0.01857	-27.23	-0.02832	-23.31	-0.02853	-61.38	-0.01907	-15.84	-0.0097	-11.25	-0.02484	-41.79

Under-reporting Wage Earners (Ys)	Parameter	t ratio
t under reporting ratio for ys)	0.48	3.22

Table VIII: Results of Self Employment for Full Expenditure Based on the Complete Demand System; All Population (GMM) 2003-2006

Variables	Food	t- ratio	Pc+Health	t- ratio	Housing	t- ratio	Clothing	t- ratio	Education	t- ratio	Transport	t- ratio	Leisure	t- ratio
Constant	-0.47579	-6.16	-0.22907	-6.91	-0.01809	-0.63	0.001717	0.13	-0.19759	-4.98	0.002532	0.07	0.117357	1.34
2003	-		-		-		-		-		-		-	
2004	0.005366	5.12	0.00131	3.17	0.001561	9.75	-0.00006	-0.67	-0.00037	-0.87	-0.00004	-0.17	0.004219	6.68
2005	0.075348	130.78	0.235708	1567.72	0.056245	378.89	0.010434	232.19	0.005639	46.48	0.091672	576.20	0.524302	1752.13
2006	0.091984	118.71	0.112093	872.83	0.066723	365.40	0.021827	255.93	0.021384	57.70	0.089508	413.82	0.485875	784.76
Number of households members	0.000214	3.60	-0.00002	-0.72	0.000133	5.15	0.000272	17.25	0.000162	3.89	-0.00009	-2.48	-0.00085	-10.05
Home ownership	-0.00051	-2.85	0.000191	2.26	0.000186	3.15	-0.00004	-1.49	-0.00046	-4.44	-0.00022	-2.63	0.000178	0.89
Husband in white collar occupation	0.000059	0.13	-0.00014	-0.65	0.000102	0.79	0.000401	6.09	0.000914	3.54	0.000941	4.45	-0.00242	-5.01
Husband in blue collar occupation	-0.00216	-5.35	-0.00121	-6.63	-0.00006	-0.31	0.000209	2.83	-0.00041	-1.73	0.000686	3.00	-0.00064	-1.28
Wife in blue collar occupation	-0.00161	-3.17	0.000481	2.37	0.000063	0.41	-0.00003	-0.36	-0.00032	-1.72	-0.00018	-0.69	-0.00144	-2.65
Wife in white collar occupation	0.003334	4.60	0.001897	5.53	0.000139	0.56	0.00005	0.41	0.001415	3.93	0.000547	1.38	-0.00183	-2.15
Area (urban = 1)	0.001821	1.98	0.00047	0.99	-0.00195	-6.23	-0.0007	-8.63	-0.00124	-2.99	-0.00024	-0.94	0.005279	8.22
Husband wage worker	-0.00175	-1.50	-0.0028	-3.53	-0.00168	-2.61	-0.00111	-4.69	-0.00424	-5.45	0.000948	1.39	0.010077	6.26
Wife wage worker	0.002726	4.45	0.000821	3.81	-0.00014	-0.85	-0.0001	-1.24	0.000284	1.27	0.000688	2.61	0.000818	1.39
Husband with out contract	-0.00499	-3.25	-0.0048	-4.35	-0.00207	-2.44	-0.00084	-2.67	-0.00446	-4.08	0.00142	1.59	0.010083	4.78
Computer	0.002619	5.70	0.001109	4.56	0.000618	3.22	0.000231	2.73	0.001296	4.96	-0.00025	-0.95	-0.00167	-2.88
Car	0.00009	0.53	-0.00022	-2.87	-0.00005	-0.73	0.000072	2.23	-0.00003	-0.39	0.000565	5.16	-0.00009	-0.40
Good heating system	0.001718	5.81	0.000315	3.35	0.00066	8.35	0.000109	2.65	0.000485	4.16	0.00012	1.02	-0.00031	-1.12
Number of rooms in the house	-0.00022	-1.74	-0.00015	-3.06	0.000109	2.79	0.000041	1.89	-0.00006	-0.93	-0.00007	-1.07	-0.00006	-0.37
Children under than 16 years old	0.00074	2.29	-0.00049	-3.09	8.832E-6	0.07	-0.00004	-0.84	0.000337	2.43	0.000625	4.54	0.000444	1.51
ys	0.104193	2.42	0.104346	4.70	0.036787	1.51	-0.02494	-3.24	-0.03198	-1.20	-0.15964	-6.60	0.099148	1.88
ys^2	-0.08883	-0.68	-0.33169	-4.61	-0.15795	-1.81	0.030453	1.26	0.015413	0.21	0.531028	6.94	0.081203	0.50
ys^3	-0.02707	-0.28	0.225393	4.33	0.122086	1.91	-0.0059	-0.35	0.011146	0.22	-0.37783	-7.05	-0.17771	-1.56
Y	0.119832	6.12	0.057348	6.73	0.004231	0.58	-0.00016	-0.05	0.051246	5.08	0.000975	0.10	-0.03366	-1.52
Y^2	-0.00735	-6.06	-0.00353	-6.66	-0.00022	-0.50	0.000012	0.06	-0.0032	-5.12	-0.00015	-0.25	0.002118	1.55
Full Price	-0.00302	-7.71	0.000287	3.79	0.000346	3.34	-0.0001	-12.15	7.788E-6	0.12	0.000056	1.41	0.000305	4.38

Under-reporting Self-employment (Yr)	Parameter	t ratio
k under reporting ratio for yr)	1.91	2.24

Table IX: Results of Wage Earners for Full Expenditure Based on the Complete Demand System; All Population (GMM) 2003-2006

Variables	Food	t- ratio	Pc+Health	t- ratio	Housing	t- ratio	Clothing	t- ratio	Education	t- ratio	Transport	t- ratio	Leisure	t- ratio
Constant	-0.10587	-9.35	-0.02989	-3.34	0.004343	0.43	-0.02294	-3.52	-0.09121	-4.48	0.031343	2.93	0.157264	4.40
2003	-		-		-		-		-		-		-	
2004	0.00163	52.34	0.000571	23.38	0.001598	43.29	0.000436	22.90	0.000219	4.74	0.000338	9.78	0.000323	4.02
2005	0.071794	1036.02	0.236018	6395.12	0.056363	1182.94	0.010473	340.24	0.006146	158.13	0.092052	2037.57	0.523701	4284.66
2006	0.087797	612.15	0.111847	2094.86	0.066252	480.32	0.022178	364.98	0.022782	87.43	0.090572	736.47	0.483255	1143.76
Number of households members	0.000208	15.96	0.000017	1.74	0.000054	4.61	0.000184	16.83	0.000125	3.89	0.000066	6.38	-0.00048	-10.48
Home ownership	-0.00025	-5.86	0.000108	3.20	0.00007	1.68	-0.00011	-5.23	-0.00037	-5.02	-0.00016	-4.01	0.000746	5.89
Husband in white collar occupation	0.000181	3.10	-0.00001	-0.30	0.000098	1.67	0.000073	2.31	0.000131	1.31	-0.00008	-1.25	-0.0001	-0.55
Husband in blue collar occupation	-0.00004	-0.81	-0.00005	-1.26	0.000119	2.53	-7.32E-6	-0.29	-0.00017	-1.94	-0.00005	-1.14	0.000214	1.36
Wife in blue collar occupation	0.000137	1.27	0.00024	1.67	0.000126	1.22	-0.00005	-0.96	-0.00028	-1.69	-0.00004	-0.32	-0.00015	-0.47
Wife in white collar occupation	0.00069	4.58	0.00014	0.78	0.000123	0.82	0.000235	2.91	0.000466	2.12	0.000097	0.53	-0.00123	-2.84
Area (urban = 1)	-0.00035	-7.65	0.0007	14.62	-0.00109	-19.08	-0.00007	-2.73	0.000202	2.70	-0.00024	-5.82	-0.00016	-1.27
Husband wage worker	0.000174	3.75	-0.00007	-2.07	0.000269	5.90	0.000181	7.80	0.000226	2.98	0.000198	4.44	-0.00051	-3.81
Wife with out contract	-0.00052	-2.89	0.000365	1.63	-0.00037	-1.82	-0.00022	-2.75	-0.00032	-1.30	0.00042	2.07	0.000677	1.57
Wife wage worker	-0.00006	-0.54	0.00045	2.96	0.000015	0.13	0.000025	0.41	0.000106	0.62	0.000324	2.17	-0.0001	-0.28
Husband with out contract	0.000204	1.26	-0.00012	-0.83	-0.00032	-2.13	0.000454	4.62	0.001476	4.10	0.000192	1.30	-0.00158	-2.83
Computer	0.000774	8.44	0.00009	1.27	0.0003	3.69	0.000204	4.45	0.000409	2.82	-0.00009	-0.93	-0.00096	-3.46
Car	0.000235	5.33	0.000059	1.78	0.000038	0.92	0.000024	1.10	-0.00014	-2.11	0.000387	8.55	0.000136	1.08
Good heating system	0.000306	4.79	0.000015	0.32	0.000561	9.52	0.000118	4.04	0.00007	0.78	-0.00006	-1.04	-0.00029	-1.68
Number of rooms in the house	0.000087	3.11	-0.00003	-1.44	0.000148	5.63	0.000013	0.84	-0.00008	-1.64	-0.0001	-4.02	0.000134	1.61
Children under than 16 years old	0.000074	1.62	-0.00024	-6.49	0.000193	4.62	0.000061	2.48	0.000429	5.97	0.000146	3.37	-0.00058	-4.32
ys	-0.09021	-5.13	0.022122	3.48	-0.07084	-7.78	-0.01813	-5.13	0.040327	3.13	-0.06723	-1.15	0.084088	1.31
ys^2	0.261785	6.86	-0.04399	-2.77	0.187771	7.52	0.043045	4.29	-0.09771	-3.05	0.233639	2.26	-0.20432	-2.13
ys^3	-0.17591	-7.75	0.023843	2.27	-0.12143	-7.50	-0.02544	-3.81	0.063616	2.87	-0.16536	-3.00	0.118012	2.41
Y	0.029593	9.37	0.008281	3.32	-0.00118	-0.42	0.006259	3.45	0.025621	4.51	-0.00847	-2.84	-0.04451	-4.47
Y^2	-0.00205	-9.32	-0.00058	-3.35	0.000078	0.39	-0.00043	-3.45	-0.0018	-4.55	0.000557	2.69	0.00313	4.51
Full Price	-0.00046	-15.42	0.000049	4.16	0.000179	13.08	-0.00009	-14.77	-0.00009	-2.28	0.000223	19.71	0.000373	22.17

Under-reporting Wage Earners (Ys)	Parameter	t ratio
t under reporting ratio for ys)	0.58	2.33

Table X: Full Cross-Price Elasticities, Whole Population

Cross-Price Elasticities								
Commodity Groups	Food	Housing	Personal Care and Health	Clothing	Education	Transport	Leisure	Others
Food	-1,080	0,214	0,119	0,052	0,008	0,073	0,281	0,204
Housing	0,212	-0,951	0,159	0,029	0,013	0,061	0,311	0,091
Personal Care and Health	0,200	0,154	-0,940	0,032	0,016	0,147	0,318	0,113
Clothing	0,224	0,184	0,178	-1,420	0,021	0,109	0,393	0,230
Education	0,307	0,218	0,226	0,056	-0,927	0,111	0,304	0,161
Transport	0,135	0,134	0,187	0,040	0,001	-1,091	0,305	0,168
Leisure	0,177	0,148	0,160	0,030	0,007	0,077	-0,720	0,259
Others	0,555	0,668	0,273	0,318	0,038	0,663	0,264	-0,859

Price elasticities are estimated under symmetry and homogeneity constraints.
All elasticities are significantly different from zero at a 1% level of significance.

Table XI: Extended Full Cross-Price Elasticities, Whole Population

Cross-Price Elasticities								
Commodity Groups	Food	Housing	Personal Care and Health	Clothing	Education	Transport	Leisure	Others
Food	-1,081	0,222	0,140	0,053	0,003	0,078	0,300	0,149
Housing	0,174	-0,987	0,153	0,031	0,012	0,071	0,298	0,144
Personal Care and Health	0,176	0,153	-0,946	0,033	0,009	0,148	0,334	0,148
Clothing	0,199	0,188	0,184	-1,397	0,007	0,089	0,347	0,190
Education	0,289	0,258	0,201	0,053	-0,895	0,115	0,302	0,173
Transport	0,158	0,157	0,191	0,047	0,061	-1,041	0,304	0,164
Leisure	0,190	0,150	0,152	0,024	0,009	0,074	-0,748	0,706
Others	0,758	0,610	0,334	0,193	0,038	0,182	0,525	-0,857

Price elasticities are estimated under symmetry and homogeneity constraints.
All elasticities are significantly different from zero at a 1% level of significance.