An Evaluation of Indirect Taxes in Turkey *

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Abstract

The share of indirect taxes in tax revenues, specifically consumption taxes, is quite high in Turkey when compared to other OECD economies. This emphasis on indirect taxes in Turkey, as well as other developing economies, is argued to emerge from the inability of the government to collect direct taxes because of the existence of a large informal sector that is not easily taxable. It has been suggested that the recent increase in the indirect taxes puts the burden on mostly the poor, raising concerns of inequality. This paper evaluates the efficiency of the current indirect taxes in Turkey by taking into account distributional concerns. Using data from the 2003 Household Budget Survey, we estimate elasticities of different consumption goods and services using AIDS method. We then perform a marginal tax reform analysis to assess the efficiency of indirect taxes. Our findings indicate that there is room for improvement and the current tax rates are not optimal.

Keywords: Indirect taxes; Household survey; Marginal tax reform; AIDS estimation.
JEL Classification: D12, D63, H21, H23.

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1 Introduction

Indirect taxes in Turkey constitute a large proportion of total tax revenues: their share in tax revenues has steadily increased since the 1980s, and by 2008 has become 65%. At the same time, tax revenues as a share of GDP have increased from around 10% to around 20%. Figure 1 below depicts the evolution of the shares of direct and indirect taxes in total tax revenues.[1]

A casual look at the data suggests that indirect taxes, and specifically taxes on consumption goods and services, are extensive and come in a variety. Although in terms of VAT, Turkey is not much different from the OECD average (15.8% vs. 16.6% of total taxes, respectively) because of the extent of the other two types of taxes on consumption of specific goods, consumption taxes constitute a significant share in tax revenues. Special consumption tax in Turkey was around 24% of tax revenues in 2006, while this share was around 11% on average for the OECD countries at the same time period.

This emphasis on indirect taxes in Turkey, and more specifically on taxes on consumption, can be argued to originate due to the inability of the government to collect direct taxes. An important characteristic of developing economies is the existence of a large informal sector that is not easily taxable. The size of the informal sector makes taxation difficult and costly, and especially so for direct taxes. Since administrative costs of tax collection in indirect taxes are lower than those in direct taxes, developing economies rely mostly on indirect taxes.

For example, Zenginobuz *et al.* (2006) report that in the aftermath of the 2001 crisis, the Turkish government, in pursuing fiscal tightening, relied increasingly on taxes on consumption to raise revenues. Furthermore, their findings indicate that the burden of these taxes have mostly been on the poor, and for some consumption goods the taxes were so high that evasion became an attractive option. In evaluating the results from this study together with the data presented above, an interesting and important question arises: how efficient is the current indirect tax system in Turkey and how does the marginal efficiency of taxes change with equity concerns? Hence, the purpose of this paper is to evaluate the marginal efficiency of indirect taxes in Turkey by taking into account distributional concerns. The obvious and most important outcome of indirect taxes is their effect on relative prices. As changes in relative prices have implications for the economy as a whole in terms of demand, production, tax revenues, and income distribution, ensuring the efficiency of the indirect tax system is crucial.

There is a vast literature on the efficiency of indirect taxes. For example, Nichele and Robin (1995) assess the consequences of two reforms in the French indirect tax

[1] See Bulutoglu and Thirsk (1997) for a detailed historical account of the Turkish tax system and tax reforms.

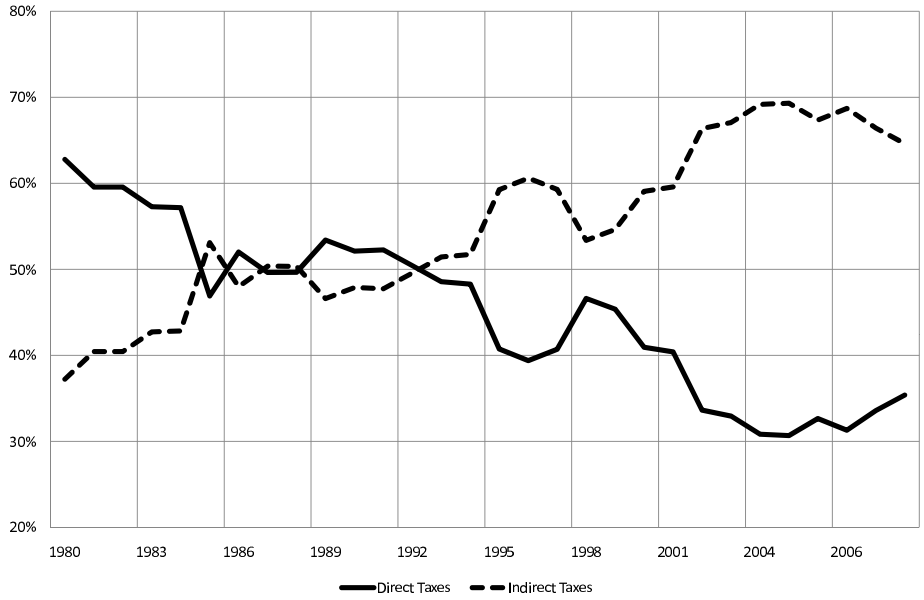

Figure 1: Share of Direct Taxes and Indirect Taxes in Tax Revenues: 1923 - 2009
Source: Revenue Administration (www.gib.gov.tr)

system, namely VAT harmonization and carbon tax. Madden (1995) finds that there has been room for reform in the indirect tax system in Ireland in the 1980s. Liberati (2001) studies the distributional effects of changes in indirect taxes in Italy, and finds that a simple two-rate VAT structure is welfare-improving and revenue neutral. Kaplanoglou and Newbery (2003) assess the indirect tax system in Greece and conclude that a simpler tax structure is more equitable and more efficient. Munoz and Cho (2003) analyze the effects of introducing VAT in Ethiopia and compare it to the incidence of the earlier sales tax in effect.

There are three major indirect tax types in Turkey: taxes on consumption goods and services, taxes on foreign trade and stamp tax. Among the three, taxes on consumption goods and services constitute about 66% of revenues from indirect taxes, i.e. 42% of total tax revenues as of 2008.[2] As the majority of tax revenues come from consumption taxes, they merit special attention. The consumption taxes are composed of value added tax (VAT), special consumption tax, and special communication tax. An 18% VAT is levied on all transactions involving consumption of goods and services, although reduced rates of 1% and 8% apply on certain items such as basic food, newspapers, etc. VAT has been in effect since 1985. Special consumption tax is levied on cigarettes, gas, energy, alcohol, cell phone services and luxury goods at

[2]For further details on tax data, see the web site of the Revenue Administration: www.gib.gov.tr, and Revenue Administration's Activity Report for 2008 on the same web site.

various rates. In addition, the communication sector, i.e. cable radio and television, cell phone services and telecommunication, is subject to a special communication tax levied after the 1999 earthquake to cope with the large budget deficits of the time, which is still in effect. As of 2008, revenues from VAT, special consumption tax, and special communication tax amount to around 25%, 34%, and 4% of revenues from indirect taxes, respectively.

The analysis of this paper follows a series of studies started by the seminal work of Ahmad and Stern (1991). Following Kaplanoglou and Newbery (2003), the paper estimates the marginal social cost of taxation for twelve groups of commodities. Using a Benthamite social welfare function and addressing distributional concerns, we report results for various degrees of inequality aversion. Data from Household Budget Survey (HBS) of 2003 by TurkStat is utilized to estimate a demand system that eventually allows the computation of elasticities. Using the same data set adjustments reflecting equity concerns are made and discussed. The results indicate that there is room for improvement in terms of efficiency of the indirect tax system in Turkey.

The rest of this paper is organized as follows. The next section discusses the methodology used in marginal tax reform analysis. Section 3 summarizes the current Turkish tax data and the data used in estimations. The fourth section describes the findings. A discussion of results and conclusion follows in section 5. The methodology and empirical results of the demand system estimation are provided in the Appendix.

2 Methodology

In this section, we describe briefly the methodology we employ in tax reform analysis. In this setup, the government, or the fiscal authority, maximizes social welfare subject to the revenue constraint by addressing distributional concerns to find optimal tax rates on each commodity group. For further details, see Kaplanoglou and Newbery (2003).

Consider a model with $h = 1, ..., H$ households and $k = 1, ..., K$ goods. Let $\mathbf{p}$ be the vector of producer prices and $\mathbf{q}$ be the vector of consumer prices such that $\mathbf{q} = \mathbf{p} + \mathbf{t}$ where $\mathbf{t}$ is the vector of indirect taxes. Suppose further that $v^h(y^h + g, \mathbf{q})$ is the welfare of household h, where y^h is net income and g denotes transfers. $\mathbf{x}^h$ denotes the vector of demands by household h and $\mathbf{X}$, which is simply the sum of $\mathbf{x}^h$ over all h, is the aggregate demand vector. Finally, let $V \equiv W(v^1, v^2, ..., v^H)$ be a Benthamite social welfare function with π^h as weights.

The question, then, is as follows: What is the value of $\mathbf{t}$ that maximizes social welfare subject to a given level of tax revenues to be raised? Mathematically, this implies:

$$\max_{\mathbf{t}} \quad W(v^1, v^2, ..., v^H) \quad \text{subject to} \quad R(\mathbf{t}) = \mathbf{t}'\mathbf{X} \geq \bar{R} \tag{1}$$

where $\bar{R}$ denotes required revenues.

Assuming producer prices do not change when taxes change,[3] it is possible to consider the effects of a change in the tax on commodity j on the social welfare as follows:

$$\frac{\partial W}{\partial t_j} = \frac{\partial W}{\partial q_j} = \sum_h \frac{\partial W}{\partial v^h}\frac{\partial v^h}{\partial q_j} = -\sum_h \beta^h x_j^h \tag{2}$$

where

$$\beta^h = \frac{\partial W}{\partial v^h}\alpha^h, \qquad \alpha^h = \frac{\partial v^h}{\partial (y^h + g)}$$

β^h is the social marginal utility of income (and transfers) to household h and α^h is the private marginal utility of income to household h. The last equality in (2) is derived by inserting Roy's identity.

The next step is to derive the marginal social productivity of taxing good j. Since $\partial R/\partial t_j$ denotes the extra revenues generated by taxing good j by one more unit (of currency), and $-\partial W/\partial t_j$ denotes the loss in social welfare due to a one unit increase in taxes on good j, it is possible to define the *marginal social productivity* of tax j as

$$\theta_j \equiv -\frac{\partial R/\partial t_j}{\partial W/\partial t_j} \tag{3}$$

That is, θ_j shows the trade-off between benefits and costs of taxing good j. Note that

$$\frac{\partial R}{\partial t_j} = X_j + \sum_k t_k \frac{\partial X_k}{\partial t_j} \tag{4}$$

After some algebraic manipulation, it is possible to write (4) as

$$\frac{\partial R}{\partial t_j} = X_j \left[1 + \sum_k \frac{\omega_k \tau_k \varepsilon_{kj}}{\omega_j}\right] \tag{5}$$

where X_j is the sum of x_j^h over all h. Here, ω_k is the budget share of good k, τ_k is the indirect tax on k divided by the tax-inclusive price of k, and ε_{kj} is the cross-price elasticity of good k with respect to the price of good j. Define d_j as

$$d_j \equiv \frac{\sum_h \beta^h x_j^h}{\bar{\beta} X_j} \tag{6}$$

[3]For example, following Diamond and Mirrlees (1971), if we assume competitive markets and constant returns to scale, producer prices will be fixed.

where $\bar{\beta}$ is the average of β^h over all h. In this regard, it is possible to interpret d_j as the degree of concentration of the consumption of good j on those with high values of β^h, i.e. the poor. Then, after some algebra, we can rewrite (2) as

$$\frac{\partial W}{\partial t_j} = -\bar{\beta} d_j X_j \tag{7}$$

The marginal social productivity of tax j is then

$$\theta_j \equiv -\frac{\partial R/\partial t_j}{\partial W/\partial t_j} = \frac{1}{d_j}\left[1 + \tau_j \varepsilon_{jj} + \sum_{k \neq j} \tau_k \frac{\omega_k \varepsilon_{kj}}{\omega_j}\right] \tag{8}$$

hence, the marginal social productivity of tax j depends inversely on d_j, and positively on own-price and cross-price elasticities. It is possible to interpret $1/d_j$ as the tax appeal of good j. For example, if the absolute value of own-price elasticity is high for good j, the distortionary cost of tax is higher. But distributional concerns in the form of a high d_j in this case offsets this distortionary effect.

At this point, we assume $W = \sum v^h$ and

$$v^h = \begin{cases} \frac{(c^h)^{(1-\gamma)}}{1-\gamma} & , \gamma \neq 1 \\ \ln c^h & , \gamma = 1 \end{cases} \tag{9}$$

where c^h is real consumption per capita which is a proxy for income and γ is the coefficient of inequality aversion. With this specification, $\beta^h = (c^h)^{-\gamma}$. Thus, a higher γ implies a higher concern of inequality by the government, and $\gamma = 0$ indicates no inequality aversion.

Using household level data and AIDS estimation methodology, it is possible to estimate own-price and cross-price elasticities of commodity groups. Then, under various degrees of inequality aversion, i.e. for various values of γ, it is possible to calculate θ_j, $j = 1, ..., K$. It will then be possible to rank these commodity groups from the least taxable to the most taxable: the lower the value of θ_j is, the lower the tax productivity of good j will be. Hence, tax rate on good j should be lower.

3 Data

For the analysis we use the set of elasticity estimates calculated using the Almost Ideal Demand System (AIDS) methodology of Deaton and Muellbauer (1980).[4] Estimation is based on the data from Household Budget Survey 2003 (HBS 2003) conducted

[4]See Appendix A for details.

by the Turkish Statistical Institute (TurkStat).[5] The HBS 2003 is a survey of a representative random sample of all private households in Turkey. From January 2003 to December 2003, a total of 25,920 households were surveyed (1512 households from urban and 648 households from rural areas per month). Excluding those who quit, the survey results in a total sample of 25,764 households.

The survey data report monthly expenditures of households. Household expenditures on goods and services are coded under 198 categories and then these expenditures are aggregated under 12 major commodity groups based on COICOP (Classification of Individual Consumption by Purpose) system. The analysis uses variation in prices across NUTS2 level regions as well as months of the year to estimate elasticities.[6] Table 1 presents these commodity groups along with own price and income elasticities, indirect tax rates, and the budget shares calculated from HBS 2003.[7] The figures are as expected. Food, clothing, health are among the categories with low elasticity. Transportation has one of the lowest elasticities, possibly reflecting the fact that the elasticity estimates are obtained from data covering one year only. Recreation and culture has the highest elasticity along with furnishing and house maintenance which covers big ticket items. Alcoholic beverages and tobacco is highly inelastic, possibly due to prevalence of tobacco addiction.

The other important component of the marginal tax reform analysis is the weighted average indirect tax rates pertaining to the 12 commodity aggregates. Value-Added-Tax, Special Consumption Tax, Special Communication Tax and Gambling Tax are the indirect taxes on commodities that are taken into account when calculating the tax rates from the relevant resolutions of the Council of Ministers and codes. They are weighted according to the budget shares of these classifications within their group in the Household Budget Survey. The average tax rates for the commodity groups, thus found, are also given in Table 1. Alcohol and tobacco, transportation, and communication are very heavily taxed in Turkey. Food, health, and education are the least taxed categories.

[5]While more recent surveys (2004, 2005, and 2006) are also available, the one in 2003 is based on a much larger sample (about three times larger than the surveys in the following years). Moreover, later surveys do not disclose the month in which a household is surveyed, information necessary to measure variation in prices. TurkStat does not publicly disclose the data on region and month. However, we are able to obtain the information on region and month of the year that an observation belongs to from HBS 2003 by matching the inflation adjustment factor (the factor to inflate the income) in the data with regional monthly inflation figures from TurkStat (CPI index for urban and rural general price levels). In the later years this was not possible because inflation levels are relatively low and does not allow us to differentiate across different months and regions of the year.

[6]See footnote 5 on identification of household location and month of the survey.

[7]see Table 3 in Appendix A for all elasticities and standard errors obtained using bootstrap.

Aggregate Commodity Groups	Aggregate Budget Shares	Average Indirect Tax Rates	Own Price Elasticities	Expenditure Elasticities
Food and Non-Alcoholic Beverages	28.50%	8.50%	-0.57	0.75
Alcoholic Beverages and Tobacco	4.30%	83.70%	-0.11	0.69
Clothing and Footwear	6.30%	15.40%	-0.13	1.2
Housing, Water, Gas, Electricity & Other Fuels	27.90%	19.00%	-0.74	0.86
Furnishing, House Maintenance & Equipment	5.80%	19.30%	-1.65	1.84
Health	2.10%	8.30%	-0.05	1.73
Transportation	9.50%	41.70%	-0.06	1.45
Communication	4.30%	39.40%	-1.06	0.92
Recreation and Culture	2.00%	16.50%	-2.05	1.14
Education	1.80%	8.00%	-0.68	0.9
Hotels, Cafes, Restaurants	4.00%	18.00%	-0.87	0.66
Other Goods and Services	3.50%	20.80%	-0.46	1.41

Table 1: Elasticities, average budget shares and average indirect taxes

4 Results

Table 2 below summarizes the results of the marginal tax reform analysis based on the elasticity estimates in Table 1 above and Table 3 in Appendix A. The analysis is performed for different levels of inequality aversion. Specifically, the values of the parameter γ used are 0, 2, and 5. For each inequality aversion level, we present the distributional characteristic of each category, d, and the marginal social productivity of tax, θ. The goods and services are ranked from the least taxable to the most in each γ category.

The differences in tax appeal indicates that there is room for improvement in tax rates. For $\gamma = 0$, meaning no concern for equity (and same distributional coefficient for all categories), we find the most likely candidates for higher taxation to be housing, alcoholic beverage and tobacco, and recreational activities. Hotel and restaurant expenditures, food, and furnishing follow these categories. Healthcare, clothing, and others categories are those that are the least desirable for taxation.[8] Transportation, communication, and education follow these. The difference in the cost of taxation is rather small. Our results are similar to Madden (1995) and Kaplanoglou and Newbery (2003) who find small differences across goods and services in terms of cost of taxation. Goods that are candidates for higher taxes differ significantly from the results for Greece (Kaplanoglou and Newbery, 2003) where tobacco and recreation turn out to be the least desirable for a marginal tax increase. On the other hand our results are in line with Irish case (Madden, 1995). As noted many times in the earlier literature, the results should be considered with caution considering theoretical issues in elasticity estimation and optimal tax calculations.

[8] θ for health category is negative. This implies decrease in tax revenues with further tax on health. Madden (1995) report such finding for tobacco under some demand specifications with Irish data and interprets it as a commodity specific Laffer effect.

$\gamma = 0$			$\gamma = 2$			$\gamma = 5$		
Categories	d	θ	Categories	d	θ	Categories	d	θ
Health	1	-0.11	Health	0.32	-0.33	Health	0.02	-4.94
Other	1	0.36	Other	0.31	1.17	Housing	0.14	6.21
Clothing	1	0.51	Food & Beverages	0.69	1.26	Food & Beverages	0.08	10.74
Transportation	1	0.62	Clothing	0.35	1.45	Other	0.03	12.11
Communication	1	0.67	Communication	0.40	1.67	Hotels, Restaurants	0.05	16.28
Education	1	0.71	Alcohol & Tobacco	0.61	1.67	Alcohol & Tobacco	0.04	23.00
Furnishing	1	0.78	Housing	0.48	1.86	Communication	0.02	29.11
Food & beverages	1	0.86	Hotels, Restaurants	0.36	2.39	Clothing	0.02	32.24
Hotels, restaurants	1	0.87	Transportation	0.26	2.43	Transportation	0.01	63.24
Housing	1	0.89	Furnishing	0.30	2.60	Furnishing	0.01	73.53
Alcohol & Tobacco	1	1.02	Recreation & Culture	0.22	4.95	Recreation & Culture	0.01	135.71
Recreation & Culture	1	1.09	Education	0.14	5.23	Education	0.00	1253.20

Table 2: Distributional characteristics, d, and marginal social productivity, θ

Given the results with no inequality concern, we can now focus on the impact of the distributional concerns on rankings. Table 2 also displays the results for $\gamma = 2$ and $\gamma = 5$. As may be expected, food, housing, and alcohol and tobacco categories, which constitute necessities, become less desirable to be taxed.[9] In line with our results, health and food are among the least taxed items currently (at about 8%). Alcohol and tobacco, on the other hand are heavily taxed. It is clear from our results that these taxes constitute a big burden for lower income households. It should also be noted, however, that our results do not take into consideration health hazards related to tobacco consumption, neither negative externalities on non-smokers. In the housing and utilities category, taxes are rather large, about 19%. Housing and especially utilities could constitute an area where a reduction in taxes may be considered for equity purposes.

On the other hand furnishing, transportation, and education are now ranked higher with greater equity consideration. It should be noted that education is provided for free to a large part of population in Turkey and private schools and other educational activities are mostly used by wealthier households. Hence, an increase in taxation is not of a big concern for poor households. However, private schools are argued to take some of the burden from government and allow it to provide more resources to the rest of population. Whether this justifies a rather low tax rate of 8% is left for further studies. In transportation the tax rates are already high at about 40% level and in furnishing tax rates are higher than many other categories.

For other categories we do not observe much of a change in the rankings. Recreation and culture is still among the leading candidates for taxing and health ranks the last for taxation.

[9]Alcohol and tobacco category is heavily dominated by tobacco which is very widely used in Turkey especially in lower income brackets.

5 Conclusion

This paper aims to evaluate the indirect taxes in effect in Turkey using data from the 2003 Household Budget Survey. After estimating elasticities for twelve commodity groups using AIDS methodology of Deaton and Muellbauer (1980), we follow Kaplanoglou and Newbery (2003) to conduct a marginal tax reform analysis. When there is no concern for inequality, we find the most likely candidates for higher taxation to be housing, alcoholic beverage and tobacco, and recreational activities while healthcare and clothing are those that are the least desirable for taxation. Once inequality aversion is inserted, food, housing, and alcohol and tobacco categories, which constitute necessities, become less desirable to be taxed while recreation, education and furnishings are the categories for which higher taxes are called.

At this point, we would like to note that our analysis is subject to usual caveats of indirect tax reform studies. We assume competitive markets and disregard tax evasion, an important characteristic of developing countries. Furthermore, the analysis considers indirect taxes in isolation. It is clear that the system as a whole should be investigated for a thorough investigation of the efficiency of taxes, including direct taxes and institutional conditions. We would like to note, however, that it is still beneficial to evaluate the indirect taxes since they are easier to change and are in fact often subject to change in Turkey.

An even more important caveat is the tax evasion which is prevalent in Turkey. The analysis implicitly assumes away tax evasion. If it took place differentially across the goods, marginal optimality would be miscalculated since official tax rates that are used in the analysis would differ from the actual rates. Furthermore, if tax evasion does also differ across households with different income levels, distributional concerns may not be properly reflected in the results. Unfortunately data is lacking on tax evasion and we leave analysis of tax evasion and efficiency of indirect taxes for further studies.

A Almost Ideal Demand System (AIDS)

A.1 Theory

The Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980) is a commonly used method in demand system estimation[10] AIDS estimation allows the use of cross-section or time series data, has a flexible expenditure function, satisfies the axioms of choice, is compatible with aggregation over consumers and has a functional form consistent with available household budget data. The model is specified in the following form:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln \frac{y}{P} + \sum_{j=1}^{N} \lambda_{ij} D_j + u_i, \qquad i = 1, ..., n \quad \text{(A1)}$$

where w_i is the budget share of the ith good, p_i is the price of good i, y is total per capita expenditure on all n goods, D are other characteristics affecting demand, u is a random disturbance term, and P is a price index defined by:

$$\ln P = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln p_k + \frac{1}{2} \sum_{k} \sum_{l} \gamma_{kl} \ln p_k \ln p_l \quad \text{(A2)}$$

The presence of P makes the system highly non-linear which renders the model hard to estimate. However if prices are collinear, P can be approximated by the Stone's index, given by: [11]

$$\ln P^* = \sum_{k=1}^{n} w_k^0 \ln p_k \quad \text{(A3)}$$

where w_k^0 is the average budget share of good k. The models using Stone's index—or more generally, the models using a linear approximation of for the price index—are referred to as the Linearized Almost Ideal Demand System (LA/AIDS).

At this point, it is important to note that one may need to modify the AIDS method proposed by Deaton and Muellbauer slightly when using data from a household budget survey. Consider the following situation where household i does not consume good j at the time of data collection. This may not be because household i does not prefer to consume good j, but simply because household i does not need to consume good j at the time of data collection. This is a typical example of a censored

[10] See, for example, Ozmucur (1995) for Turkey using aggregate data from Turkish national income accounts for the period 1987Q1 - 1994Q3.

[11] Deaton and Muellbauer (1980) show that Stone's index does not affect the estimates of the AIDS considerably as long as prices are collinear.

regression and requires a two-stage estimation. To correct for potential biases that may arise due to this type of censoring, we use the two-stage estimation method proposed by Shonkwiler and Yen (1999). According to Shonkwiler and Yen, the demand system can be written as follows:

$$w_i^* = f(x_i, \mu_i) + u_i, \quad d_i^* = z_i'\theta_i + v_i \tag{A4}$$

$$y = \begin{cases} 1 & \text{if } d_i^* > 0 \\ 0 & \text{if } d_i^* \leq 0 \end{cases}$$

$$w_i = d_i w_i^* \tag{A5}$$

where w_i^* is the actual (unobserved) budget share of good i, w_i is the observed budget share, and d_i^* is the latent variable depending on which the household chooses to consume good i where this choice is indicated by the observed variable d_i. Hence, we only observe the budget shares whenever the household makes an expenditure on good i. Here, x_i and z_i are vectors of explanatory variables, and μ_i and θ_i are vectors of parameters. Furthermore, u_i and v_i are random disturbance terms that are assumed to be bivariate normal with $cov(u_i, v_i) = \delta_i$.

In this framework, the first stage involves estimating a probit model for the binary variable d_i with explanatory variables z_i, and the second stage involves the SUR estimation of the demand system with bias correction using the probability density function (pdf), $\phi(z_i'\theta_i)$, and the cumulative distribution function (cdf), $\Phi(z_i'\theta_i)$ as follows:

$$w_i = \Phi(z_i'\theta_i) f(x_i, \mu_i) + \delta_i \phi(z_i'\theta_i) + e_i \tag{A6}$$

which, using equation (A1) , implies the following:

$$w_i = \alpha_i \Phi(z_i'\theta_i) + \sum_{j=1}^{n} \gamma_{ij} \ln p_j \Phi(z_i'\theta_i) + \beta_i \Phi(z_i'\theta_i) \ln \frac{y}{P} + \sum_{j=1}^{N} \lambda_{ij} D_j \Phi(z_i'\theta_i) + \delta_i \phi(z_i'\theta_i) + e_i \tag{A7}$$

For further details on methodology, see Shonkwiler and Yen (1999).

The use of AIDS estimation will enable us to calculate the own-price, cross-price and income elasticities of demand using the following:

1. Marshallian own-price elasticity:

$$\varepsilon_{ii} = \frac{\gamma_{ii}}{w_i} - (1 + \beta_i) \tag{A8}$$

2. Marshallian cross-price elasticity:

$$\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i} \tag{A9}$$

3. Expenditure elasticity:

$$n_i = \frac{\beta_i}{w_i} + 1 \tag{A10}$$

A.2 Empirical Method

Several other variables can be added in the main equation (A1) of the AIDS system as well as to the first stage estimation of presence of any expenditure through probit model, in order to capture some other variables' effects on the budget shares of individuals in addition to logarithm of prices and real expenditure. It can be expected that socio-demographic or socio-economic characteristics of the households also play a role in the consumption decisions or consumption patterns of the households.

Household size can be an important determinant in the expenditures of the households. Alpay and Koc (2000) found a negative relation between household size and food and housing expenditures. The OECD equivalent household size[12] variable is added to the main budget shares equations to see the effects of the size of the household on consumption. In addition, age of household head is controlled through three dummies.

The expenditure patterns of the households can show variations according to the season. We capture the seasonality in the shares of the aggregate commodity groups by adding three dummy variables for spring, summer and autumn into the budget share equations. In addition a dummy for urban residents and two dummies representing the education level of the household head are also included in the AIDS model. Finally, to control for regional differences a series of dummies are added to represent Istanbul and seven main regions in Turkey. Also included are some additional control variables that can be thought as relevant for particular goods and services. Presence of private car for transportation services, dummies for new year and religious holidays for alcohol and tobacco are among such variables.

[12]The OECD equivalent household size is calculated by summing the weights attached to the members of the household. The weights are; 1 for the first adult in the household, 0.5 for members older than 14 years of age, 0.3 for members younger than 14 years of age.

	FO		ALC		CLO		HOU		FUR		HEA		TRA		COM		REC		EDU		HOT		OTH		Income	
FO	-0.57	***	-0.75	***	0.24		-0.26	**	-0.61		2.93	***	0.88	***	-0.35		-1.82	***	-0.38	***	-1.01	***	0.05		0.75	***
	(0.12)		(0.25)		(0.21)		(0.12)		(0.46)		(0.48)		(0.24)		(0.32)		(0.50)		(0.09)		(0.33)		(0.33)		(0.01)	
ALC	-0.18	***	-0.11		-0.61	***	0.33	***	-0.55		0.17		-0.09		0.61	**	0.09		-0.17	**	-0.13		-0.34		0.69	***
	(0.06)		(0.20)		(0.16)		(0.08)		(0.36)		(0.33)		(0.19)		(0.28)		(0.48)		(0.07)		(0.27)		(0.38)		(0.04)	
CLO	0.10		-0.72	***	-0.13		-0.20	***	0.34		-0.41		0.18		-0.33		-0.68	**	0.09		-0.36		0.65	**	1.20	***
	(0.06)		(0.19)		(0.20)		(0.08)		(0.30)		(0.30)		(0.16)		(0.22)		(0.32)		(0.06)		(0.23)		(0.26)		(0.03)	
HOU	-0.23	*	1.26	***	-0.67	***	-0.74	***	0.09		-1.95	***	-0.75	**	-0.71		0.57		0.43	***	1.79	***	0.63		0.86	***
	(0.12)		(0.32)		(0.24)		(0.20)		(0.75)		(0.58)		(0.30)		(0.53)		(0.75)		(0.09)		(0.43)		(0.39)		(0.01)	
FUR	-0.11		-0.44		0.27		0.04		-1.65		-1.07	*	-0.18		1.38	*	1.69	**	0.05		0.18		-0.22		1.84	***
	(0.11)		(0.33)		(0.22)		(0.18)		(1.27)		(0.60)		(0.33)		(0.73)		(0.84)		(0.10)		(0.45)		(0.74)		(0.04)	
HEA	0.53	***	0.14		-0.24		-0.35	***	-0.87	*	-0.05		-0.70	***	0.28		1.27	***	-0.42	***	0.35		0.86	**	1.73	***
	(0.08)		(0.23)		(0.17)		(0.10)		(0.46)		(0.54)		(0.21)		(0.35)		(0.47)		(0.10)		(0.27)		(0.41)		(0.08)	
TRA	0.42	***	-0.07		0.29		-0.30	**	-0.31		-1.60	***	-0.06		-0.86	*	-0.40		0.16		-0.04		-0.89	*	1.45	***
	(0.10)		(0.33)		(0.22)		(0.13)		(0.62)		(0.52)		(0.36)		(0.46)		(0.75)		(0.10)		(0.37)		(0.53)		(0.02)	
COM	-0.05		0.46	**	-0.21		-0.13		1.06	*	0.27		-0.41	**	-1.06		0.68		-0.11	**	0.07		-0.13		0.92	***
	(0.06)		(0.20)		(0.13)		(0.10)		(0.59)		(0.37)		(0.20)		(0.67)		(0.55)		(0.06)		(0.29)		(0.47)		(0.02)	
REC	-0.23	***	0.06		-0.29	**	0.08		0.90	*	0.90	***	-0.16		0.47		-2.05	***	0.04		-0.20		-0.20		1.14	***
	(0.06)		(0.24)		(0.13)		(0.10)		(0.48)		(0.34)		(0.22)		(0.38)		(0.62)		(0.07)		(0.28)		(0.39)		(0.06)	
EDU	-0.23	***	-0.39	**	0.15		0.27	***	0.08		-1.45	***	0.18		-0.38	**	0.17		-0.68	***	0.08		-0.04		0.90	***
	(0.05)		(0.16)		(0.12)		(0.06)		(0.25)		(0.32)		(0.14)		(0.18)		(0.34)		(0.08)		(0.18)		(0.28)		(0.05)	
HOT	-0.21	***	-0.10		-0.27	*	0.40	***	0.10		0.39		-0.07		0.07		-0.36		0.03		-0.87	**	-1.08	***	0.66	***
	(0.07)		(0.23)		(0.16)		(0.09)		(0.42)		(0.32)		(0.19)		(0.33)		(0.47)		(0.07)		(0.37)		(0.39)		(0.03)	
OTH	0.02		-0.17		0.29	**	0.10	*	-0.18		0.70	**	-0.34	*	-0.09		-0.21		0.00		-0.70	***	-0.46		1.41	***
	(0.05)		(0.22)		(0.12)		(0.06)		(0.47)		(0.34)		(0.18)		(0.37)		(0.45)		(0.07)		(0.26)		(0.58)		(0.04)	

Table 3: Own-price elasticity, cross-price elasticity and income elasticity estimates along with standard errors (in parentheses)

Aggregate Commodity Groups	Aggregate Budget Shares	Average Indirect Tax Rates	Own Price Elasticities	Expenditure Elasticities
Food	32.82%	18.32%	-0.71	0.56
Clothing	6.34%	15.43%	-0.98	1.2
Housing	32.22%	21.75%	-0.74	0.87
Furnishing	5.76%	19.29%	-0.84	1.64
Health	2.07%	8.26%	-1.34	0.74
Transportation	9.47%	41.73%	-0.25	1.94
Entertainment	2.03%	16.51%	-0.4	1.7
Education	1.82%	8.00%	-1.24	1.94
Tourism	3.97%	18.00%	-1.07	1.1
Other	3.51%	20.76%	-0.84	1.52

Table 4: Elasticities, average budget shares and average indirect taxes with the 2003 HBS data, using 1994 classifications

B Alternative Elasticity Estimates

As an alternative to our own elasticity calculations we also consider elasticities from an earlier study by Koc and Alpay (2000). Koc and Alpay use the 1994 HBS, which has ten aggregate commodity groups: food, clothing, housing, furnishing, health, transportation, entertainment, education, tourism, and others. The Alcoholic Beverages & Tobacco, and Communication categories from HBS 2003 are included in the Food & Non-Alcoholic Beverages and the Housing, Water, Gas, Electricity & Other Fuels categories respectively to match the categories in the 1994. Table 4 reports the new categories, own price and income elasticities, as well as average budget shares and tax rates.

It should be noted that using the elasticities calculated on HBS 1994 may be misleading in some respects. First, the categories that did not exist in 1994, alcohol & tobacco, and communication, are currently heavily taxed and merging these two commodity groups with others may be problematic. Second, there have been major changes in health and education over time and private providers were more common in 2000s compared to 1990s, which may have changed the elasticities of these services.

We also repeat the calculations using elasticity estimates of Koc and Alpay (2000) and report the results in Table 5. The most dramatic difference is in health and entertainment expenditures. Health is ranked as most taxable with new elasticities while it was ranked the last in our own calculations. This might be due to increased role of private sector in healthcare services during the 2000s compared to 1990s making health expenditure more elastic in recent years. In contrast entertainment is ranked as least taxable in using elasticities from Koc and Alpay (2000) while it was ranked as one of the most taxable using our elasticities. Other than these goods and services rankings do not differ radically. The movement of goods and elasticities in terms of

$\gamma = 0$			$\gamma = 2$			$\gamma = 5$		
Categories	d	θ	Categories	d	θ	Categories	d	θ
Other	1	0.43	Food	0.68	1.17	Food	0.15	5.43
Education	1	0.69	Other	0.31	1.38	Housing	0.15	5.47
Entertainment	1	0.71	Housing	0.47	1.78	Other	0.05	8.68
Food	1	0.79	Clothing	0.36	2.43	Tourism	0.06	15.96
Housing	1	0.84	Tourism	0.36	2.59	Clothing	0.04	22.10
Transportation	1	0.86	Health	0.32	3.06	Health	0.04	25.43
Clothing	1	0.87	Furnishing	0.30	3.07	Furnishing	0.03	31.46
Furnishing	1	0.92	Entertainment	0.22	3.23	Transportation	0.03	34.07
Tourism	1	0.93	Transportation	0.26	3.29	Entertainment	0.02	35.07
Health	1	0.98	Education	0.14	4.96	Education	0.00	229.52

Table 5: Distributional characteristics, d, and marginal social productivity, θ Koc and Alpay (2000)

	FO	CLO	HOU	FUR	HEA	TRA	ENT	EDU	TOU	OTH
FO	-0.71	0	0.09	-0.04	-0.01	-0.07	0.02	0.05	-0.04	0.15
CLO	-0.21	-0.98	-0.12	0.02	-0.02	0.1	0.01	-0.03	0.04	0.01
HOU	0.02	-0.02	-0.74	-0.04	0.01	-0.03	-0.01	-0.03	-0.03	-0.04
FUR	-0.59	-0.01	-0.32	-0.84	-0.04	0.3	-0.03	-0.04	-0.06	-0.01
HEA	-0.14	-0.03	-0.06	-0.05	-1.33	0.46	-0.14	0.42	-0.24	0.37
TRA	-0.87	0.06	-0.35	0.31	0.11	-0.25	-0.16	-0.2	0.15	-0.73
ENT	-0.16	-0.02	-0.34	-0.12	0.03	-0.54	-0.39	0.13	0.01	-0.3
EDU	0.79	-0.27	-0.79	-0.21	0.59	-0.96	-0.19	-1.24	0.17	-0.19
TOU	-0.76	0.15	0.26	-0.14	-0.24	0.47	0.02	0.11	-1.07	0.1
OTH	0.63	-0.02	-0.36	0	0.12	-0.93	-0.11	-0.04	0.03	-0.84

Table 6: Marshallian Elasticities from Koc and Alpay (2000)

tax appeal is similar to the results with our own elasticity calculations since the same distributional concern adjustment is made.

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