

A LOOK AT INDIRECT TAX SYSTEM IN TURKEY  
BASED ON DEMAND SYSTEM ESTIMATION

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A LOOK AT INDIRECT TAX SYSTEM IN TURKEY  
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## Thesis Abstract

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“A Look at Indirect Tax System in Turkey Based on Demand System Estimation”

Taxation systems are not established only to raise the necessary revenue for the government budget. A redistributive function is also generally attributed to those systems to alleviate income inequality problems. A properly designed and efficiently exercised direct taxation system can help to solve an important part of inequality by directly taxing individuals and corporates according to their earnings. However, developing countries, including Turkey, for several reasons, usually rely on indirect taxes rather than direct income taxes for the collection of the government revenue. The purpose of this study is to analyse the indirect taxation system in Turkey on distributional grounds. Marginal Tax Reform Analysis is applied for the indirect tax system in effect in 2003. 2003 Household Budget Survey of the Turkish Statistical Institute (TurkStat) is used in exploring the consumption pattern of the households in Turkey and obtaining the necessary price elasticities. The indirect taxes in 2003 are found not to be optimal. At different levels of inequality aversion for the government, the same amount of revenue can be raised by adjusting the indirect tax rates.

## Tez Özeti

Gürcan Soydan

### “Talep Sistemi Hesaplaması Temelli, Türkiye’deki Dolaylı Vergi Sistemine Bir Bakış”

Vergi sistemleri sadece devlet bütçesine gerekli olan gelirleri sağlamak üzere kurulmazlar. Genelde, bu sistemlere ülkedeki gelir dağılımı eşitsizliklerini azaltma yönünde bir yeniden dağıtım fonksiyonu da atfedilmiştir. Uygun bir biçimde tasarlanmış ve etkin bir şekilde yürütülebilen doğrudan vergileme sistemi direkt olarak şirketlerin ve gerçek kişilerin kazançlarından vergi alarak bu gelir dağılımı eşitsizliklerinin önemli bir bölümünün giderilmesine yardımcı olabilmektedir. Ancak Türkiye’nin de içinde bulunduğu gelişmekte olan ülkeler, çeşitli sebeplerden dolayı, bütçeye gelir toplamak için doğrudan vergiler yerine dolaylı vergilere dayanmaktadırlar. Bu çalışmanın amacı Türkiye’deki dolaylı vergi sistemini gelirin yeniden dağıtım yönünden incelemektir. 2003’te geçerli olan dolaylı vergi sistemi için Marjinal Vergi Reformu Analizi uygulanmıştır. Türkiye’deki hanehalklarının tüketim kalıplarını inceleme ve gerekli fiyat esnekliklerini bulabilme amacıyla 2003 Hanehalkı Bütçe Anketi kullanılmıştır. 2003 yılında geçerli olan dolaylı vergilerin optimal olmadığı sonucuna ulaşılmıştır. Farklı seviyelerdeki hükümet eşitsizlik kaygısı parametrelerinde, aynı miktarda gelir, dolaylı vergi oranlarını değiştirerek elde edilebilir.

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## CHAPTER 1

### INTRODUCTION

#### Objective

Indirect taxes in Turkey have a high share in the total tax revenue accrued to the government budget. Almost 66% of the government's tax collection in 2007 consisted of the indirect taxes, whereas this ratio is around 45% for the OECD and the EU countries (OECD, 2007). Indirect taxes in Turkey are collected, in large part, by the system of Value Added Taxes (VAT) which is applied to almost all commodities and by various kinds of excise duties applied mostly on luxury goods. Turkey, as a developing country, suffers from many problems in its economic structure and in effective collection of direct taxes in which tax evasion and the negative effects of informality are common. Therefore Turkey has become and is becoming more dependent on taxes on goods and services rather than taxes on income. But the high share of indirect taxes compared to the direct taxes is not preferred from a standpoint of equality since with the indirect taxation, people are not taxed according to what they earn but what they spend. Therefore, the functioning of the redistributive property of taxation system is a debatable issue in Turkey. The objective of this study is to explore the indirect taxation system in Turkey and suggest possible and proper tax rate changes for redistribution purposes. This study focuses only on the indirect taxation system and takes the current direct

taxes as given. In effect, we attempt the analyse the levels of indirect tax rates' distributional effects at constant levels of direct taxes.

### Taxation in Developing Countries

Establishing an efficient and effective tax system in developing economies has some merits that differ from the establishment of the tax systems in developed economies. The developing economies that have an industrial base regarded as 'undeveloped' or 'developing' generally possess some common features in their economic structures or economic behaviour that differentiate them from the industrialized nations in their taxation systems and tax policy issues. Despite the need to rely on their taxation systems for necessary government revenue to converge towards the productivity and welfare level of the developed economies, these countries face important challenges to build a satisfactory tax structure that would provide enough revenue in an efficient way for the government that would support rather than hinder economic growth.

Since their economies have not reached a decent level of industrialization, the agricultural sector, in which it is more difficult to monitor the employment of the workers officially, still has a higher share in total output level of the economy. Moreover, a significant amount of non-agricultural production is also done in small establishments and a large proportion of these facilities generally operate in the informal sector. The base for an income tax is poor since workers are generally employed without registration. Furthermore, the earnings are usually spent out of large markets, where sales are not officially recorded. Therefore, one important characterization of the developing economies is that they have large informal sectors

that are not easily taxable. Enste and Schneider (2000) estimate the size of the shadow (informal) economy for 76 countries which are classified as developing, transition and OECD countries.<sup>1</sup> For the period between 1990 and 1993, the size of the shadow economy as a percent of GDP ranges between 70% to 13% for developing economies, whereas for the OECD countries the range is narrower; 27% (Greece) – 6% (Austria). On average, in developing economies the share of the shadow sector is 39% in GDP and it is around 12% of GDP for developed (OECD) economies. The high level of the informal sector in the developing economies puts them in a vicious circle of informality and high tax rates. Since a large proportion of production, economic transactions and employment take place out of the registered area of economic activity where government does not have enough control and ability to tax, the loss of revenue from these activities forces the tax authority to excessive levels of tax rates imposed on the formal sector. The increased burden of taxes and sometimes social security payments induce economic actors to forgo the registered activity and propel them to join the shadow economy. Loayza (1996) estimates the size of the informal sector in Latin American countries and finds out that tax burden affects the level of the informal sector activity positively. Schneider (1994) estimates a currency demand function for the shadow economy and the direct tax burden turns out to have the biggest impact on the size of the shadow economy.

Administrative costs of tax collection in indirect taxes are lower than those in direct taxes. Therefore, the problems mentioned above drive developing economies to rely on indirect taxes rather than direct taxes. Tanzi and Zee (2000) calculate the tax revenues for developing and OECD countries for the period 1995 to 1997.

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<sup>1</sup> The selected OECD countries exclude Turkey and consist of Greece, Italy, Spain, Portugal, Belgium, Sweden, Norway, Denmark, Ireland, France, Netherlands, Germany, Great Britain, Japan, USA, Austria, Switzerland

Developing countries, on average, collect only 5.2% of GDP as income taxes whereas OECD countries, on average, are able to collect 14.2% of their GDP as income taxes. Large informal sector in the developing economies also affects the ratio of the corporate income tax to the personal income tax. Since there's a huge amount of unregistered employment, the share of revenues from the personal income tax in total tax revenue does not reach the level of the developed economies. The personal income tax brings four times more revenue than the corporate tax revenue in OECD economies (10.8% to 3.1% of GDP) whereas in developing economies, its share is lower than the corporate tax revenue (2.2% to 2.6% of GDP). Heady (2002) calculates the share of different taxes in the total tax revenue for selected countries for the year 1999. According to his classification of countries, lower-middle income countries and upper-middle income countries collect around 19% of their tax revenue from income taxes whereas this ratio is 32% for the OECD countries. 28% of tax revenue in OECD countries is provided by sales taxes, however in 'middle-income' countries around 38% of total tax revenue is derived from sales taxes.<sup>2</sup> These figures suggest that the role of direct taxation in developing countries is somehow limited.

These differential composition of tax revenues in developed and lower income countries also reflects itself in the total tax revenue of the countries. Tax revenue as a proportion of GDP is lower in developing countries than in rich countries. Gordon and Li (2005) calculate the source of government revenue for the years between 1996 and 2001. In high-income countries 25% of GDP is collected as tax revenue, almost two-thirds of this ratio (17.6%) is collected in all-developing

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<sup>2</sup> Although Turkey is an OECD country, its tax structure resembles the countries in the 'middle-income' category more. In 2000, 40% of its tax revenue is in the form of sales taxes whereas 28% is collected as income taxes.

nations and in the lowest-income countries, on average, the tax revenue is only 14.1% of GDP.<sup>3</sup>

Another problematic issue in taxation in developing economies is the difficulty in establishing a good tax administration compared to the ones in the developed economies. Low levels of education and training, inability to pay decent wages to tax officials and low levels of technology utilization in taxation operations are the obstacles in creating an effective and efficient tax system. These unfavorable conditions lead the authorities to exploit the current system more rather than create a rational and modern tax system.

Tanzi and Zee (2000) mention the difficulties in obtaining reliable and detailed statistics which would help policymakers in their assessment of the current tax system or finding possible paths for tax policy reforms. Large amount of informal activities, limited reporting requirements and financial limitations make it harder to reach reliable data which would be useful in improving the current tax system or implementing a tax reform.

It should be noted that, large income inequalities in the developing countries relative to the advanced economies can have a deteriorating effect on the progressivity of the tax systems. The economic and political powers that are concentrated in the hands of the wealthier individuals sometimes prevent the authorities from implementing tax reforms that would increase their own tax burden. As a result, property tax or personal income taxes can not be exploited significantly in those countries (Tanzi and Zee (2000)).

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<sup>3</sup> The classification of countries to groups follow the World Bank classification of low income (GDP per capita less than \$745), lower-middle income (GDP per capita between \$746-1,975), middle income (GDP per capita between \$2,976-9,205) and high income countries (GDP per capita greater than \$,9206)

## Taxation and Tax Reforms in Turkey in the Twentieth Century

The first years of the Turkish Republic was similar to the Ottomans in terms of the composition of the tax revenue. The Ottoman Tax System had an almost equal share of direct and indirect taxes in its last years. In 1923, the first year of the republic, 48% of the government tax revenue consisted of direct taxes and indirect taxes had a share of 52%. Following that year, the portion of the direct taxes declined sharply in favor of the indirect taxes. By the year 1928, the indirect taxes reached a level of 77% share in total tax revenue. That was a result of the abolition of the tithe<sup>4</sup> in February 1925 and signalled a major tax policy change. In the last years of the 1920's, the government revenue consisted majorly of the production and sale of some basic consumption goods such as salt, tobacco and sugar and the indirect taxes accrued through the consumption of these items (see Table 1).<sup>5</sup>

The outbreak of the World War II and the consequent harsh international and national economic conditions led the government to increase the tax rates and implement new direct taxes. The most important and controversial of these new taxes were the Wealth Tax (Varlık Vergisi) and the 'Land Products Tax' (Toprak Mahsülleri Vergisi).<sup>6</sup> The Wealth Tax was levied on wealthy citizens to raise the necessary funds to help the government budget which deteriorated terribly in war conditions. In 1942, 315 million TL was collected as Wealth Tax Revenue, and this amounted approximately to the 40% of the government tax revenue. It was largely

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<sup>4</sup> A tax collected from the farmers. Its level is generally one-tenth of the agricultural products that was produced in one year by the farmer. The collection of the 'tithe' was not effective and it was considered to be affecting small farmers rather than big ones more.

<sup>5</sup> Yakup Kepenek and Nurhan Yentürk, *Türkiye Ekonomisi* (İstanbul: Remzi Kitabevi, 2004), p. 39

<sup>6</sup> The Wealth Tax was legislated on November 11, 1942 and the 'Land Products Tax' on June 1, 1941. The Wealth Tax was completely abolished in 1944 and the 'Land Products Tax' was collected for 2 years.

imposed on the non-muslim society of Turkey, and they were the ones which suffered most severely. It's estimated that 53% of the Wealth Tax was collected from non-muslim citizens and 10.5% from foreigner resident and businessmen.<sup>7</sup> The Land Products Tax was, in a way, the reimplementation of the tithe, 10% of the agricultural production was taxed for 2 years. As a result of these taxes, the share of direct taxes rose significantly in the first half of the 1940's to around 50%, reaching a peak at 62% in 1942 (see Table 1).

Table 1. Composition of Tax Revenue, 1923 - 1945

|      | Total Tax Revenue | Direct Tax Revenue |           | Indirect Tax Revenue |           |
|------|-------------------|--------------------|-----------|----------------------|-----------|
| YEAR | (1000 TL)         | (1000 TL)          | Share (%) | (1000 TL)            | Share (%) |
| 1923 | 95,354            | 46,223             | 48        | 49,131               | 52        |
| 1924 | 115,186           | 54,405             | 47        | 60,781               | 53        |
| 1925 | 138,270           | 44,157             | 32        | 94,113               | 68        |
| 1926 | 149,366           | 41,868             | 28        | 107,498              | 72        |
| 1927 | 163,355           | 41,757             | 26        | 121,598              | 74        |
| 1928 | 180,059           | 41,760             | 23        | 138,299              | 77        |
| 1929 | 182,535           | 45,262             | 25        | 137,273              | 75        |
| 1930 | 164,607           | 42,915             | 26        | 121,692              | 74        |
| 1931 | 141,360           | 42,291             | 30        | 99,069               | 70        |
| 1932 | 162,348           | 59,264             | 37        | 103,084              | 63        |
| 1933 | 156,483           | 56,891             | 36        | 99,592               | 64        |
| 1934 | 143,571           | 62,456             | 44        | 81,115               | 56        |
| 1935 | 154,957           | 68,287             | 44        | 86,670               | 56        |
| 1936 | 135,420           | 72,284             | 53        | 63,136               | 47        |
| 1937 | 163,083           | 45,560             | 28        | 117,523              | 72        |
| 1938 | 203,174           | 80,477             | 40        | 122,697              | 60        |
| 1939 | 196,243           | 86,934             | 44        | 109,309              | 56        |
| 1940 | 231,506           | 108,455            | 47        | 123,051              | 53        |
| 1941 | 313,164           | 138,261            | 44        | 174,903              | 56        |
| 1942 | 730,457           | 449,617            | 62        | 280,840              | 38        |
| 1943 | 758,201           | 356,054            | 47        | 402,147              | 53        |
| 1944 | 835,388           | 410,087            | 49        | 425,301              | 51        |
| 1945 | 522,976           | 255,118            | 49        | 267,858              | 51        |

Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/VI/GBG/Tablo\\_3.xls.htm](http://www.gib.gov.tr/fileadmin/user_upload/VI/GBG/Tablo_3.xls.htm)

<sup>7</sup> Kepenek and Yentürk (2004), p. 83

Income Tax Law<sup>8</sup> and Artisan Tax Law<sup>9</sup> were enacted in 1949 and came into force in 1950. “Law on Collection of Public Receivables” which regulates the collection of receivables belonging to the state was enacted in 1953 and the Excise Tax Law was put into effect in 1957. These modernization acts of the tax system led to a sharp increase in the tax revenue of the government. The average amount of tax collected between 1950-1954 was 1.5 billion TL, whereas between the years 1955 and 1959, total tax revenue of the government more than doubled, reaching a level of 3.3 billion TL (see Table 2).

Table 2. Government Budget Revenue, 1945 - 1959

|      | Total Revenue | Tax Revenue |
|------|---------------|-------------|
| Year | (1000 TL)     | (1000 TL)   |
| 1945 | 658,759       | 522,976     |
| 1946 | 1,041,494     | 739,654     |
| 1947 | 1,615,024     | 1,105,141   |
| 1948 | 1,467,701     | 1,084,381   |
| 1949 | 1,628,672     | 1,399,225   |
| 1950 | 1,419,449     | 1,242,185   |
| 1951 | 1,645,996     | 1,236,624   |
| 1952 | 2,235,829     | 1,580,619   |
| 1953 | 2,272,141     | 1,707,938   |
| 1954 | 2,390,787     | 1,940,700   |
| 1955 | 3,148,365     | 2,254,668   |
| 1956 | 3,304,844     | 2,587,345   |
| 1957 | 3,966,601     | 3,023,688   |
| 1958 | 4,822,080     | 3,563,886   |
| 1959 | 6,385,837     | 5,053,438   |

Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/VI/GBG/Tablo\\_1.xls.htm](http://www.gib.gov.tr/fileadmin/user_upload/VI/GBG/Tablo_1.xls.htm)

The 1960's and 1970's were the periods of state-directed economic activity.

State Planning Organization was established in 1960 and the main theme was a

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<sup>8</sup> The Income Tax Law proposed the taxation of every kind of personal and partnership revenues with a few exceptions. The exemption of the agricultural sector was the most important one. Personal income taxes ranged from 15% to 45%. A certain amount of income of a family could be exempt from the tax according to the family size.

<sup>9</sup> This tax was soon to be abolished by the year 1955.

mixed economy dominated by the state. One important condition for a successful economic development was considered to have a strong government budget and this necessitated the government revenue to be increased. However, the proposed tax reforms could not be implemented. Although the tax burden<sup>10</sup> rose gradually and reached to the levels around 15% by the end of the 1970's from 10% in 1968 (see Table 3), the increase in the government indirect tax revenue was achieved largely by raising the existing tax levels of some commodities like fuel-oil or imposing new indirect taxes such as the motor vehicle tax. The taxation of the agricultural income or the earnings from the sales of luxury land or housing was limited and the tax burden was largely carried by the regular wage and salary earners. Around 70% of the direct taxes consisted of the income taxation of the wages and salaries.<sup>11</sup>

Table 3. Tax Burden, 1968 - 1979

|      | Tax Revenue | GDP       | Tax Burden |
|------|-------------|-----------|------------|
| Year | YTL         | YTL       | (%)        |
| 1968 | 16,240      | 163,515   | 9.9        |
| 1969 | 19,114      | 182,760   | 10.5       |
| 1970 | 23,003      | 205,567   | 11.2       |
| 1971 | 31,425      | 255,061   | 12.3       |
| 1972 | 39,013      | 304,862   | 12.8       |
| 1973 | 51,958      | 383,471   | 13.5       |
| 1974 | 65,157      | 520,009   | 12.5       |
| 1975 | 95,009      | 674,130   | 14.1       |
| 1976 | 127,055     | 856,952   | 14.8       |
| 1977 | 168,249     | 1,096,485 | 15.3       |
| 1978 | 246,420     | 1,632,392 | 15.1       |
| 1979 | 405,484     | 2,850,590 | 14.2       |

Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/VI/GBG1.htm](http://www.gib.gov.tr/fileadmin/user_upload/VI/GBG1.htm)

Poor economic performance of the economy, unfavorable effects of the international oil crisis in the last period of the 1970's and the consequent economic

<sup>10</sup> Tax Burden is defined as the ratio of the total tax revenue to the GDP.

<sup>11</sup> Kepenek and Yentürk (2004), p. 162

crisis put an end to the state-led, planned economic growth policy of the last two decades. The spread of the globalization of the financial and economic activities gained momentum and Turkey took its first steps to be integrated into this process. The early 1980's was an era of financial liberalization, free trade and private sector dependent economic activity. An economic package was announced in January 24, 1980 which initiated the liberalization and economic stabilization program. Reducing the extremely high level of inflation,<sup>12</sup> and alleviating the severe foreign exchange crisis were the immediate goals of the program. However, the new economic program also had long-term objectives such as adopting a free market system and switching to the export-oriented economic growth strategy instead of the import-substitution policy, which proved unsuccessful in the last years. Fixed exchange rate system was replaced with a flexible exchange rate regime and on July 1, 1980, the interest rates were freed. To improve the export volume of the country, wages were restrained and public spending was limited. These fundamental changes in the economic strategies and policies had also far-reaching effects on the organization of the taxation system.

The focus of the economic activity was shifted from the state-planned strategies or state-owned enterprises to the private sector. Therefore, the tax burden on the private sector enterprises and capital was bound to be decreased and the taxation system was used as an instrument to transfer resources to the private sector in order to boost its economic activity, assist in international competition, create incentives to produce and increase its share in the GDP. Corporate tax rate was reduced from 50% to 40% in 1983 and several exemptions such as corporate tax exemption or customs duty exemption were provided.

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<sup>12</sup> The inflation rate in 1980 was 115.6%.

The liberalization of cross-border trade also led to a decline in tax revenues from custom duties. The percentage share of taxes in GNP collected from foreign trade decreased from 3.05% in 1976 to an average share of 1.8% in the 1980's (see Table 4).

Table 4. The Percentage Share of Foreign Trade Taxes in GNP, 1976 - 1989

| Year     | Share (%) |
|----------|-----------|
| 1976     | 3.05      |
| 1977     | 2.82      |
| 1978     | 2.59      |
| 1979     | 2.34      |
| 1980     | 1.38      |
| 1981     | 1.42      |
| 1982 (*) | 1.37      |
| 1983     | 1.83      |
| 1984     | 1.70      |
| 1985     | 2.11      |
| 1986     | 1.94      |
| 1987     | 2.37      |
| 1988     | 2.07      |
| 1989     | 1.84      |

\* 10-month data.

Source: <http://ekutup.dpt.gov.tr/ekonomi/gosterge/tr/1950-06/esg.htm>

Liberalization process therefore meant a reduction in the tax collections of the government as a result of policies in favor of the private sector. To alleviate fiscal imbalances and the government budget deficit, the Value-Added Tax (VAT) was introduced on January 1, 1985 as the common sales tax. VAT replaced eight other indirect taxes, but its share in total tax revenues was much higher than those eight taxes together. In the five years preceeding the introduction of the VAT, the average share in total tax revenue of the replaced taxes together was 19.6%, whereas in the five years following 1985, the average share of VAT in total tax revenues reached 26.6% (see Table 5).

Table 5: The Share of VAT and Taxes Replaced by VAT in Total Tax Revenue

| Year | The Share of Taxes Which were Replaced by VAT in Total Tax Revenue (%) | The Share of VAT in Total Tax Revenue (%) |
|------|------------------------------------------------------------------------|-------------------------------------------|
| 1980 | 18                                                                     |                                           |
| 1981 | 17                                                                     |                                           |
| 1982 | 23                                                                     |                                           |
| 1983 | 19                                                                     |                                           |
| 1984 | 21                                                                     |                                           |
| 1985 |                                                                        | 25                                        |
| 1986 |                                                                        | 26                                        |
| 1987 |                                                                        | 28                                        |
| 1988 |                                                                        | 29                                        |
| 1989 |                                                                        | 25                                        |

Source: Merter, Acar and Arslan, 2007, p.36

By 1986, the share of corporate taxes in total tax revenue gradually declined from 15.9% to 7.1% in 1992. VAT, on the other hand, increased its share in total tax revenue from 24.3% in 1985 to an average of 30.6% in the 1990's (see Table 6).

Table 6. The Share of Corporate Tax and VAT in Total Tax Revenue

| Year | The Share of Corporate Tax in Total Tax Revenue (%) | The Share of VAT in Total Tax Revenue (%) |
|------|-----------------------------------------------------|-------------------------------------------|
| 1985 | 11.7                                                | 24.8                                      |
| 1986 | 15.9                                                | 26.3                                      |
| 1987 | 14.7                                                | 28.4                                      |
| 1988 | 14.9                                                | 29.3                                      |
| 1989 | 14.1                                                | 25.3                                      |
| 1990 | 10.2                                                | 27.2                                      |
| 1990 | 9.0                                                 | 29.0                                      |
| 1992 | 7.1                                                 | 29.7                                      |
| 1993 | 7.2                                                 | 31.0                                      |
| 1994 | 8.2                                                 | 33.0                                      |
| 1994 | 7.5                                                 | 30.1                                      |
| 1995 | 9.5                                                 | 32.7                                      |
| 1996 | 8.4                                                 | 33.1                                      |
| 1997 | 8.3                                                 | 32.9                                      |
| 1998 | 8.1                                                 | 29.5                                      |
| 1999 | 10.5                                                | 28.1                                      |
| 2000 | 8.9                                                 | 31.6                                      |

Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/VI/CVI/Tablo\\_51.xls.htm](http://www.gib.gov.tr/fileadmin/user_upload/VI/CVI/Tablo_51.xls.htm), Merter, Acar and Arslan, 2007, p.41

## Taxation Trends in Turkey

Turkish taxation is argued to possess a regressive character rather than a progressive one and to have inefficient and unsuccessful methods of tax collection. Many reforms which have been implemented since 1950's turned out to be ineffective to remedy the chronic problems of the system. This might partially be due to the fact that most of these reforms were exercised to respond to the urgent and serious needs of the government budget rather than to regulate the taxation system in a proper and efficient way.

Since 1990's, Turkey experienced devastating earthquakes in 1999 and severe financial crises in 1994 and in 2001. The results of these disasters and crises were dramatic, the economy was affected terribly and the growth rates hit even negative levels.<sup>13</sup> The economic contraction also deteriorated the fiscal stance of the government and the post-crisis adjustment programs demanded tax revenue increases to improve public imbalances (Albayrak, 2008). The reflection of these pressing problems in the tax revenue organization has been a heavier reliance on indirect taxes since the inefficiency in tax collection and a sizable informal sector made it almost impossible to extract the necessary revenues from income taxation. With almost 60% of the tax revenue already accruing from indirect taxation, two more indirect tax items; Private Communication Tax and Private Consumption Tax were introduced by the year 2002, and thereafter, the share of indirect taxation has reached around 70% of total tax revenue.

Government revenue from taxes are mainly composed of direct, indirect and foreign trade taxes (which can also be considered as indirect taxes). Table 7 presents

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<sup>13</sup> The GDP growth rates in 1994 and 2001 were -6.1% and -9.5% respectively.

the components of the central government tax revenue in 2007 and their share in the total tax revenue.

Table 7. Central Government Tax Revenue, 2007

| Type of Tax                                       | Total Amount<br>( million YTL) | Share in Total Tax Revenue<br>(%) |
|---------------------------------------------------|--------------------------------|-----------------------------------|
| Direct Tax Revenue                                | 53,779                         | 31.4                              |
| Income Tax                                        | 38,061                         | 22.2                              |
| Corporation Tax                                   | 15,718                         | 9.2                               |
| Taxes on Property                                 | 3,693                          | 2.2                               |
| Inheritance and Gift Tax                          | 136                            | 0.1                               |
| Motor Vehicles Tax                                | 3,557                          | 2.1                               |
| Indirect Taxes                                    | 76,040                         | 44.4                              |
| VAT                                               | 28,965                         | 16.9                              |
| Private Consumption Tax                           | 39,351                         | 23.0                              |
| Private Communication Tax                         | 4,222                          | 2.5                               |
| Other Indirect Taxes                              | 3,502                          | 2.0                               |
| Foreign Trade Taxes<br>(including VAT on imports) | 29,001                         | 17.0                              |
| Stamp Tax                                         | 3,677                          | 2.1                               |
| Other                                             | 4,904                          | 2.9                               |
| Total Tax Revenue                                 | 171,095                        | 100                               |

Source: Activity Report 2007, Revenue Administration

Indirect taxes had the highest share in total tax revenue in 2007; 44.4% of the taxes accrued to the government budget is obtained from the taxes on consumption. If foreign trade taxes are also included, then the indirect taxes account for 61%, whereas, direct taxes account for almost half of the indirect taxes with a portion of 31.4%. The major component of the indirect taxes in 2007 is the Private Consumption Tax (PCT). Although Value Added Tax is the general sales tax and Private Consumption Tax is applied only to certain goods and services such as

petroleum, alcohol and tobacco, PCT's nominal contribution to the government budget is larger than that of VAT.

Direct taxes are composed of Personal Income Tax (PIT) and Corporate Income Tax (CIT). Personal Income Tax constitutes 71% of direct taxes, and Corporate Income Tax accounts for 29% of the total direct tax revenue.

Table 8 presents tax revenues collected by government through direct and indirect taxation and their percentage shares in total tax revenues through years 1997-2007. In the 10-year period, the average share of indirect taxes is 63.36% and direct taxes has a share equal to 36.64% in total taxes. In the year 2002, a huge shift can be observed in the composition of tax revenues; the portion of direct taxes declines from 40% to 34% and the share of indirect taxes jumps to 66% from its 60% level in the previous year. 2002 is the year in which the Private Consumption Tax was legislated and came into force. With the introduction of the PCT, the indirect tax revenue increased to 57 billion YTL from 40 billion YTL in nominal terms (a 67% increase).

High levels of indirect taxes compared to the direct taxation of income is a common feature of developing countries. Low levels of income, the size of the informal sector, and share of agricultural sector in total output production<sup>14</sup>, makes it very hard for governments to gather the necessary tax revenues from the direct taxation of income. In addition, in those countries the taxation system and legal framework are not properly designed for an effective collection of direct taxes. In that sense, these countries prefer to supply the government budget with indirect taxes, which are easier to manage and collect. As a developing country, Turkey also possesses these characteristics, and therefore is dependent on indirect taxes more. Its

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<sup>14</sup> In 2007, the agricultural sector's share in GDP was 8.6 percent for Turkey and 26 percent of the labor force was in agricultural sector ([www.tuik.gov.tr](http://www.tuik.gov.tr)).

GDP per capita is well below the OECD average despite the strong growth in recent years<sup>15</sup> (see Table 9). There are various estimations about the size of the informal sector in Turkey, generally hovering around 30% and 50% (including agricultural informal sector) which suggests that there's an almost half of the formal economy that is not registered, therefore not taxable (Pinar, 2001).

Table 8. Direct and Indirect Tax Composition, 1997-2007

| Year              | Total Tax Revenue | Direct Tax Revenue * | Share in Total Tax Revenue | Indirect Tax Revenue ** | Share in Total Tax Revenue |
|-------------------|-------------------|----------------------|----------------------------|-------------------------|----------------------------|
|                   | (million YTL)     | (million YTL)        | (%)                        | (million YTL)           | (%)                        |
| 1997              | 4,745             | 1,932                | 40.71                      | 2,814                   | 59.29                      |
| 1998              | 9,229             | 4,303                | 46.62                      | 4,926                   | 53.38                      |
| 1999              | 14,802            | 6,716                | 45.37                      | 8,087                   | 54.63                      |
| 2000              | 26,504            | 10,850               | 40.94                      | 15,654                  | 59.06                      |
| 2001              | 39,736            | 16,058               | 40.41                      | 23,678                  | 59.59                      |
| 2002              | 59,632            | 20,061               | 33.64                      | 39,571                  | 66.36                      |
| 2003              | 84,316            | 27,780               | 32.95                      | 56,536                  | 67.05                      |
| 2004              | 101,039           | 31,147               | 30.83                      | 69,892                  | 69.17                      |
| 2005              | 119,251           | 36,590               | 30.68                      | 82,661                  | 69.32                      |
| 2005              | 131,949           | 43,081               | 32.65                      | 88,867                  | 67.35                      |
| 2006              | 151,272           | 47,335               | 31.29                      | 103,937                 | 68.71                      |
| 2007              | 171,095           | 57,472               | 33.59                      | 113,622                 | 66.41                      |
| 10 Year - Average |                   |                      | 36.64                      |                         | 63.36                      |

\* Direct taxes include taxes on property

\*\* Indirect taxes include foreign trade taxes, stamp tax and other fees.

Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/VI/GBG/Tablo\\_3.xls.htm](http://www.gib.gov.tr/fileadmin/user_upload/VI/GBG/Tablo_3.xls.htm)

Table 9, GDP per capita, USD, constant prices, 2002-2006

| Year | Turkey | OECD   |
|------|--------|--------|
| 2002 | 8,463  | 25,294 |
| 2003 | 8,772  | 25,581 |
| 2004 | 9,449  | 26,209 |
| 2005 | 10,204 | 26,718 |
| 2006 | 10,772 | 27,343 |

Source: [http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA\\_TABLE1](http://stats.oecd.org/wbos/Index.aspx?datasetcode=SNA_TABLE1)

<sup>15</sup> Its GDP has increased by 27% from 2002 to 2006 (Source, OECD)

Table 10 and 11 present the share of taxes on goods and services and the share of taxes on income, profits and capital gains as a percentage of GDP for Turkey, OECD, EU countries and three other developing countries; Mexico, Poland and Czech Republic for comparison purposes.

Table 10. Share of Taxes on Goods and Services, 1995-2005

| Year | Taxes on Goods and Services (% of GDP) |       |       |        |        |                |
|------|----------------------------------------|-------|-------|--------|--------|----------------|
|      | Turkey                                 | OECD  | EU-19 | Mexico | Poland | Czech Republic |
| 1995 | 8.48                                   | 11.06 | 12.16 | 8.97   | 12.75  | 12.07          |
| 1996 | 9.73                                   | 11.15 | 12.21 | 9.31   | 12.92  | 11.84          |
| 1997 | 10.35                                  | 11.12 | 12.14 | 9.41   | 12.04  | 11.28          |
| 1998 | 10.23                                  | 11.13 | 12.06 | 8.27   | 11.90  | 10.81          |
| 1999 | 11.21                                  | 11.36 | 12.26 | 8.61   | 12.12  | 11.47          |
| 2000 | 13.57                                  | 11.27 | 12.05 | 9.80   | 11.47  | 11.17          |
| 2001 | 14.10                                  | 11.06 | 11.78 | 9.67   | 11.20  | 10.84          |
| 2002 | 14.58                                  | 11.10 | 11.87 | 8.86   | 12.26  | 10.79          |
| 2003 | 16.20                                  | 11.23 | 11.92 | 10.00  | 12.55  | 11.06          |
| 2004 | 14.92                                  | 11.27 | 12.05 | 10.53  | 12.44  | 11.92          |
| 2005 | 15.93                                  | 11.36 | 12.09 | 11.29  | 12.60  | 11.82          |

Source: OECD Revenue Statistics

Table 11. Share of Taxes on Income, Profits and Capital Gains

| Year | Taxes on Income, Profits and Capital Gains (% of GDP) |       |       |        |        |                |
|------|-------------------------------------------------------|-------|-------|--------|--------|----------------|
|      | Turkey                                                | OECD  | EU-19 | Mexico | Poland | Czech Republic |
| 1995 | 6.39                                                  | 12.42 | 12.70 | 4.15   | 11.07  | 9.38           |
| 1996 | 6.66                                                  | 12.57 | 12.86 | 4.05   | 10.65  | 8.12           |
| 1997 | 7.65                                                  | 12.81 | 13.05 | 4.56   | 10.35  | 8.65           |
| 1998 | 9.41                                                  | 12.89 | 12.96 | 4.73   | 10.23  | 8.07           |
| 1999 | 9.81                                                  | 12.97 | 13.01 | 5.04   | 9.87   | 8.29           |
| 2000 | 9.54                                                  | 13.35 | 13.19 | 5.04   | 9.66   | 8.03           |
| 2001 | 10.14                                                 | 13.03 | 12.91 | 5.25   | 9.51   | 8.61           |
| 2002 | 7.71                                                  | 12.61 | 12.55 | 5.23   | 9.62   | 8.95           |
| 2003 | 7.77                                                  | 12.34 | 12.11 | 5.05   | 6.02   | 9.45           |
| 2004 | 6.91                                                  | 12.42 | 12.06 | 4.67   | 5.87   | 9.61           |
| 2005 | 7.05                                                  | 12.95 | 12.41 | 4.80   | 6.43   | 9.11           |

Source: OECD Revenue Statistics

In developed economies, around 12% of GDP is collected as taxes on goods and services. This ratio is almost constant since 1995 through 2005. Turkey, on the

other hand, has been increasing the portion of taxes on goods and services constantly since 1995, reaching a level of 16% in 2005. Its counterparts, Mexico, Poland and Czech Republic collect 11.29%, 12.60% and 11.82% of their GDP from indirect taxes, respectively, which are below the level of Turkey.

As for the income taxes, the developing economies, including Turkey, have significantly low levels of income taxes as the percentage of their GDP's than developed countries. The EU-19 members and OECD members collect on average 12.95% and 12.41% of their GDP's from taxes on income in 2005. This ratio is almost the half for Turkey. Despite the relatively high levels in 1999, 2000 and 2001 because of the serious contraction of GDP as a result of earthquakes and economic crises, the share of taxes on income nearly returned to its levels of 10 years before.

#### Current Tax Structure and Taxes in Turkey

The Turkish Tax System is a multi-tax system composed of direct and indirect taxes. Taxes can be classified under three major headings as

- Income Taxes or Direct Taxes, which, the net income of corporations and individuals are subject to.
- Taxes on Expenditure or Indirect Taxes, which impose a levy on the transaction of goods and services within the borders of the country
- Taxes on Wealth, to which the possession of land, housing or motor vehicles and the transition of goods from one to another without return (gifts and inheritances) are subjects to.

## Direct Taxes

### Corporate Income Tax

The net income of the corporations realised from their commercial and agricultural activities are subject to the corporate income tax. The corporate income tax is applied at a rate of 20%, which has recently been decreased from 33% (in 2004) and 30% (in 2006).<sup>16</sup> The companies who are established in Turkey or whose statutory domicile is in Turkey have full tax liability, and their worldwide earnings are also subject to the Corporate Income Tax. The non-resident companies will be subject to the tax on the profits earned in Turkey if they conduct their business through a branch or a joint venture. Certain income, other than agricultural and commercial income, such as dividends, rents, interest or capital gain are subject to a withholding tax ranging from 0% to 20% and are exempt from 20% corporate income tax.

### Personal Income Tax

The net amount of profits and earnings realised from individual's professional, commercial and agricultural activities and the salaries earned in Turkey are subject to the Personal Income Tax at various rates depending on the annual earnings (see Table 13).

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<sup>16</sup> Source: [http://www.gib.gov.tr/fileadmin/user\\_upload/Yararli\\_Bilgiler/2007\\_KV\\_Oranlari.html](http://www.gib.gov.tr/fileadmin/user_upload/Yararli_Bilgiler/2007_KV_Oranlari.html)

Table 13. Personal Income Tax Rates

| Annual Income                                      | Personal Income Tax Rate |
|----------------------------------------------------|--------------------------|
| Up to TRY 7,800                                    | 15%                      |
| Up to TRY 19,800 (for first TRY 7,800, TRY 1,170)  | 20%                      |
| Up to TRY 44,700 (for first TRY 19,800, TRY 3,570) | 27%                      |
| Over TRY 44,700 (for first TRY 44,700, TRY 10,293) | 35%                      |

Source: <http://www.gib.gov.tr/index.php?id=1210>

Other than commercial, agricultural, professional income and salaries, income such as interest, dividend and capital gain are exempt from the general income tax but are subject to a withholding tax ranging from 0% to 20%. Turkish nationals, unless they have residence abroad, and foreigners which stay in Turkey without interruption for more than six months for reasons other than imprisonment, illness or assignment for specific and temporary projects are accepted as resident and therefore are unlimited taxpayers. Foreigners who stay in Turkey less than a continuous interval of six months in a calendar year and foreigners who stay more than a period of six months but are in Turkey for specific and temporary projects are taxed only on their income from employment in Turkey. Although personal income taxation is based on annual declaration of earnings, wagers are not obligated for an income declaration, employers deduct the income tax from their salaries and transfers it to the tax authority every month.

### Indirect Taxes

#### Value Added Tax (VAT)

Value Added Tax is levied on the transaction and importation of all goods and services in Turkey. Goods and services within the scope of commercial,

agricultural, industrial and independent professional activities and imports of all kinds are the subject of the VAT.

Three different rates are applied to goods and services; 18% rate of VAT is the current standard rate and reduced rates of 1% and 8% are imposed on certain commodities. Some group of commodities under these rates are as follows;

Table 14. VAT Rates for Certain Commodities

| VAT Rate | Subjects of the Rate                                                              |
|----------|-----------------------------------------------------------------------------------|
| 1%       | dried foods, cotton, wheat, sheep and cattle, bread, newspaper and magazines etc. |
| 8%       | Basic food items (milk, pasta, cooking oil, etc.), books, medical appliances etc. |
| 18%      | Goods and services that are not subject to the reduced VAT rates.                 |

Source: <http://www.gib.gov.tr/index.php?id=830>

#### Special Consumption Tax (SCT)

Certain goods such as cigarettes, gas, energy, alcohol and luxury goods are subject to the Special Consumption Tax. SCT is applied on various rates and some of the SCT, such as the taxes on petroleum products are excise taxes rather than ad valorem type. There are mainly 4 different group of commodities that SCT is levied on different rates;

- List I is related to petroleum products, natural gas, lubricating oil, solvents etc.
- List II is related to automobiles and other vehicles, motorcycles, planes, helicopters, yachts
- List III is related to tobacco and tobacco products, alcoholic beverages and soda

- List IV is related to the luxury goods.

### Special Communication Tax

In the aftermath of the 1999 Marmara Earthquake, large budget deficits led the government to impose a special type of tax on the communication sector. Services of cell phone, cable radio and television broadcasts and telecommunication are subject to the Special Communication Tax. The rates of the Special Communication Tax range from 15% to 25% whereas excise type taxes also exist in the cell phone services.

### Other Indirect Taxes

- Banking and Insurance Transaction Tax (BITT): All transactions of banks and insurance companies are the subject of the tax. BITT ranges from 5% (all fees and interest, commission revenues of local banks, finance companies), to 1% (revenues from interbank transactions) and 0.1% (local foreign exchange transactions).
- Stamp Tax: Preparation of the documents related to acts, official reports, commercial transactions, conclusions and receipts are the subjects of this tax. A stamp tax rate of 0.75% are imposed over the aggregate amount of these documents
- Customs Duty: All goods and services imported from abroad are the subjects of the Customs Duty.

## Taxes on Wealth

### Inheritance and Gift Tax

The transition of goods that belong to Turkish citizens and which are within Turkey by inheritance or without return are the subjects of this tax. People who acquire these goods in question are the taxpayers. Turkish citizens that gain the possession of goods outside the borders of Turkey are also liable to pay this tax. Inheritance and Gift tax rates range from 1% to 30% according to the value of the inherited or gift goods. Table 15 presents the rates for inheritance and gift tax.

Table 15. Inheritance and Gift Tax Rates

| Value                             | Rate of Inheritance Tax | Rate of Gift Tax |
|-----------------------------------|-------------------------|------------------|
| First TRY 150,000                 | 1%                      | 10%              |
| Following TRY 320,000             | 3%                      | 15%              |
| Following TRY 680,000             | 5%                      | 20%              |
| Following TRY 1,380,000           | 7%                      | 25%              |
| Following exceeding TRY 2,530,000 | 10%                     | 30%              |

Source:<http://www.gib.gov.tr/index.php?id=1079&uid=uYpm8x8AZUJxFJo3&type=teblig>

### Real Estate Tax

Lands and buildings within the borders of Turkey are the subjects of the Real Estate Tax. The ownership of the land or the building is the taxable event and the tax is accrued annually, which is to be paid in two installments. Sales and purchase of the real estates are also subject to the “Real Estate Sale and Purchase Tax”, in which a tax rate of 3% of the value of the property is levied on the seller and the purchaser of the property equally.

## Motor Vehicle Tax

Registered motor vehicles in Turkey are the subject of the tax. Registered owners of these vehicles are the payers of the Motor Vehicle Tax which is accrued annually and paid in two installments.

### Outline of the Remaining Chapters

Chapter 2 provides an overview of the previous empirical applications of the demand system estimation models both in the world and in Turkey. Chapter 3 presents the description of data that has been used in this study and lays out the methodology. The estimated models and related findings are presented in Chapter 4. Chapter 5 provides a summary and major findings of this study.

## CHAPTER 2

### LITERATURE REVIEW

#### Almost Ideal Demand System

Among several demand systems<sup>17</sup> in the literature, the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980) is the most commonly used methodology. The AIDS model defines the budget shares of commodities in terms of prices and real expenditure. Deaton and Muellbauer (1980) suggest that, it gives an arbitrary first-order approximation to any other demand system, satisfies the axioms of choice exactly and consistent with household-budget data. The AIDS model is the basis of many applied works on consumer behaviour with time-series or cross-section micro data. The ease of estimation, ability to estimate the elasticities within one subgroup rather than including all goods in the model and flexibility in group construction are some of the reasons which make the AIDS a very attractive area of research and application among economists. There are numerous studies on consumer behaviour which estimate elasticities using AIDS in the economics literature. Some of these studies focus on elasticities of a certain commodity or commodity aggregate alone or commodities and commodity aggregates within a certain group such as food category. Some others focus on estimating the elasticities of the aggregate commodity groups in which all the goods and services in a country are included.

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<sup>17</sup> Linear Expenditure System (Stone, 1954), Rotterdam Model (Theil, 1965) and Translog Model (Christensen et. al., 1975) are some other generally used demand systems.

Jiang and Davis (2007) analyze the rural food consumption behaviour in Jilin Province in China. Assuming a three-stage budgeting procedure, they estimate conditional and total expenditure elasticities using survey data and find out that animal products have the highest elasticity in the food category and meat in the animal products category. Regorsek and Erjavec (2007) explore the household food consumption behaviour in Slovenia using a household budget survey (HBS). The households are segmented by quantile income levels and unit values are used instead of the nominal prices. Without incorporating any explanatory variable other than real income and prices, they conclude that dairy products and vegetables are the most sensitive food items to total food expenditure. Jabarin (2005) estimates a meat demand system for Jordan under which the meat category consists of four groups of products: beef, poultry, mutton and fish. The income and price elasticities are estimated and the results reveal that the demand for mutton and poultry is elastic while the demand for beef and fish is inelastic. Beef and mutton turn out to be luxury goods. Mergos et.al. (1989), estimate an AIDS for seven commodity groups using the annual time-series Greek data covering the years between 1960 and 1986. After finding a correlation problem in the residuals, which is common in time-series data, they incorporate a lagged consumption parameter to attain a dynamic structure in the model. They reveal that only food and housing are necessity for Greek people. Menezes et al. (2007) use Brazilian Expenditure Surveys of 1987/88 and 1995/96 to conduct a demand system analysis with a two-stage budgeting procedure. In the first step, they estimate the income and price elasticities of eight groups of goods and services<sup>18</sup> and in the second stage, elasticities of eleven sub-groups of staples are estimated. Their results confirm the income inequality in Brazil; income elasticities

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<sup>18</sup> Food, housing, clothing, transportation, health and personal care, personal expenditure, education and tobacco.

differ across income groups. Income elasticity is higher for households for the most consumed staples such as wheat, rice and bean and milk.

Regarding the AIDS studies in Turkey, Yavuz and Baydemir (1999) estimate a food demand system with five commodity groups (cereal, vegetable, fruit, meat and dairy products) using a survey of 240 households in Erzurum district. The lowest income elasticity is of the cereal group and the highest one turn out to be of the dairy products. Except for fruit and meat products, low-income families have higher income elasticities compared to the higher income groups. Alpay and Koç (2000) estimate a complete demand system with 10 commodity aggregates<sup>19</sup>. They overcome the lack of price information in the 1994 Household Budget Survey data by using the price indices, constructed by the State Institute of Statistics, for 19 provinces across the country. Their results reveal that only food, housing and health services have expenditure elasticities less than one and the largest elasticity is for education and transportation services. Interestingly, the household size has a negative effect on food and housing expenditures. Şengül (2004) uses the 1994 Household Budget Survey and splits the sample households into five income categories. The AIDS model is estimated according to these sub-groups for food category. One of the main findings of this study is that the food demand for high-income households is affected by socio-demographic characteristics and total expenditure, whereas for low-income households, it depends largely on prices. Fidan and Klasra (2005) analyse the seasonality in household demand for meat and fish with the AIDS by using an expenditure survey consisting of 500 households conducted in Ankara district. Their findings show considerable seasonal fluctuations in meat varieties. Consumption of red meat increases during spring (the time of the Muslim Festival of

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<sup>19</sup> Food, clothing, education, entertainment, furnishing, health, housing, tourism, transportation and other goods and services.

Sacrifice at the year of the survey) and beef consumption increases in winter and spring. Akbay et.al. (2007) analyse Turkish household food consumption by using the 2003 Household Expenditure Survey. The food category is classified under 11 food groups.<sup>20</sup> Their model is rather a large one since it includes 29 socio-demographic characteristics other than prices and real income. Meat and meat-products, oils and fats and JHC turn out to be expenditure-elastic. All income elasticities are smaller than unit value, therefore all food groups are necessities. Their results also show that the food consumption behaviour in Turkey is highly responsive to the socio-demographic characteristic of the households; 208 of 260 demographic-related parameters come out as significant at the 5% level. The authors, then, disaggregate the analysis further and explore the variations in elasticities in different social and demographic classes of households. Elasticities are estimated according to the place of residence (urban vs. rural, income regions), income groups and education level and age of the household size. Armağan and Akbay (2008) explore the animal products<sup>21</sup> consumption patterns using a household survey conducted in Aydın Province of Turkey. Their results reveal that all of the animal products in the study are necessity goods and except for meat, all the goods included have inelastic demand. They also incorporate several socio-demographic variables in the system. However only 6 of 36 coefficients belonging to these variables turn out to be significant. The number of the household members have negative effect on milk consumption: education level affects yoghurt, fish, poultry, meat consumption positively and milk consumption negatively.

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<sup>20</sup> (i) Breads (ii) Cereals (iii) Meat and meat products (iv) Oils and fats (v) Vegetables (vi) Fruit (vii) Dairy products (viii) Jam, honey, chocolate and sugar (JHC) (ix) Coffee and tea (CT) (x) Non-alcoholic beverages (NAB) (xi) Other foods (OF).

<sup>21</sup> Milk, yoghurt, cheese, poultry, fish, meat and other are the animal products categories in the study.

Other than Alpay and Koç (2000), to our knowledge, there is no AIDS study in Turkey that estimate the elasticities of commodity aggregates which cover the whole group of commodities that households consume. The 2003 HBS classifies the goods and services that are in the households' consumption bundle into twelve commodity groups and this study differs from other AIDS studies in Turkey in its attempt to estimate the price elasticities of these twelve commodity aggregates using data on a household level.

## Indirect Optimal Taxation and Marginal Tax Reform

### Theoretical Background

In welfare analysis, the first-best solution to the efficiency and distributional problems of taxation is the lump-sum taxation. The amount of a lump-sum direct tax does not depend on the actions of an individual. In theory, by using lump-sum transfers to and from each individual, a government can achieve the desired outcome of efficiency (no distortion to the economic behaviour) and redistribution among the members of the society. However, implementing a desirable lump-sum transfer system is almost impossible and the theories of optimal taxation can be seen as analyses of optimal taxation when lump-sum taxation is ruled out (Stern, 1987).

The first thorough analysis of indirect taxation was made by Ramsey (1927). In his seminal paper, he tried to find the optimal commodity tax rates to satisfy a given revenue requirement with a minimum loss of utility. His model was based on only one consumer with lump-sum income and time endowment for labor, maximizing his utility by choosing his consumption bundle and leisure time. The

model ends with a rule called the famous ‘Ramsey Rule’ which suggests that when commodity taxes are imposed, the proportional reduction in compensated demand for goods should be the same across commodities. This rule, then, implies that taxes should be inversely related with the price elasticities of the goods, since for equal proportional reduction, a low price-elastic good should be taxed more heavily than the high price-elastic goods.

The problem with the Ramsey model and the Ramsey rule is that on distributional grounds, it might not be acceptable to impose heavy taxes on necessities such as food or housing since they have low price elasticity. Although the Ramsey rule is a result of a model with one consumer only, it can easily be generalized to many consumers with appropriate adjustments in the model. Replacing the indirect utility function of the individual with a Bergson – Samuelson type welfare function, incorporating in the model a variable for the net social marginal valuation of income<sup>22</sup> for households and a generalization of Feldstein’s (1972) distributional characteristics of a good,<sup>23</sup> it can be shown that rather than being equal for all goods and commodities, the proportional reduction in demand for goods resulting from indirect taxes should vary across commodities according to the concentration of the consumption of that good in the hands of ‘rich’, where ‘rich’ refers to the individuals with low social marginal valuation of income.

A flat rate for all indirect taxes is another debated issue in the taxation literature. The Ramsey rule obviously rejects the case for uniform taxation which is suggested for countries especially with considerable administrative problems. The proposed advantages for uniform taxation are that; it restrains the administration

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<sup>22</sup> “The value of an extra dollar to an individual as perceived by the government plus any extra indirect tax revenue arising from the expenditure of that dollar” (Stern, 1987, p. 34)

<sup>23</sup> A measure for the share of ‘socially deserving’ in the total consumption of a good (see Chapter 4).

from applying irrational, short-term policies and it reduces the burden on the administration. It is also based on the argument on the impossibility of finding the optimal tax rates since it's very hard to estimate the price elasticities correctly.

In addition to these practical concerns, some theories combining direct and indirect taxation propose the optimality of uniform indirect taxation. Under a linear income tax scheme and an economy consisting of identical individuals, solving for the optimal indirect taxes reveal that if government is indifferent to distributional considerations then all indirect taxes are zero and revenue is raised by lump-sum grants. Indirect taxes are important only if there's concern for inequality and Atkinson (1977) shows that under this scheme, with a direct utility function of Stone-Geary form for individuals, the optimal indirect taxes are uniform from equity perspective as well. The second theorem on the combination of direct and commodity taxation states that if optimal income tax is non-linear, individuals differ only in the wage rate and goods are weakly separable<sup>24</sup> from labor then there is a case for the optimality of the uniform indirect taxation (Stern, 1987).

Instead of exploring the optimal tax structure of the system, trying to find the optimal changes in taxes is a more modest and applicable approach. Marginal tax reform analysis requires only local information about economic responses to tax changes whereas the optimal tax studies require global information about these responses. The marginal tax reform analysis is the approach that we apply in our study, and similar to the optimal tax analysis mentioned above, it is based on a Utilitarian social welfare function which is composed of the utility functions of each individual in the society. The marginal costs of raising one more unit of currency from the tax on each commodity is calculated by dividing the rate of change in the

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<sup>24</sup> Weak separability refers to independence of marginal rate of substitution between goods from marginal rate of substitution between labor and leisure.

value of the welfare function with respect to the tax increase by the change in the government revenue as a result of this modification in the tax rate. If these marginal costs differ across commodities, then there's a case for altering the tax rates until the marginal social costs are equal (see Chapter 4 for a detailed analysis of this model).

### Empirical Studies on Indirect Tax Reform

Using a model in which (1) there's a Benthamite additive iso-elastic social welfare function for government to maximise and (2) the distributional considerations are in line with Feldstein's (1972) distributional characteristic of each good, Kaplanoglou and Newbery (2003) estimate the marginal welfare costs of commodity groups by using the 1987 / 88 Greek Household Expenditure Survey and the elasticities obtained from two previous demand estimation studies using macro time-series data for Greece. They find out that the tax structure at that period is not optimal for any degree of inequality aversion.<sup>25</sup> They advise a more uniform taxation system and at high levels of inequality aversion, commodity groups like transport, clothing and alcohol happen to be attractive candidates for additional taxation. In the second part of their paper, they explore the cross-sectional characteristics of the marginal indirect tax rates which are defined as the extra indirect tax paid on additional goods purchased when income increases by one unit. This analysis shows that, controlling for demographic variables, the marginal indirect tax rates are constant across income groups, therefore the tax structure could be considered to be fair on distributional grounds.

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<sup>25</sup> Atkinson's (1970) inequality aversion.

In another study of these authors, Kaplanoglou and Newbery (2004) focus on the simplification of the Greek tax system between 1988 and 2002 using HBS data. By a simple analysis of the share of indirect taxes on the household budgets, they reveal that the tax reform benefited wealthier households and the inequality indices (Gini, Atkinson, Theil) support their results. In the last stage, with a marginal tax reform analysis they suggest that the indirect tax system lost some of its redistributive power as a result of these tax reforms.

Nichele and Rober (1995) analyse the reform on the French indirect tax system imposed by the European Community for the harmonization of VAT rates across commodities. They simulate the effects of this reform by estimating an AIDS model with both pooled micro data (1978-79, 1984-85 and 1989 French HBS's) and macro data (quarterly data from 1970-1990). Their conclusion is that the harmonization process of the VAT rates reduce the government revenue and benefits the richest income groups rather than lower income groups.

Liberati (2001), explores the VAT adjustments in Italy in 1995 and 1997. He reports the distributional characteristics of 68 goods in three inequality aversion parameters (0.5, 1, 2) and the resulting welfare changes. He finds that reforms in 1995 has an adverse redistributive effect as the proportional change in welfare is negative for all inequality aversion parameters.

In Turkey, although there are several studies on tax system and its problems, studies on optimal indirect taxes or indirect tax reform are not abundant. Using the 1987 Household Incomes and Consumption Expenditures Survey, Özmucur (1995) assesses the impact of VAT rate changes on income distribution in Turkey by calculating the Gini coefficient under different VAT scenarios.

## CHAPTER 3

### METHODOLOGY

#### Description of Data

##### 2003 Turkish Household Budget Survey

The Household Budget Survey (HBS) conducted by the State Institute of Statistics<sup>26</sup> in 2003 is the main body of data used for the estimations<sup>27</sup>. The HBS 2003 is a survey of a representative random sample of all private households in Turkey. The survey data consists of the expenditures and the characteristics of the households members and the households. From January 2003 to December 2003, each month, 1512 households from urban and 648 households from rural areas are surveyed. The household bundle is renewed completely in every month, which gives a number of 25,920 households for the whole year. However, excluding the households that were unable to be reported for several reasons such as inability to get sufficient information from the household or the termination of the survey by the household, results in a total sample of 25,764 households. The survey was conducted in 26 cities of Turkey representative of the whole country. One important drawback of the 2003 HBS was that the month in which a household was surveyed was

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<sup>26</sup> This institution's current official title is Turkish Statistical Institute.

<sup>27</sup> 2004 and 2005 Household Budget Surveys were also available during our studies, however, they are problematic for the purposes of our research since the information on the locations of the surveyed households and the month in which they were surveyed are not revealed in the dataset of these two surveys. This makes them impossible to use in the demand system estimations, since goods consumed by households can't be matched with their corresponding prices.

concealed. This was a huge problem since then it would not be possible to find the prices for the demand functions of households. However, with the help of the city information and ‘the factor to inflate the income to 2003’ series in the survey data, we could extract the month that the household was surveyed. ‘The factor to inflate the income to 2003’ series functions as an inflator to bring each households income to a standard base level. It is actually the CPI index for urban and rural general price levels and by obtaining this monthly inflation data from the SIS we matched each household with its survey month.

The frequency distribution of the households across these cities and the distribution of the sample within 12 months can be found in the Appendix (see Table A.1 and Table A.2).

In this fairly detailed household survey, information obtained from households can be classified under three main headings;

- (i) Socio-economic characteristics of households such as city of residence, size of the household, type of the residence, total monthly expenditure and total yearly income, the goods that are owned by the households like a car or a refrigerator.
- (ii) The variables defining the consumption patterns. Two separate datasets are available for the expenditure information as food category and non-food category. Total expenditure on items are available, however they are aggregated according to the COICOP system (see below for details). For instance, total spending on a good such as a t-shirt is not revealed, instead, total spending on clothes is in the data.
- (iii) Characteristics of the household members such as age, education level, occupation or income earned in the current year.

In aggregating the consumption and expenditure patterns of the households, COICOP (Classification of Individual Consumption by Purpose) system is used. The

individual expenditures on goods and services are coded under 198 categories and then these expenditures of household members are aggregated under 12 major commodity groups;

- (i) Food and non-alcoholic beverages
- (ii) Alcoholic beverages and tobacco
- (iii) Clothing and footwear
- (iv) Housing, water, electricity, gas and other fuels
- (v) Furnishing, household equipment and routine maintenance of the house
- (vi) Health
- (vii) Transport
- (viii) Communication
- (ix) Recreation and culture
- (x) Education
- (xi) Hotels, cafés, restaurants
- (xii) Other goods and services

For the purposes of our research, data on the budget shares of these 12 aggregate commodity groups in total household expenditure is an essential information and the descriptive statistics of these budget shares and the aggregate share of these classes in the survey sample is given in Table 15 and Table 16.

According to the results of the survey, on average, expenditures on food and non-alcoholic beverages and housing expenditures comprise almost 56% of a household budget.

Table 15. Descriptive Statistics of Budget Shares

| Aggregate Commodity Groups                       | Number | Mean | Std. Deviation | Minimum | Maximum |
|--------------------------------------------------|--------|------|----------------|---------|---------|
| Food and Non-Alcoholic Beverages                 | 25,764 | 34%  | 15%            | 0       | 95%     |
| Alcoholic Beverages and Tobacco                  | 25,764 | 5%   | 6%             | 0       | 53%     |
| Clothing and Footwear                            | 25,764 | 5%   | 7%             | 0       | 63%     |
| Housing, Water, Gas, Electricity and Other Fuels | 25,764 | 30%  | 14%            | 0       | 100%    |
| Furnishing, House Maintenance and Equipment      | 25,764 | 5%   | 7%             | 0       | 85%     |
| Health                                           | 25,764 | 2%   | 5%             | 0       | 80%     |
| Transportation                                   | 25,764 | 7%   | 9%             | 0       | 87%     |
| Communication                                    | 25,764 | 4%   | 4%             | 0       | 57%     |
| Recreation and Culture                           | 25,764 | 1%   | 3%             | 0       | 79%     |
| Education                                        | 25,764 | 1%   | 4%             | 0       | 83%     |
| Hotels, Cafes, Restaurants                       | 25,764 | 4%   | 5%             | 0       | 57%     |
| Other Goods and Services                         | 25,764 | 3%   | 4%             | 0       | 73%     |

Table 16. Aggregate Budget Shares

| Aggregate Commodity Groups                       | Aggregate Budget Shares |
|--------------------------------------------------|-------------------------|
| Food and Non-Alcoholic Beverages                 | 28.5%                   |
| Alcoholic Beverages and Tobacco                  | 4.3%                    |
| Clothing and Footwear                            | 6.3%                    |
| Housing, Water, Gas, Electricity and Other Fuels | 27.9%                   |
| Furnishing, House Maintenance and Equipment      | 5.8%                    |
| Health                                           | 2.1%                    |
| Transportation                                   | 9.5%                    |
| Communication                                    | 4.3%                    |
| Recreation and Culture                           | 2.0%                    |
| Education                                        | 1.8%                    |
| Hotels, Cafes, Restaurants                       | 4.0%                    |
| Other Goods and Services                         | 3.5%                    |

### Price Data

In the HBS data, prices that the individuals faced are not reported. The expenditures on the food category are reported with the quantities purchased, which makes it possible to obtain their unit prices. However, for the non-food category,

only expenditures are reported, therefore, for non-food items, it's not possible to see the price that the household faced during the transaction. But even if these prices could be observed completely, it would not be practically correct to use these unit values in the calculations since the quality of the goods bought differ across households and these quality effects have an obvious impact on its price, which would necessitate modelling these quality effects that are not directly observable in any way.

For the price information to be included in the AIDS model, the monthly price indices (2003=100) for 26 cities are obtained from the State Institute of Statistics. These aggregated indices for 12 commodity groups, exactly match the commodity classification of the HBS data. However, by using these price indices, we are making an implicit assumption that the prices do not vary within a city but differ across cities.

### Commodity Taxes

The other important component of the marginal tax reform analysis setting is the 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 for these 12 commodity groups. The tax rates for the year 2003 for each commodity classification under these aggregates are extracted from the relevant resolutions of the Council of Ministers and codes and they are weighted according to the shares of these classifications within their group in the Household

Budget Survey. The average tax rates for the commodity groups, thus found, are given in Table 17.

Table 17. Average Indirect Tax Rates, 2003

| Aggregate Commodity Groups                       | Average Indirect Tax Rates |
|--------------------------------------------------|----------------------------|
| Food and Non-Alcoholic Beverages                 | 8.5%                       |
| Alcoholic Beverages and Tobacco                  | 83.7%                      |
| Clothing and Footwear                            | 15.4%                      |
| Housing, Water, Gas, Electricity and Other Fuels | 19.0%                      |
| Furnishing, House Maintenance and Equipment      | 19.3%                      |
| Health                                           | 8.3%                       |
| Transportation                                   | 41.7%                      |
| Communication                                    | 39.4%                      |
| Recreation and Culture                           | 16.5%                      |
| Education                                        | 8.0%                       |
| Hotels, Cafes, Restaurants                       | 18.0%                      |
| Other Goods and Services                         | 20.8%                      |

## Methodology

Our research on the indirect tax system in Turkey is based on two different but related models. In the first step, an AIDS model is estimated to obtain the price elasticities of the twelve aggregate commodity groups. Then, these elasticities are used in the standard theory of marginal tax reform to find out which indirect taxes should be decreased or increased.

### Almost Ideal Demand System (AIDS)

#### Theory

The Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980) is one of the most commonly applied methodologies in demand system estimation. It is the basis of many applied works on consumer behaviour with time-series or cross-

sectional micro data. It has a fairly flexible cost function, satisfies the axioms of choice, is compatible with aggregation over consumers and has a functional form consistent with available household budget data. The AIDS model is specified with its main equation in the following form;

$$w_i = \alpha_i + \sum \gamma_{ij} \ln p_j + \beta_i \ln (x / P) + \delta_i V \quad (1)$$

where  $w_i$  is the budget share of the  $i$ th good,

$p_i$  is the price of good  $i$ ,

$x$  is total per capita expenditure on all  $n$  goods,

$V$  is the vector of other factors affecting the share equation

$P$  is a price index defined by

$$\ln P = \alpha_0 + \sum \alpha_k \ln p_k + (1/2) \sum_k \sum_l \gamma_{kl} \ln p_k \ln p_l \quad (2)$$

This price index term makes the system highly non-linear which renders the model hard to estimate, however if prices are closely collinear,  $P$  can be approximated by the Stone's index

$$\ln P^* = \sum w_k \ln p_k \quad (3)$$

The models using Stone index instead of the main price index  $P$ , or more general, the models using a linear approximation of the price index is referred to as Linearized Almost Ideal Demand System (LA/AIDS). Deaton and Muellbauer (1980) show that using the Stone's approximation does not affect the estimates of the AIDS considerably. Our model is also an LA/AIDS model as the constructed Stone price index is used instead of  $P$  in the equations.

Since the cost function is linearly homogeneous and strictly increasing in prices, from duality theory, the Hicksian demand functions that are derived using Shephard's Lemma satisfy neoclassical conditions. Therefore AIDS needs to satisfy the three classes of restrictions;

$$\text{Adding-up restriction: } \Sigma_k \alpha_k = 1, \Sigma_k \beta_k = 0, \Sigma_k \gamma_{kj} = 0 \quad (5)$$

$$\text{Homogeneity restriction: } \Sigma_k \gamma_{jk} = 0 \quad (6)$$

$$\text{Symmetry restriction: } \gamma_{ij} = \gamma_{ji} \quad (7)$$

The adding-up restriction is satisfied by construction and homogeneity and symmetry restrictions need to be imposed beforehand or tested ex-post. Our main objective in using the AIDS model in our project is the calculation of the elasticities and this is done by using the estimated parameters of the AIDS model as such;

Marshallian (Uncompensated) own-price elasticity:

$$\varepsilon_{ii} = (\gamma_{ii} / w_i) - (1 + \beta_i) \quad (8)$$

Marshallian (Uncompensated) cross-price elasticity:

$$\varepsilon_{ij} = (\gamma_{ij} / w_i) - \beta_i (w_j / w_i) \quad (9)$$

Hicksian (Compensated) price elasticity:

$$e_{ij} = \varepsilon_{ij} + \eta_{ij} * w_j \quad (10)$$

Expenditure elasticity:

$$\eta_i = (\beta_i / w_i) + 1 \quad (11)$$

### Empirical Method

Several other variables can be added in the main equation (1) of the AIDS system 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. Therefore in our study, we also incorporated several other variables into the AIDS budget share equations. Household size can be an important determinant in the

expenditures of the households. Alpay and Koç (2000) found a negative relation between household size and food and housing expenditures. The OECD equivalent household size<sup>28</sup> variable is added to the main budget shares equations to see the effects of the size of the household on consumption. The expenditure patterns of the households can show variations according to the season. We try to capture the seasonality in the shares of the aggregate commodity groups by adding three dummy variables for spring, summer and autumn into the budget shares 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. The description of the variables used in the AIDS model is given in Table 18.

#### Multicollinearity Analysis

Multicollinearity problem arises when explanatory variables in a regression are highly correlated. Multicollinearity may be a threat to the precision of the coefficient estimates because it leads to large standard errors for coefficients and therefore smaller t-statistics. Rejecting the null hypothesis of parameter value equals to zero is more difficult under multicollinearity.

One common test for detection of multicollinearity is calculating the tolerance values and variance inflation factors (VIF) of the independent variables. Tolerance is the amount of variability of the independent variable not explained by other variables. VIF, on the other hand, is the reciprocal of tolerance and general rule

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<sup>28</sup> 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.

Table 18. Definition of the Variables in the AIDS Model

| <u>Variables</u>                   | <u>Definiton</u>                                                                               |
|------------------------------------|------------------------------------------------------------------------------------------------|
| <u>Dependent Variables</u>         |                                                                                                |
| bs_1                               | budget share of food and non-alcoholic beverages expenditures in the household                 |
| bs_2                               | budget share of alcoholic beverages and tobacco expenditures in the household                  |
| bs_3                               | budget share of clothing and footwear expenditures in the household                            |
| bs_4                               | budget share of housing, water, gas, electricity and other fuels expenditures in the household |
| bs_5                               | budget share of furnishing, house maintenance and equipment expenditures in the household      |
| bs_6                               | budget share of health expenditures in the household                                           |
| bs_7                               | budget share of transportation expenditures in the household                                   |
| bs_8                               | budget share of communication expenditures in the household                                    |
| bs_9                               | budget share of recreation and culture expenditures in the household                           |
| bs_10                              | budget share of education expenditures in the household                                        |
| bs_11                              | budget share of hotels, cafes and restaurants expenditures in the household                    |
| bs_12                              | budget share of other goods and services expenditures in the household                         |
| <u>Independent Variables</u>       |                                                                                                |
| <u>Prices</u>                      |                                                                                                |
| ln p(FO)                           | logarithm of the price index for food and non-alcoholic beverages                              |
| ln p(ALC)                          | logarithm of the price index for alcoholic beverages and tobacco                               |
| ln p(CLO)                          | logarithm of the price index for clothing and footwear                                         |
| ln p(HOU)                          | logarithm of the price index for housing, water, gas, electricity and other fuels              |
| ln p(FUR)                          | logarithm of the price index for furnishing, house maintenance and equipment                   |
| ln p(HEA)                          | logarithm of the price index for health                                                        |
| ln p(TRA)                          | logarithm of the price index for transportation                                                |
| ln p(COM)                          | logarithm of the price index for communication                                                 |
| ln p(REC)                          | logarithm of the price index for recreation and culture                                        |
| ln p(EDU)                          | logarithm of the price index for education                                                     |
| ln p(HOT)                          | logarithm of the price index for hotels, cafes and restaurants                                 |
| ln p(OTH)                          | logarithm of the price index for other goods and services                                      |
| <u>Real Expenditure</u>            |                                                                                                |
| Real Exp                           | logarithm of the total real expenditure of the household                                       |
| <u>Socio-Demographic Variables</u> |                                                                                                |
| OECD HS                            | OECD equivalent household size                                                                 |
| Dummy Spring                       | dummy for spring                                                                               |
| Dummy Fall                         | dummy for autumn                                                                               |
| Dummy Summer                       | dummy for summer                                                                               |
| Dummy Urban                        | dummy for urban residence                                                                      |
| Dummy Education 1                  | dummy for education level of household head with elementary school or less                     |
| Dummy Education 2                  | dummy for education level of household head with high school or less                           |
|                                    | (does not include individuals suitable for Dummy Education 1)                                  |

of thumb is that VIF values greater than 10 (or, accordingly, tolerance values between 0 and 0.1) may be a sign of a multicollinearity problem.

### Marginal Tax Reform

The second part of the analytical methods of this research is the marginal tax reform analysis.

#### The Model

The marginal tax reform analysis, within specific assumptions about the economy and government objectives, can suggest the directions to be taken in an indirect tax reform framework. It can indicate which indirect taxes should be decreased and which ones should be increased, provided that sufficient information about demand elasticities is available. Kaplanoglou and Newbery (2003) apply the marginal tax reform framework for Greece, and this methodology is what we follow throughout our research. The model starts with a definition of an objective government welfare function.

The government has a Utilitarian social welfare function,

$$W(V^1, ..., V^h, ..., V^H) \quad (12)$$

$v^h$  is the individual welfare and depends on income (Y), transfers (g) and consumer prices (q);

$$V^h = V^h(y^h + g, q) \quad (13)$$

Then, the impact on social welfare of a change in consumer prices  $q_i$ , that is caused by a change in  $t_i$  is,

$$\frac{\partial W}{\partial q_i} = \sum_h \frac{\partial W}{\partial V^h} \cdot \frac{\partial V^h}{\partial q_i} = - \sum_h \beta^h \cdot x_i^h \quad (14)$$

where 
$$\beta^h = \frac{\partial W}{\partial V^h} \cdot \frac{\partial V^h}{\partial g} \quad (15)$$

$\beta^h$  is the social marginal utility of transferring 1 unit of currency to agent  $h$ ,  $x_i^h$  is the consumption of the good  $i$  by the individual  $h$ .

This model is based on the estimation of  $\theta_i$ , the marginal social tax productivity of good  $i$  defined as the extra revenue collected for a unit increase in social pain,  $-\partial W / \partial t_i$ ;

$$\theta_i = - \frac{\partial R / \partial t_i}{\partial W / \partial t_i} = \frac{1}{d_i} \left( 1 + \sum_k \tau_k \frac{w_k \epsilon_{ki}}{w_i} \right) \quad (16)$$

where  $\tau_k$  is the ratio of the tax to the tax inclusive price of good  $k$ ,

$\epsilon$ 's are the cross and own price elasticities,

$d_i$  is the distributional characteristic of good  $i$  which measures the level of concentration of the consumption of good  $i$  on the socially deserving and is defined as

$$d_i = \frac{\sum_h \beta^h x_i^h}{\frac{1}{H} \sum_h \beta^h \sum_h x_i^h} \quad (17)$$

In addition to the model, an inequality aversion coefficient to represent the distributional concerns of the government can be included in the social welfare function through the individual utilities or independently from them before estimation. In theory, the  $\theta$ 's estimated from the model should be equal across commodities since, otherwise, increasing the taxes of goods with higher  $\theta$ 's and decreasing the taxes of ones with lower  $\theta$ 's is optimal for the government and this reasoning gives the suggested direction of tax reform.

## Empirical Method

In the marginal tax reform calculations, the social welfare function is chosen as the additive iso-elastic social welfare function following Kaplanoglou and Newbery's (2003) method;

$$W = \sum u^h \quad u^h = \frac{(c^h)^{1-v}}{1-v}, (v \neq 1) \quad u^h = \log c^h, (v = 1) \quad (18)$$

where  $c^h$  is the consumption per equivalent adult and  $v$  is the inequality aversion parameter. The degree of  $v$  represents the government's concern with the income inequalities in the society. In this function consumption per equivalent adult is a proxy for income, and at high values of  $v$ , the social welfare function begins to be dominated by the utilities of the poorer. At  $v = 1$ , each household's utility is simply added to each other to reach the social welfare value. At  $v=0$ , there's no inequality aversion and for example at  $v=3$ , the poor's utility becomes the main driving force of the social welfare function.

Finally the thetas calculated by equation (16), gives information about the marginal tax productivity of the goods and by ranking these goods according to the theta values, the model can give suggestions about which indirect taxes to be increased or decreased. For a rational, welfare maximizing government, it's always optimal to collect the same revenue by increasing the taxes of goods with higher thetas and decreasing the taxes of goods with lower theta values.

## CHAPTER 4

### RESULTS

#### Estimation of the LA/AIDS Model

As explained in the previous chapter, the LA/AIDS model is estimated for 12 aggregate commodity groups. Each equation in the system has the same independent variables differing only in the explained variable which is the budget share of the commodity group in question. The estimated equation for the  $i$ th category of commodity aggregate is;

$$\begin{aligned} bs_i = & \gamma_{i1} \ln p(FO) + \gamma_{i2} \ln p(ALC) + \gamma_{i3} \ln p(CLO) + \gamma_{i4} \ln p(HOU) + \gamma_{i5} \ln \\ & p(FUR) + \gamma_{i6} \ln p(HEA) + \gamma_{i7} \ln p(TRA) + \gamma_{i8} \ln p(COM) + \gamma_{i9} \ln p(REC) + \\ & \gamma_{i10} \ln p(EDU) + \gamma_{i11i} \ln p(HOT) + \gamma_{i12i} \ln p(OTH) + \beta_i \text{ Real Exp} + \delta_{i1} \text{ OECD} \\ & \text{HS} + \delta_{i2} \text{ Dummy Spring} + \delta_{i3} \text{ Dummy Fall} + \delta_{i4} \text{ Dummy Summer} + \delta_{i5} \\ & \text{Dummy Urban} + \delta_{i6} \text{ Dummy Education 1} + \delta_{i7} \text{ Dummy Education 2} + u_i \end{aligned}$$

The system of equations are estimated by Zellner's Iterative Seemingly Unrelated Regression method in Stata 9.0. The dependent variables of the system, the budget shares, sum to unity by construction. Therefore, if the whole system is estimated, 12 regressions are run, the variance-covariance matrix of the disturbances would be singular. To solve for that, one equation is extracted from the system and 11 simultaneous equations are estimated. Doing that, the adding-up restriction is automatically satisfied, by calculating the deleted equations parameters accordingly. Symmetry and homogeneity restrictions are imposed into the estimation beforehand.

Homogeneity restriction can be imposed either directly on the coefficients.

Alternatively, using the relative prices in the equations would also render the system coefficients satisfy the restriction. We apply the first method and impose both symmetry and homogeneity into the estimation and leave out the 12th, the other goods, equation. The coefficients of this equation are then calculated so that it satisfies the adding-up property.

### Regression Results

The regression results for the system of demand equations are given in Table 19, Table 20 and Table 21.

Table 19. Summary Statistics for AIDS Equations

| Equation | Root Mean Square Error | R-Square | Adjusted R-Square |
|----------|------------------------|----------|-------------------|
| bs1      | 0.119                  | 0.387    | 0.386             |
| bs2      | 0.061                  | 0.026    | 0.026             |
| bs3      | 0.066                  | 0.078    | 0.077             |
| bs4      | 0.126                  | 0.220    | 0.219             |
| bs5      | 0.071                  | 0.056    | 0.055             |
| bs6      | 0.050                  | 0.019    | 0.018             |
| bs7      | 0.082                  | 0.133    | 0.132             |
| bs8      | 0.041                  | 0.028    | 0.027             |
| bs9      | 0.033                  | 0.065    | 0.064             |
| bs10     | 0.042                  | 0.048    | 0.047             |
| bs11     | 0.051                  | 0.037    | 0.037             |
| bs10     | 0.042                  | 0.048    | 0.047             |
| bs11     | 0.051                  | 0.037    | 0.037             |

Table 19 reveals that the R-Square values and adjusted R-Square values of the AIDS equations are pretty low. They range from 3% to 39%. However, as Akbay et.al. (2007) state, low R-square values are common in budget share estimations

using household budget survey data because of the large degree of stochastic variation. The examples they give support their conclusion, the demand estimation studies that use survey data have also low R-square values ranging from 6% to 43%. The root mean square errors of the equations are pretty low, ranging from 3% to 13%, which means that the difference between the actual budget shares and the estimated budget shares is low, indicating a good predictive power for the AIDS model. Table 21 presents the t-values for the estimated coefficients. Most of the coefficients in the AIDS equations are significant. Especially, real expenditure, household size, dummy for urban and education dummies turn out to be significant in the system equations. However, in the price variables, insignificance is common. For instance, only one price coefficient is significant in the Communication equation and none of them come out as significant in Furnishing, Household Equipment and House Maintenance equation.

Table 20 shows the estimated coefficients of the share equations. The OECD equivalent household size coefficient is significant in all equations except for Education and Hotels etc. share equations. The biggest impact of household size is on the food consumption of the households. As the equivalent size of the household increases, the share of food and clothing in the household budget goes up. In six categories, increasing number of household members have a negative effect on the budget share of that commodity group. Nearly half of the seasonal dummies (15 of 33) are statistically significant. In spring and summer, the budget share of transportation increase while the share of food and non-alcoholic beverages decline. During fall, the share of income spent on clothing goes up significantly. The coefficients of the urban dummy are significant for all equations except for the Recreation & Culture category. Living in an urban area affects the budget share of

foods, clothing and health expenditures negatively. The effect of urbanization on housing and housing expenditures is significantly positive, as expected. Households living in urban areas also spend more of their budget on education, cafes and restaurants. Finally, the education level of the household head have impacts on the expenditure patterns of the household. Dummy Education 1 represents household heads with a very low education level (elementary school diploma or no diploma, see Chapter IV). On average, having a low education level household head reflects itself as a higher share of food and alcohol & tobacco expenditures. As expected, communication, recreation & culture and education expenditure is negatively affected by the low education level of the household. We can infer that, since low education degree generally means low-paid jobs and therefore relatively low income levels, even normal levels of nominal expenditures on basic food stuff, or tobacco comprise a large proportion of the household budget.

### Elasticities

From the estimated coefficients, uncompensated and compensated price elasticities and expenditure elasticities are calculated. Table 22 present the Marshallian own and cross price elasticities for the 12 commodity groups. Hicksian elasticities can be found in the Appendix (see Table A.3).

Own price elasticities are of the expected sign (negative) except for the transportation group. Transportation expenditure of the households turns out to have a positive but very small response to price variations, magnitude of the elasticity is small enough that expenditures on transportation can be said to be unresponsive to price changes. The highest own price elasticities are in the recreation & culture

Table 20. Coefficients of the AIDS equations

|                   | Food &<br>Non-<br>Alcoholic<br>Beverages | Alcohol &<br>Tobacco | Clothing &<br>Footwear | Housing, Water,<br>Electricity, Gas<br>and Other Fuels | Furnishing,<br>Household<br>Equipment and<br>House Maintenance | Health  | Transportation | Communication |
|-------------------|------------------------------------------|----------------------|------------------------|--------------------------------------------------------|----------------------------------------------------------------|---------|----------------|---------------|
| ln p(FO)          | 0.106*                                   | -0.097*              | 0.030                  | -0.039                                                 | -0.006                                                         | 0.040*  | 0.112*         | -0.005        |
| ln p(ALC)         | -0.097*                                  | 0.041*               | -0.024*                | 0.109*                                                 | 0.003                                                          | -0.017  | -0.029         | 0.021         |
| ln p(CLO)         | 0.030                                    | -0.024*              | 0.063*                 | -0.046*                                                | 0.032                                                          | -0.034* | 0.015          | -0.013        |
| ln p(HOU)         | -0.039                                   | 0.109*               | -0.046*                | 0.092                                                  | -0.041                                                         | -0.034  | -0.118*        | -0.052        |
| ln p(FUR)         | -0.006                                   | 0.003                | 0.032                  | -0.041                                                 | -0.007                                                         | -0.025  | 0.001          | 0.035         |
| ln p(HEA)         | 0.040*                                   | -0.017               | -0.034*                | -0.034                                                 | -0.025                                                         | 0.017   | -0.045*        | 0.033         |
| ln p(TRA)         | 0.112*                                   | -0.029               | 0.015                  | -0.118*                                                | 0.001                                                          | -0.045* | 0.100*         | -0.041        |
| ln p(COM)         | -0.005                                   | 0.021                | -0.013                 | -0.052                                                 | 0.035                                                          | 0.033   | -0.041         | -0.007        |
| ln p(REC)         | -0.048*                                  | 0.003                | -0.015                 | -0.019                                                 | 0.020                                                          | 0.032*  | 0.002          | 0.042*        |
| ln p(EDU)         | -0.046*                                  | 0.007                | -0.012                 | 0.029                                                  | -0.006                                                         | -0.019* | 0.026*         | -0.011        |
| ln p(HOT)         | -0.055*                                  | -0.019               | -0.023*                | 0.088*                                                 | -0.011                                                         | 0.024   | 0.003          | 0.009         |
| ln p(OTH)         | 0.007                                    | 0.001                | 0.024*                 | 0.031                                                  | 0.006                                                          | 0.028   | -0.026         | -0.009        |
| Real Exp          | -0.102*                                  | -0.008*              | 0.025*                 | -0.056*                                                | 0.030*                                                         | 0.011*  | 0.048*         | 0.005*        |
| OECD HS           | 0.044*                                   | 0.008*               | 0.004*                 | -0.041*                                                | -0.005*                                                        | -0.003* | -0.004*        | -0.001*       |
| Dummy Spring      | -0.045*                                  | 0.010*               | -0.004*                | 0.015*                                                 | 0.008*                                                         | -0.002  | 0.006*         | 0.001         |
| Dummy Fall        | -0.003                                   | -0.002               | 0.020*                 | -0.005                                                 | 0.001                                                          | -0.001  | 0.004          | -0.003*       |
| Dummy Summer      | -0.014*                                  | 0.006*               | 0.000                  | 0.000                                                  | 0.002                                                          | -0.001  | 0.014*         | 0.001         |
| Dummy Urban       | -0.075*                                  | -0.002*              | -0.008*                | 0.095*                                                 | -0.007*                                                        | -0.006* | -0.012*        | 0.001*        |
| Dummy Education 1 | 0.028*                                   | 0.010*               | 0.000                  | -0.014*                                                | 0.012*                                                         | 0.011*  | -0.015*        | -0.012*       |
| Dummy Education 2 | 0.001                                    | 0.014*               | 0.002                  | -0.006*                                                | 0.007*                                                         | 0.004*  | -0.009*        | -0.005*       |
| Constant          | 1.868*                                   | 0.145*               | -0.345*                | 1.207*                                                 | -0.412*                                                        | -0.150* | -0.660*        | -0.025*       |

\* indicates significance at 5%.

Table 20. continued

|                   | Recreation<br>& Culture | Education | Hotels,<br>Cafes and<br>Restaurants | Other<br>Goods &<br>Services |
|-------------------|-------------------------|-----------|-------------------------------------|------------------------------|
| ln p(FO)          | -0.048*                 | -0.046*   | -0.055*                             | 0.007                        |
| ln p(ALC)         | 0.003                   | 0.007     | -0.019                              | 0.002                        |
| ln p(CLO)         | -0.015                  | -0.012    | -0.023*                             | 0.028                        |
| ln p(HOU)         | -0.019                  | 0.029     | 0.088*                              | 0.031                        |
| ln p(FUR)         | 0.020                   | -0.006    | -0.011                              | 0.006                        |
| ln p(HEA)         | 0.032*                  | -0.019*   | 0.024                               | 0.028                        |
| ln p(TRA)         | 0.002                   | 0.026*    | 0.003                               | -0.026                       |
| ln p(COM)         | 0.042*                  | -0.011    | 0.009                               | -0.009                       |
| ln p(REC)         | -0.004                  | 0.006     | -0.001                              | -0.019                       |
| ln p(EDU)         | 0.006                   | 0.017*    | 0.015                               | -0.005                       |
| ln p(HOT)         | -0.001                  | 0.015     | 0.018                               | -0.047                       |
| ln p(OTH)         | -0.019                  | -0.005    | -0.047*                             | 0.009                        |
| Real Exp          | 0.001*                  | 0.012*    | 0.010*                              | 0.014                        |
| OECD HS           | -0.001*                 | 0.001     | 0.000                               | 0.000                        |
| Dummy Spring      | 0.001                   | 0.004*    | 0.005*                              | 0.000                        |
| Dummy Fall        | -0.001                  | 0.000     | -0.007*                             | 0.009                        |
| Dummy Summer      | -0.006                  | -0.003*   | 0.003                               | 0.001                        |
| Dummy Urban       | 0.000                   | 0.002*    | 0.010*                              | 0.000                        |
| Dummy Education 1 | -0.012*                 | -0.006*   | 0.003*                              | 0.000                        |
| Dummy Education 2 | -0.009*                 | -0.004*   | 0.006*                              | -0.003                       |
| Constant          | -0.123*                 | -0.177*   | -0.133*                             | -0.328                       |

\* indicates significance at 5%.

Table 21. T-Statistics of the Coefficients of the AIDS Equations.

|                   | Food &<br>Non-<br>Alcoholic<br>Beverages | Alcohol &<br>Tobacco | Clothing &<br>Footwear | Housing, Water,<br>Electricity, Gas<br>and Other Fuels | Furnishing,<br>Household<br>Equipment and<br>House Maintenance | Health | Transportation | Communication |
|-------------------|------------------------------------------|----------------------|------------------------|--------------------------------------------------------|----------------------------------------------------------------|--------|----------------|---------------|
| ln p(FO)          | 2.57                                     | -5.73                | 1.7                    | -1.03                                                  | -0.2                                                           | 2.33   | 4.29           | -0.33         |
| ln p(ALC)         | -5.73                                    | 2.64                 | -2.22                  | 4.44                                                   | 0.14                                                           | -1.39  | -1.64          | 1.7           |
| ln p(CLO)         | 1.7                                      | -2.28                | 4.38                   | -2.02                                                  | 1.86                                                           | -3.12  | 0.91           | -1.35         |
| ln p(HOU)         | -1.03                                    | 4.44                 | -2.02                  | 1.22                                                   | -0.88                                                          | -1.22  | -2.77          | -1.83         |
| ln p(FUR)         | -0.2                                     | 0.14                 | 1.86                   | -0.88                                                  | -0.11                                                          | -0.98  | 0.03           | 1.03          |
| ln p(HEA)         | 2.33                                     | -1.39                | -3.12                  | -1.22                                                  | -0.98                                                          | 0.83   | -2.11          | 1.99          |
| ln p(TRA)         | 4.29                                     | -1.64                | 0.91                   | -2.77                                                  | 0.03                                                           | -2.11  | 2.46           | -1.91         |
| ln p(COM)         | -0.33                                    | 1.7                  | -1.35                  | -1.83                                                  | 1.03                                                           | 1.99   | -1.91          | -0.23         |
| ln p(REC)         | -3.9                                     | 0.3                  | -1.88                  | -0.91                                                  | 0.84                                                           | 2.67   | 0.12           | 2.63          |
| ln p(EDU)         | -3.91                                    | 0.81                 | -1.75                  | 1.78                                                   | -0.48                                                          | -2.32  | 2.19           | -1.42         |
| ln p(HOT)         | -3.23                                    | -1.55                | -2.21                  | 3.38                                                   | -0.49                                                          | 1.78   | 0.14           | 0.63          |
| ln p(OTH)         | 0.45                                     | 0.12                 | 2.53                   | 1.18                                                   | 0.23                                                           | 1.97   | -1.34          | -0.53         |
| Real Exp          | -76.73                                   | -12.14               | 34.25                  | -39.89                                                 | 37.77                                                          | 19.72  | 53.07          | 10.83         |
| OECD HS           | 48.18                                    | 16.26                | 7.8                    | -42.57                                                 | -9.18                                                          | -8.32  | -6.95          | -4.25         |
| Dummy Spring      | -14.06                                   | 6.08                 | -2.65                  | 4.21                                                   | 3.31                                                           | -1.18  | 2.52           | 1.04          |
| Dummy Fall        | -1.23                                    | -1.4                 | 13.45                  | -1.8                                                   | 0.38                                                           | -1.08  | 1.91           | -2.99         |
| Dummy Summer      | -5.19                                    | 3.6                  | 0.02                   | 0.14                                                   | 0.9                                                            | -0.82  | 5.9            | 0.46          |
| Dummy Urban       | -43.43                                   | -2.35                | -8.65                  | 51.71                                                  | -6.94                                                          | -8.22  | -9.69          | 2.38          |
| Dummy Education 1 | 9.75                                     | 7.06                 | -0.15                  | -4.69                                                  | 7.04                                                           | 8.7    | -7.37          | -11.92        |
| Dummy Education 2 | 0.51                                     | 9.57                 | 1.19                   | -2.11                                                  | 4.21                                                           | 3.38   | -4.29          | -4.48         |
| Constant          | 88.42                                    | 13.54                | -29.51                 | 54.02                                                  | -32.66                                                         | -16.68 | -45.42         | -3.41         |

Table 21. continued.

|                   | Recreation<br>& Culture | Education | Hotels,<br>Cafes and<br>Restaurants |
|-------------------|-------------------------|-----------|-------------------------------------|
| ln p(FO)          | -3.9                    | -3.91     | -3.23                               |
| ln p(ALC)         | 0.3                     | 0.81      | -1.55                               |
| ln p(CLO)         | -1.88                   | -1.75     | -2.21                               |
| ln p(HOU)         | -0.91                   | 1.78      | 3.38                                |
| ln p(FUR)         | 0.84                    | -0.48     | -0.49                               |
| ln p(HEA)         | 2.67                    | -2.32     | 1.78                                |
| ln p(TRA)         | 0.12                    | 2.19      | 0.14                                |
| ln p(COM)         | 2.63                    | -1.42     | 0.63                                |
| ln p(REC)         | -0.23                   | 1.02      | -0.12                               |
| ln p(EDU)         | 1.02                    | 2.3       | 1.89                                |
| ln p(HOT)         | -0.12                   | 1.89      | 0.98                                |
| ln p(OTH)         | -1.55                   | -0.71     | -3.62                               |
| Real Exp          | 26.58                   | 26.32     | 17.91                               |
| OECD HS           | -5.58                   | 1.59      | -0.63                               |
| Dummy Spring      | 0.7                     | 3.3       | 3.34                                |
| Dummy Fall        | -1.56                   | -0.27     | -5.49                               |
| Dummy Summer      | -5.2                    | -3.02     | 1.99                                |
| Dummy Urban       | 0.85                    | 2.72      | 13.77                               |
| Dummy Education 1 | -14.69                  | -5.79     | 2.5                                 |
| Dummy Education 2 | -11.3                   | -3.87     | 5.2                                 |
| Constant          | -20.99                  | -24.07    | -14.67                              |

Table 22 Marshallian (Uncompensated) Elasticities

|     | FO    | ALC   | CLO   | HOU   | FUR   | HEA   | TRA   | COM   | REC   | EDU   | HOT   | OTH   |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| FO  | -0.53 | -0.32 | 0.13  | -0.04 | 0.00  | 0.15  | 0.43  | 0.00  | -0.16 | -0.15 | -0.18 | 0.04  |
| ALC | -2.20 | -0.04 | -0.54 | 2.59  | 0.08  | -0.40 | -0.66 | 0.50  | 0.07  | 0.17  | -0.43 | 0.04  |
| CLO | 0.37  | -0.39 | -0.03 | -0.84 | 0.48  | -0.54 | 0.19  | -0.23 | -0.24 | -0.20 | -0.38 | 0.37  |
| HOU | -0.08 | 0.40  | -0.15 | -0.61 | -0.13 | -0.12 | -0.40 | -0.18 | -0.06 | 0.11  | 0.32  | 0.12  |
| FUR | -0.24 | 0.03  | 0.52  | -0.85 | -1.16 | -0.45 | -0.03 | 0.58  | 0.34  | -0.12 | -0.22 | 0.09  |
| HEA | 1.79  | -0.86 | -1.68 | -1.78 | -1.26 | -0.19 | -2.22 | 1.56  | 1.54  | -0.94 | 1.15  | 1.33  |
| TRA | 1.04  | -0.33 | 0.12  | -1.39 | -0.02 | -0.49 | 0.01  | -0.46 | 0.01  | 0.27  | 0.01  | -0.29 |
| COM | -0.15 | 0.48  | -0.32 | -1.24 | 0.80  | 0.76  | -0.96 | -1.18 | 0.98  | -0.27 | 0.20  | -0.22 |
| REC | -2.49 | 0.12  | -0.74 | -1.08 | 0.97  | 1.58  | 0.05  | 2.06  | -1.19 | 0.30  | -0.08 | -0.97 |
| EDU | -2.70 | 0.36  | -0.73 | 1.42  | -0.39 | -1.07 | 1.38  | -0.65 | 0.33  | -0.10 | 0.80  | -0.32 |
| HOT | -1.46 | -0.48 | -0.60 | 2.14  | -0.30 | 0.60  | 0.04  | 0.22  | -0.04 | 0.37  | -0.57 | -1.18 |
| OTH | 0.09  | 0.04  | 0.76  | 0.79  | 0.15  | 0.79  | -0.77 | -0.28 | -0.56 | -0.16 | -1.34 | -0.76 |

Table 23. Own-Price Elasticities

|                                                  |       |
|--------------------------------------------------|-------|
| Food and Non-Alcoholic Beverages                 | -0.53 |
| Alcoholic Beverages and Tobacco                  | -0.04 |
| Clothing and Footwear                            | -0.03 |
| Housing, Water, Gas, Electricity and Other Fuels | -0.61 |
| Furnishing, House Maintenance and Equipment      | -1.16 |
| Health                                           | -0.19 |
| Transportation                                   | 0.01  |
| Communication                                    | -1.18 |
| Recreation and Culture                           | -1.19 |
| Education                                        | -0.10 |
| Hotels, Cafes, Restaurants                       | -0.57 |
| Other Goods and Services                         | -0.76 |

(-1.19), communication (-1.18) and furnishing, house maintenance & equipment (-1.16) groups. The demand for these commodities are highly responsive to changes in their prices. The two commodity groups which comprise almost 55% of the households on average; food & non-alcoholic beverages and housing, water, gas, electricity & other fuels turn out to have a decent level of elasticity with -0.53 and -0.61 respectively.

Table 24 presents the expenditure elasticities of the twelve aggregate commodity groups. According to the expenditure elasticities, food & non-alcoholic beverages, alcoholic beverages & tobacco and housing, water, gas, electricity & other fuels categories fall into necessity groups. The other commodity groups have expenditure elasticities larger than one and the highest expenditure elastic group is the education group. A one percent increase in total expenditure would increase the education expenditure by 1.67%. Health, transportation and furnishing, house maintenance & equipment classes follow the education group in their high-level of expenditure elasticities.

Table 24. Expenditure Elasticities

|                                                  |      |
|--------------------------------------------------|------|
| Food and Non-Alcoholic Beverages                 | 0.64 |
| Alcoholic Beverages and Tobacco                  | 0.81 |
| Clothing and Footwear                            | 1.40 |
| Housing, Water, Gas, Electricity and Other Fuels | 0.80 |
| Furnishing, House Maintenance and Equipment      | 1.52 |
| Health                                           | 1.54 |
| Transportation                                   | 1.51 |
| Communication                                    | 1.12 |
| Recreation and Culture                           | 1.48 |
| Education                                        | 1.67 |
| Hotels, Cafes, Restaurants                       | 1.26 |
| Other Goods and Services                         | 1.41 |

Zero consumption problem in demand system estimation is also present in our AIDS model. The percentage of zero budget shares in the twelve aggregate commodity groups in the household survey data can be found in the Appendix (see Table A.4). The problematic issue with the zero expenditure is that the non-consumers of a commodity are affected by the changes in the explanatory variables of the system, however their response to these changes is discrete; they enter the

market or do not. The demand system techniques, on the other hand, model the responses as smooth adjustment processes. Therefore, a discrete response model can also be incorporated into the system to take into consideration zero consumers. Akbay et. al. (2007), in their household food demand study for Turkey apply Shonkwiler and Yen's (1999) consistent two-step estimation procedure. A brief summary of the econometric techniques to deal with the zero expenditures can be found in Gould (1996). While in our research, our focus is on the marginal tax reform calculations, we sidestep the zero consumption issue.

### Multicollinearity Analysis

The VIF and tolerance values, calculated by Stata 9.0 are given in Table 25. As mentioned before, the rule of thumb states that VIF values larger than 10 and tolerance values between 0 and 0.1 should be a reason for concern about the existence of multicollinearity.

The multicollinearity test results reveal that of the twenty predictor variables, three of them,  $\ln p(\text{ALC})$ ,  $\ln p(\text{FUR})$  and  $\ln p(\text{COM})$  may be correlated with other regressors. Although three VIF's are greater than 10, the average VIF of the regressors is 8.41 and smaller than 10. But even extreme multicollinearity does not violate the BLUE<sup>29</sup> property of OLS or GLS (in our case, in Seemingly Unrelated Estimation estimators are Generalized Least Squares estimators). Therefore this raises no concern for the values of the coefficient estimates or elasticities derived from them.

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<sup>29</sup> Best, Linear, Unbiased, Estimator

Table 25. Multicollinearity Test Results

| Variable          | VIF   | Tolerance |
|-------------------|-------|-----------|
| ln p(FO)          | 5.25  | 0.19      |
| ln p(ALC)         | 44.71 | 0.02      |
| ln p(CLO)         | 4.24  | 0.24      |
| ln p(HOU)         | 7.08  | 0.14      |
| ln p(FUR)         | 22.77 | 0.04      |
| ln p(HEA)         | 5.94  | 0.17      |
| ln p(TRA)         | 3.46  | 0.29      |
| ln p(COM)         | 19.64 | 0.05      |
| ln p(REC)         | 4.07  | 0.25      |
| ln p(EDU)         | 9.60  | 0.10      |
| ln p(HOT)         | 7.79  | 0.13      |
| ln p(OTH)         | 3.74  | 0.27      |
| Real Exp          | 1.32  | 0.75      |
| OECD HS           | 1.10  | 0.91      |
| Dummy Spring      | 6.94  | 0.14      |
| Dummy Fall        | 4.21  | 0.24      |
| Dummy Summer      | 8.64  | 0.12      |
| Dummy Urban       | 1.12  | 0.89      |
| Dummy Education 1 | 3.52  | 0.28      |
| Dummy Education 2 | 3.05  | 0.33      |
|                   |       |           |
| Mean              | 8.41  | 0.28      |

### Marginal Tax Reform Analysis

Using the price elasticities estimated in the AIDS model, the marginal tax reform calculations are made for two different values of inequality aversion parameter  $v$ .  $v=0.1$  represents the case where there's very little concern for income inequality and  $v=2$  is the situation where there's strong emphasis on the welfare of the poor. By equation (16) thetas of the twelve aggregate commodity groups are estimated and they are ranked accordingly to see the possible equity improving paths of indirect tax changes.

Table 26. Equity Parameters for  $v=0.1$ 

| Inequality Aversion ( $v$ )<br>0.1                  | Distributional<br>Characteristic | Marginal<br>Social Cost<br>of Revenue | Marginal<br>Social Tax<br>Productivity | Rank |
|-----------------------------------------------------|----------------------------------|---------------------------------------|----------------------------------------|------|
| Aggregate Commodity Groups                          | (d)                              | ( $\lambda$ )                         | ( $\theta = 1/\lambda$ )               |      |
| Food and Non-Alcoholic Beverages                    | 0.98                             | 1.18                                  | 0.85                                   | 7    |
| Alcoholic Beverages and Tobacco                     | 0.98                             | 0.97                                  | 1.03                                   | 10   |
| Clothing and Footwear                               | 0.94                             | 1.24                                  | 0.81                                   | 6    |
| Housing, Water, Gas, Electricity and Other<br>Fuels | 0.96                             | 1.09                                  | 0.92                                   | 8    |
| Furnishing, House Maintenance and Equipment         | 0.94                             | 0.98                                  | 1.02                                   | 9    |
| Health                                              | 0.94                             | 2.12                                  | 0.47                                   | 1    |
| Transportation                                      | 0.92                             | 1.52                                  | 0.66                                   | 2    |
| Communication                                       | 0.95                             | 1.45                                  | 0.69                                   | 4    |
| Recreation and Culture                              | 0.91                             | 0.76                                  | 1.32                                   | 11   |
| Education                                           | 0.89                             | 0.65                                  | 1.54                                   | 12   |
| Hotels, Cafes, Restaurants                          | 0.95                             | 1.24                                  | 0.80                                   | 5    |
| Other Goods and Services                            | 0.93                             | 1.47                                  | 0.68                                   | 3    |

Table 27. Equity Parameters for  $v=2$ 

| Inequality Aversion ( $v$ )<br>2                    | Distributional<br>Characteristic | Marginal<br>Social Cost<br>of Revenue | Marginal<br>Social Tax<br>Productivity | Rank |
|-----------------------------------------------------|----------------------------------|---------------------------------------|----------------------------------------|------|
| Aggregate Commodity Groups                          | (d)                              | ( $\lambda$ )                         | ( $\theta = 1/\lambda$ )               |      |
| Food and Non-Alcoholic Beverages                    | 0.69                             | 0.82                                  | 1.22                                   | 1    |
| Alcoholic Beverages and Tobacco                     | 0.61                             | 0.61                                  | 1.64                                   | 3    |
| Clothing and Footwear                               | 0.36                             | 0.47                                  | 2.14                                   | 8    |
| Housing, Water, Gas, Electricity and Other<br>Fuels | 0.48                             | 0.55                                  | 1.83                                   | 5    |
| Furnishing, House Maintenance and Equipment         | 0.30                             | 0.32                                  | 3.17                                   | 10   |
| Health                                              | 0.32                             | 0.73                                  | 1.37                                   | 2    |
| Transportation                                      | 0.26                             | 0.42                                  | 2.36                                   | 9    |
| Communication                                       | 0.40                             | 0.61                                  | 1.64                                   | 4    |
| Recreation and Culture                              | 0.22                             | 0.18                                  | 5.46                                   | 11   |
| Education                                           | 0.14                             | 0.10                                  | 9.84                                   | 12   |
| Hotels, Cafes, Restaurants                          | 0.36                             | 0.47                                  | 2.11                                   | 7    |
| Other Goods and Services                            | 0.31                             | 0.48                                  | 2.07                                   | 6    |

Table 26 and 27 reveal that since the thetas differ across commodities, the tax structure in 2003 was not optimal for the levels of inequality aversion at 0.1 and 2<sup>30</sup>, since it is an optimal option for the government to decrease the tax with a low level

<sup>30</sup> Table A.5 in the Appendix show the marginal social tax productivities of commodity groups and their rankings at 5  $v$  values (0.1, 0.5, 1, 2, 5).

of marginal social tax productivity and to increase the tax on the commodity group with a high level of marginal social tax productivity.

In both cases, recreation & culture and education are the best candidates for additional taxation with their high tax appeals and marginal social tax productivities. Health is the worst option for tax increases, with its low ranking for both inequality aversion parameters; to increase the tax on Health brings a much larger social cost than the others except food & non-alcoholic beverages category, when  $v$  is equal to 2. When  $v$  is increased from 0.1 to 2, probably the most dramatic impact happens to be on the ranking of the food & non-alcoholic beverages category. At a low inequality aversion level, it ranked seventh in marginal social tax productivity, however when distributional concerns are emphasized more ( $v=2$ ), it becomes the lowest ranking group within the marginal social tax productivity values. At high levels of equity considerations, food is a poor option for additional taxation on social welfare grounds.

Increasing the level of inequality aversion from 0.1 to 2, the ranking of alcoholic beverages & tobacco category decreases from the tenth to the third. This suggests an interesting point; increasing the taxes on alcohol and tobacco might actually hurt poorer more than wealthier households. The consumption of this category is concentrated in the hands of poorer, as the distributional characteristic of this group also shows. It ranks second in both cases among other classes of goods in distributional characteristic category. One of the implication of this result might be that heavy indirect taxes imposed on the alcoholic beverages and tobacco in recent years, with the introduction of the Private Consumption Tax, in fact might have hurted the low-income segments of the society more than higher income classes.

The ranking of transportation category also shows a dramatic increase when inequality aversion parameter increases. Moving from  $v=0.1$  to  $v=2$  its ranking in the marginal social tax productivity increases from the second place to ninth, suggesting higher indirect taxes on transportation if emphasis is attributed to the redistributive properties of indirect taxation.

#### Estimation with Alternative Elasticities

Alpay and Koc (2000), estimate aggregate commodity group elasticities for Turkey using 1994 Household Budget Survey. In contrast to the 2003 HBS's classification of commodities in twelve groups, the 1994 HBS has a ten commodity group structure.<sup>31</sup> As an alternative to our estimations, we also adopted the elasticities in Alpay and Koc (2000) to our marginal tax reform model. Since the commodity grouping differs from our study, the weights and average tax rates pertaining to the ten commodity groups had to be calculated (see Table A.6 and Table A.7 in the Appendix). The Alcoholic Beverages & Tobacco category is included in the Food & Non-Alcoholic Beverages category and Communication category is included in the Housing, Water, Gas, Electricity & Other Fuels category to match with Food and Housing groups in the 1994 HBS data and thereby, the ten category structure is obtained. The Marshallian cross-price elasticities of Alpay and Koç (2000) is presented in Table A.8 in the Appendix. Using these elasticities, the marginal tax reform analysis is redone. Table 28 and Table 29 present the results estimated with the inequality aversion parameter  $v$  at 0.1 and 2, Table A.9 in the Appendix show the

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<sup>31</sup> The aggregate commodity groups in 1994 HBS are: Food, Clothing, Housing, Furnishing, Health, Transportation, Entertainment, Education, Tourism and Others.

marginal social tax productivities of commodity groups and their rankings at 5  $v$  values (0.1, 0.5, 1, 2, 5).

Table 28. Equity Parameters for  $v=0.1$  with Alpay and Koc (2000) Elasticities

| Inequality Aversion ( $v$ )<br>0.1 | Distributional<br>Characteristic | Marginal Social<br>Cost of Revenue | Marginal Social<br>Tax Productivity | Rank |
|------------------------------------|----------------------------------|------------------------------------|-------------------------------------|------|
|                                    | (d)                              | ( $\lambda$ )                      | ( $\theta = 1/\lambda$ )            |      |
| Food                               | 0.98                             | 1.23                               | 0.81                                | 4    |
| Clothing                           | 0.94                             | 1.07                               | 0.93                                | 6    |
| Housing                            | 0.96                             | 1.16                               | 0.87                                | 5    |
| Furnishing                         | 0.94                             | 1.02                               | 0.98                                | 8    |
| Health                             | 0.94                             | 0.96                               | 1.04                                | 10   |
| Transportation                     | 0.92                             | 1.07                               | 0.93                                | 7    |
| Entertainment                      | 0.91                             | 1.28                               | 0.78                                | 3    |
| Education                          | 0.89                             | 1.28                               | 0.78                                | 2    |
| Tourism                            | 0.95                             | 1.02                               | 0.98                                | 9    |
| Other                              | 0.93                             | 2.17                               | 0.46                                | 1    |

Table 29. Equity Parameters for  $v=2$  with Alpay and Koc (2000) Elasticities

| Inequality Aversion ( $v$ )<br>2 | Distributional<br>Characteristic | Marginal Social<br>Cost of Revenue | Marginal Social<br>Tax Productivity | Rank |
|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|------|
|                                  | (d)                              | ( $\lambda$ )                      | ( $\theta = 1/\lambda$ )            |      |
| Food                             | 0.68                             | 0.85                               | 1.18                                | 1    |
| Clothing                         | 0.36                             | 0.40                               | 2.48                                | 4    |
| Housing                          | 0.47                             | 0.57                               | 1.76                                | 3    |
| Furnishing                       | 0.30                             | 0.33                               | 3.03                                | 6    |
| Health                           | 0.32                             | 0.33                               | 3.04                                | 7    |
| Transportation                   | 0.26                             | 0.30                               | 3.35                                | 9    |
| Entertainment                    | 0.22                             | 0.31                               | 3.23                                | 8    |
| Education                        | 0.14                             | 0.20                               | 4.99                                | 10   |
| Tourism                          | 0.36                             | 0.39                               | 2.57                                | 5    |
| Other                            | 0.31                             | 0.71                               | 1.40                                | 2    |

At a low inequality aversion ( $v = 0.1$ ) for the government, health, tourism and furnishing are the best candidates for additional taxation. Other goods, education, entertainment and food categories turn out to be the worst option for tax increases for redistributive purposes. When inequality is emphasised more and inequality

aversion parameter is increased to two, the rankings of education and entertainment show a significant increase. These two groups and transportation category are the best three candidates for tax increases. The high social marginal tax productivities of entertainment and education at a high level of inequality aversion for the government confirm our previous calculations for marginal tax reform analysis. The decline of food category's marginal social tax productivity to the lowest one among other commodity aggregates is also consistent with what we found with the elasticities estimated using the 2003 HBS.

## CHAPTER 5

### SUMMARY AND CONCLUSIONS

This research is conducted in two steps. First, by using a large group of household survey data, the consumption patterns of the households are explored and the determinants of the allocation of budget shares in twelve commodity aggregates and the elasticities of commodity classes are tried to be identified. Second, by using the price elasticities obtained in the first step and the indirect tax rates, indirect taxation system is analyzed on distributional grounds and possible paths of reform are suggested.

#### Major Findings

The results of this study provide important insights into the redistributive function of the indirect tax system and tax rates. For two inequality aversion parameters which represent a low level of inequality concern and a high level of inequality concern, the indirect tax rates in 2003 are found not to be optimal. Marginal social tax productivities differ across commodity aggregates suggesting that it's possible for the government to accrue the same amount of revenue with less social cost. Recreation & Culture and Education commodity groups turn out to be the best candidates for additional taxation, whereas goods and services in the Health group should be taxed less. Another interesting result is that very high levels of

indirect taxes on alcohol and tobacco are not defensible at high levels of inequality aversion.

As an alternative to our estimation of AIDS model, elasticities from Alpay and Koç (2000) are also incorporated into marginal tax reform analysis, after some adjustments on aggregate budget shares and average indirect tax rates on ten commodity classes that are present in 1994 HBS and Alpay and Koç (2000). Marginal social tax productivities of these groups are calculated and some of these results confirm our previous findings. Food category is not a good option for additional tax increases at high levels of inequality aversion and entertainment and education groups are proposed to be taxed higher by the model.

Finally, our estimation has some limitations, which suggest alternative research paths for future work. First, direct taxation system is considered as given, and calculations are done on the presumption that it can not be altered. Direct income tax rates can be incorporated into the model, since monthly income of surveyed individuals are available in the data and income tax rates can be extracted accordingly. Second, there's a high degree of informality in economic activity and therefore introducing tax evasion into the model can yield interesting results. However, data availability on evasion rates is a major problem, some proxies need to be found to represent the evasion rates within classes of commodities and / or within cities of residence. Third, we used aggregate price data in this study. To obtain reliable estimates, a certain level of variation is necessary to be present in the data. Although in 2003, there was a considerable level of inflation that increased the variation in prices in our dataset, if available, this research can be extended with a more detailed price data to improve the estimation, if possible.

## APPENDIX

Table A.1. The Frequency Distribution of the Househods in the 2003 HBS  
According to the City of Residence

| City      | Frequency | Share (%) |
|-----------|-----------|-----------|
| İstanbul  | 2,842     | 11        |
| Tekirdağ  | 825       | 3.2       |
| Balikesir | 880       | 3.4       |
| İzmir     | 1,649     | 6.4       |
| Aydın     | 970       | 3.8       |
| Manisa    | 1,287     | 5         |
| Bursa     | 1,398     | 5.4       |
| Kocaeli   | 610       | 2.4       |
| Ankara    | 1,504     | 5.8       |
| Konya     | 1,144     | 4.4       |
| Antalya   | 915       | 3.6       |
| Adana     | 1,786     | 6.9       |
| Hatay     | 627       | 2.4       |
| Kırıkkale | 611       | 2.4       |
| Kayseri   | 1,077     | 4.2       |
| Zonguldak | 959       | 3.7       |
| Kastamonu | 681       | 2.6       |
| Samsun    | 861       | 3.3       |
| Trabzon   | 1,169     | 4.5       |
| Erzurum   | 338       | 1.3       |
| Ağrı      | 266       | 1         |
| Malatya   | 575       | 2.2       |
| Van       | 479       | 1.9       |
| Gaziantep | 518       | 2         |
| Şanlıurfa | 1,147     | 4.5       |
| Mardin    | 646       | 2.5       |
| Total     | 25,764    | 100       |

Table A.2. The Number of Households Surveyed in Each Month in 2003 HBS.

| Month | Frequency | Share (%) |
|-------|-----------|-----------|
| 1     | 2,148     | 8.3       |
| 2     | 2,155     | 8.4       |
| 3     | 2,154     | 8.4       |
| 4     | 2,148     | 8.3       |
| 5     | 2,152     | 8.4       |
| 6     | 2,152     | 8.4       |
| 7     | 2,141     | 8.3       |
| 8     | 2,147     | 8.3       |
| 9     | 2,146     | 8.3       |
| 10    | 2,136     | 8.3       |
| 11    | 2,141     | 8.3       |
| 12    | 2,144     | 8.3       |
| Total | 25,764    | 100       |

Table A.3. Hicksian (Compensated Price Elasticities)

|     | FO    | ALC   | CLO   | HOU   | FUR   | HEA   | TRA   | COM   | REC   | EDU   | HOT   | OTH   |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| FO  | -0.34 | -0.30 | 0.17  | 0.14  | 0.04  | 0.16  | 0.49  | 0.02  | -0.15 | -0.14 | -0.15 | 0.06  |
| ALC | -1.97 | 0.00  | -0.49 | 2.81  | 0.12  | -0.38 | -0.59 | 0.54  | 0.09  | 0.18  | -0.39 | 0.07  |
| CLO | 0.77  | -0.33 | 0.06  | -0.45 | 0.56  | -0.52 | 0.33  | -0.17 | -0.21 | -0.18 | -0.33 | 0.42  |
| HOU | 0.14  | 0.43  | -0.10 | -0.39 | -0.09 | -0.10 | -0.33 | -0.14 | -0.05 | 0.12  | 0.35  | 0.15  |
| FUR | 0.19  | 0.09  | 0.61  | -0.43 | -1.07 | -0.42 | 0.11  | 0.65  | 0.37  | -0.09 | -0.16 | 0.14  |
| HEA | 2.23  | -0.79 | -1.58 | -1.35 | -1.17 | -0.16 | -2.08 | 1.63  | 1.58  | -0.91 | 1.21  | 1.38  |
| TRA | 1.47  | -0.27 | 0.22  | -0.97 | 0.07  | -0.45 | 0.15  | -0.39 | 0.04  | 0.29  | 0.07  | -0.24 |
| COM | 0.16  | 0.53  | -0.25 | -0.93 | 0.87  | 0.78  | -0.86 | -1.13 | 1.00  | -0.24 | 0.25  | -0.18 |
| REC | -2.07 | 0.19  | -0.65 | -0.67 | 1.06  | 1.61  | 0.19  | 2.12  | -1.16 | 0.33  | -0.02 | -0.92 |
| EDU | -2.22 | 0.43  | -0.62 | 1.89  | -0.29 | -1.03 | 1.53  | -0.58 | 0.36  | -0.07 | 0.86  | -0.26 |
| HOT | -1.10 | -0.43 | -0.52 | 2.49  | -0.23 | 0.63  | 0.16  | 0.27  | -0.01 | 0.39  | -0.52 | -1.14 |
| OTH | 0.49  | 0.10  | 0.85  | 1.18  | 0.23  | 0.82  | -0.64 | -0.22 | -0.53 | -0.13 | -1.29 | -0.71 |

Table A.4. Percentage of Zero-Expenditures on Commodity Groups

| Aggregate Commodity Group                        | Share of Zero-Expenditure |
|--------------------------------------------------|---------------------------|
| Food and Non-Alcoholic Beverages                 | 0%                        |
| Alcoholic Beverages and Tobacco                  | 41%                       |
| Clothing and Footwear                            | 29%                       |
| Housing, Water, Gas, Electricity and Other Fuels | 0%                        |
| Furnishing, House Maintenance and Equipment      | 12%                       |
| Health                                           | 59%                       |
| Transportation                                   | 23%                       |
| Communication                                    | 18%                       |
| Recreation and Culture                           | 45%                       |
| Education                                        | 89%                       |
| Hotels, Cafes, Restaurants                       | 35%                       |
| Other Goods and Services                         | 16%                       |
| Total Sample                                     | 31%                       |

Table A.5. Marginal Social Tax Productivities and Ranks of Commodity Groups at Five Different Levels of  $\nu$

| Inequality Aversion ( $\nu$ )                    | $\nu = 0.1$                      |      | $\nu = 0.5$                      |      | $\nu = 1$                        |      | $\nu = 2$                        |      | $\nu = 5$                        |      |
|--------------------------------------------------|----------------------------------|------|----------------------------------|------|----------------------------------|------|----------------------------------|------|----------------------------------|------|
| Aggregate Commodity Groups                       | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank |
| Food and Non-Alcoholic Beverages                 | 0.85                             | 7    | 0.91                             | 5    | 0.99                             | 2    | 1.22                             | 1    | 5.45                             | 2    |
| Alcoholic Beverages and Tobacco                  | 1.03                             | 10   | 1.12                             | 9    | 1.25                             | 5    | 1.64                             | 3    | 9.79                             | 3    |
| Clothing and Footwear                            | 0.81                             | 6    | 1.00                             | 7    | 1.29                             | 9    | 2.14                             | 8    | 19.05                            | 8    |
| Housing, Water, Gas, Electricity and Other Fuels | 0.92                             | 8    | 1.07                             | 8    | 1.28                             | 8    | 1.83                             | 5    | 5.28                             | 1    |
| Furnishing, House Maintenance and Equipment      | 1.02                             | 9    | 1.31                             | 10   | 1.76                             | 10   | 3.17                             | 10   | 32.86                            | 10   |
| Health                                           | 0.47                             | 1    | 0.60                             | 1    | 0.80                             | 1    | 1.37                             | 2    | 11.48                            | 4    |
| Transportation                                   | 0.66                             | 2    | 0.90                             | 4    | 1.27                             | 7    | 2.36                             | 9    | 24.00                            | 9    |
| Communication                                    | 0.69                             | 4    | 0.83                             | 2    | 1.04                             | 3    | 1.64                             | 4    | 12.58                            | 5    |
| Recreation and Culture                           | 1.32                             | 11   | 1.86                             | 11   | 2.72                             | 11   | 5.46                             | 11   | 59.35                            | 11   |
| Education                                        | 1.54                             | 12   | 2.36                             | 12   | 3.82                             | 12   | 9.84                             | 12   | 452.35                           | 12   |
| Hotels, Cafes, Restaurants                       | 0.80                             | 5    | 0.98                             | 6    | 1.25                             | 6    | 2.11                             | 7    | 13.11                            | 7    |
| Other Goods and Services                         | 0.68                             | 3    | 0.89                             | 3    | 1.19                             | 4    | 2.07                             | 6    | 12.82                            | 6    |

Table A.6. Aggregate Budget Shares Under 1994 HBS Classification

| Aggregate Commodity Groups | Aggregate Budget Shares |
|----------------------------|-------------------------|
| Food                       | 32.82%                  |
| Clothing                   | 6.34%                   |
| Housing                    | 32.22%                  |
| Furnishing                 | 5.76%                   |
| Health                     | 2.07%                   |
| Transportation             | 9.47%                   |
| Entertainment              | 2.03%                   |
| Education                  | 1.82%                   |
| Tourism                    | 3.97%                   |
| Other                      | 3.51%                   |

Table A.7. Average Indirect Tax Rates Under 1994 HBS Classification, 2003

| Aggregate Commodity Groups | Average Indirect Tax Rates |
|----------------------------|----------------------------|
| Food                       | 18.32%                     |
| Clothing                   | 15.43%                     |
| Housing                    | 21.75%                     |
| Furnishing                 | 19.29%                     |
| Health                     | 8.26%                      |
| Transportation             | 41.73%                     |
| Entertainment              | 16.51%                     |
| Education                  | 8.00%                      |
| Tourism                    | 18.00%                     |
| Other                      | 20.76%                     |

Table A.8. Marshallian Cross-Price Elasticities of Alpay and Koç (2000)

|                | Food  | Clothing | Housing | Furnishing | Health | Transportation | Entertainment | Education | Tourism | Other |
|----------------|-------|----------|---------|------------|--------|----------------|---------------|-----------|---------|-------|
| Food           | -0.53 | -0.32    | 0.13    | -0.04      | 0.00   | 0.15           | 0.43          | 0.00      | -0.16   | -0.15 |
| Clothing       | -2.20 | -0.04    | -0.54   | 2.59       | 0.08   | -0.40          | -0.66         | 0.50      | 0.07    | 0.17  |
| Housing        | 0.37  | -0.39    | -0.03   | -0.84      | 0.48   | -0.54          | 0.19          | -0.23     | -0.24   | -0.20 |
| Furnishing     | -0.08 | 0.40     | -0.15   | -0.61      | -0.13  | -0.12          | -0.40         | -0.18     | -0.06   | 0.11  |
| Health         | -0.24 | 0.03     | 0.52    | -0.85      | -1.16  | -0.45          | -0.03         | 0.58      | 0.34    | -0.12 |
| Transportation | 1.79  | -0.86    | -1.68   | -1.78      | -1.26  | -0.19          | -2.22         | 1.56      | 1.54    | -0.94 |
| Entertainment  | 1.04  | -0.33    | 0.12    | -1.39      | -0.02  | -0.49          | 0.01          | -0.46     | 0.01    | 0.27  |
| Education      | -0.15 | 0.48     | -0.32   | -1.24      | 0.80   | 0.76           | -0.96         | -1.18     | 0.98    | -0.27 |
| Tourism        | -2.49 | 0.12     | -0.74   | -1.08      | 0.97   | 1.58           | 0.05          | 2.06      | -1.19   | 0.30  |
| Other          | -2.70 | 0.36     | -0.73   | 1.42       | -0.39  | -1.07          | 1.38          | -0.65     | 0.33    | -0.10 |

Table A.9. Marginal Social Tax Productivities and Ranks of Commodity Groups at Five Different Levels of  $\nu$  Using Elasticities from Alpay and Koc (2000)

| Inequality Aversion ( $\nu$ ) | $\nu = 0.1$                      |      | $\nu = 0.5$                      |      | $\nu = 1$                        |      | $\nu = 2$                        |      | $\nu = 5$                        |      |
|-------------------------------|----------------------------------|------|----------------------------------|------|----------------------------------|------|----------------------------------|------|----------------------------------|------|
| Aggregate Commodity Groups    | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank | Marginal Social Tax Productivity | Rank |
| Food                          | 0.81                             | 4    | 0.87                             | 2    | 0.95                             | 2    | 1.18                             | 1    | 5.43                             | 1    |
| Clothing                      | 0.93                             | 6    | 1.16                             | 5    | 1.50                             | 4    | 2.48                             | 4    | 22.10                            | 5    |
| Housing                       | 0.87                             | 5    | 1.01                             | 3    | 1.22                             | 3    | 1.76                             | 3    | 5.47                             | 2    |
| Furnishing                    | 0.98                             | 8    | 1.25                             | 7    | 1.68                             | 7    | 3.03                             | 6    | 31.46                            | 7    |
| Health                        | 1.04                             | 10   | 1.34                             | 10   | 1.77                             | 8    | 3.04                             | 7    | 25.43                            | 6    |
| Transportation                | 0.93                             | 7    | 1.28                             | 9    | 1.81                             | 9    | 3.35                             | 9    | 34.07                            | 8    |
| Entertainment                 | 0.78                             | 3    | 1.10                             | 4    | 1.61                             | 6    | 3.23                             | 8    | 35.07                            | 9    |
| Education                     | 0.78                             | 2    | 1.20                             | 7    | 1.94                             | 10   | 4.99                             | 10   | 229.52                           | 10   |
| Tourism                       | 0.98                             | 9    | 1.19                             | 6    | 1.52                             | 5    | 2.57                             | 5    | 15.96                            | 4    |
| Other                         | 0.46                             | 1    | 0.60                             | 1    | 0.81                             | 1    | 1.40                             | 2    | 8.68                             | 3    |

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