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IMPACTS OF TAXES ON OIL USE: A RETROSPECTIVE ANALYSIS FOR TURKEY

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ABSTRACT: Findings with our I-O model decomposing import demand generation by origin and destination revealed that petroleum products sector was a far outlier as the domestic destination sector and raw petroleum was significant as the origin sector in the Turkish economy during 1973-1996. Furthermore findings with our I-O model decomposition model incorporating relative price effects indicated that petroleum products were leading in price increases in the same era. These exercises were carried with input-output data in producers' prices. A similar work done with the input-output data in basic prices for 1998 however found that Turkey's dependence on oil imports was not outstanding, though still significant. This controversial finding is the starting point of this paper.

Turkey imported about 90 % of its oil in the 1990s and even more in the 2000s. Oil price data show that taxes amount to 70-75 % of the unit price. The share of petroleum products taxes in total indirect taxes was 30 % in 1998, which amounts to 12 % in total tax revenues. Although the controversy might be due to several factors such as difference in valuation (producers' versus basic prices) and/or changing patterns in energy intensity (and/or substitution) and/or Turkey's entrance to Customs Union with the EU in 1996, this paper focuses on the impact of the tax component. It is an attempt to gain further insight into the technological aspect of oil dependency of the economy, with price distortions due to indirect taxes accounted for. We develop a methodology which defines the discrepancies between technical coefficients based on data in basic prices and in producers' prices in terms of taxes incurred during interindustrial transactions. The unique set of data that we have is two I-O tables for 1998, one in basic prices and the other producers' prices. We find that import generation coefficients are generally larger with data in basic prices. Hence we might have even underestimated dependency on oil imports in the past period.

I. Introduction

The purpose of this paper is to find out the impact of price distortions due to net indirect taxes that might have led to over-/under-estimation of Turkey's dependence on oil imports in previous input-output modeling work.

In our input-output analysis of Turkey's dependence on imports for 1973-1996, petroleum products emerged as an outlier in generating import demand, mainly from the foreign raw petroleum sector. Findings with our I-O model decomposing import demand generation by origin and destination revealed that petroleum products are significant as the domestic destination sector and raw petroleum is significant as the origin sector for leading sectors in import demand in the Turkish economy in the 1973-1996 period. Linkages for import generation indicate that petroleum products industry was a strong outlier. (Senesen and Gunluk-Senesen, 2007). This was not unexpected in view of the fact that Turkey imported around 90 % of its oil in the 1990s and even more in the 2000s. Findings with our I-O model decomposing import demand generation by origin and destination and also incorporating relative price effects indicated that petroleum products are leading in price increases in the same era. (Gunluk-Senesen and Senesen, 2005). The above mentioned exercises were carried with input-output tables in producers' prices. A similar work carried with the input-output table for 1998 however found that Turkey's dependence on oil imports was not outstanding, though still significant (Gunluk-Senesen, 2005; Konu, 2007). This data set for 1998 was compiled in basic prices, the first one by the TURKSTAT, in compliance with EUROSTAT.

This controversial finding might be attributed to the difference in valuation (producers' versus basic prices) and/or changing patterns in energy intensity (and/or substitution) and/or Turkey's entrance to Customs Union with the EU in 1996. Thus effects will be mixed in the post 1996 period as in Cabrer et al (1998) where the price effects on value added, of decreased overall import taxes, increased imports and introduced value added taxes due to EU membership are explored for Spain.

The significance of the latter factors notwithstanding, we basically focus on the first factor, i.e. valuation, in this paper because besides the world price and the exchange rate, the domestic price of oil is determined also by taxes levied on oil consumption. Similar to the Spanish case as in Cardenete and Sancho (2002), state revenues increasingly rely on indirect taxes rather than direct taxes in Turkey and oil is a leading base due to its inelastic demand[1].

Section 2 presents information on energy sources and prices in Turkey. As valuation of input-output tables in basic prices is based on elimination of indirect taxes and subsidies (EC, 2008:53) incurred during interindustrial transactions, we develop a methodology in Section 3 which defines the discrepancies between technical coefficients based on data in basic prices and in producers' prices in terms of taxes. In section 4 we apply the methodology to the 1998 I-O data in producers' prices and the 1998 I-O data in basic prices. The final section summarizes findings with technical (domestic and imported) and import generation coefficients and discusses possible extensions and applications of the proposed methodology.

II. An overview of energy use in Turkey

Turkey's oil consumption increased until mid-1990s as shown in Figure 1. The slower pace and even a decline after then clearly can be attributed to the fast increase in natural gas consumption fully imported mainly from Russia (65 %), Algeria, Nigeria and Iran (Satman, 2006). The quantity of oil and natural gas consumption are almost equal in 2000s. This trend is also reflected in the source specific energy intensity of the economy in Figure 2. Oil consumption per unit of GDP declined after mid 1990s, the decline being sharper in early 2000s, while gas consumption per unit of GDP increased steadily. The overall energy intensity of the economy, measured by consumption of both oil and gas per unit of GDP, however increased significantly. Hence substitution between oil and gas is the recent dominating trend rather than adoption of energy saving technologies. On the other hand, substitution would be inferred for late 1990s, on which our analysis focuses. The sources of both energy types are imports for the whole period and the foreseen future as Turkey lacks oil and gas reserves.

Figure 1, Figure 2

As of 2005, Turkey's energy supply depends mainly on oil (38 %), followed by coal (27%) and gas (23 %) (Satman, 2006). Most (44 %) of electricity is produced from gas (amounts to 57% of gas), while coal and hydropower have similar proportions (26 % and 25 %) in production of electricity.

Oil prices are subject to government intervention. While 22 % is the refinery cost, private consumption tax and value added tax amount to 70-75 % of unit sale price of oil in early 2000s. The rest is distribution cost per unit (Yildirim, 2003:44-45; Cengiz, 1999). A policy feature from mid 1980s on is that price declines in the world oil market are not reflected to domestic prices. The domestic oil price is sticky downwards but not so upwards, so that tax revenues are secured in any case, depending upon the direction of price movements in the world market. The share of taxes on petroleum products in total indirect taxes was 30 (23) % in 1998 (1996), which alone accounted for 12 (14) % of total tax revenues in 1998 (1996). Hence it is not surprising that domestic oil price increases in the whole period was almost twice of the overall price increase in Turkey, supporting our findings in Gunluk-Senesen and Senesen (2005). The fact that the world oil price (above $ 20 per barrel) in mid 1980s and 1990s was lower in 1998 (around $ 14)[2] would suffice to explain why oil was found to be an outlier before 1998 and not so in 1998 in import generation, had there been no domestic price distortion. Levying indirect taxes on oil consumption is a common exercise in EU also and Turkey's rates are below the EU average (Cengiz, 1996). There are variations in motives (saving energy, environment, government revenue) as well. We present below how this practice in a broader context is reflected on input-output coefficients and hence model findings.

III. Methodology

The Leontief price model is popular in the literature on cost (or price or inflation) effects of pollution and/or energy related taxes (mostly carbon) (e.g. see Kratena, 2005; Ten Raa, 1995:26, 2004:86)[3]. Related research generally focuses on impacts on consumption. Research focusing on energy saving technology mostly uses I-O quantity modeling with energy intensity coefficients. For example, Zhang (1998) simulates with a CGE model effects of hypothetical carbon taxes on macro-economic variables and energy prices and consumption. Labandeira and Labeaga (2002) examine the price effects of a hypothetical general tax rate on CO_2 emissions upon the relative prices of outputs. Cardenete and Sancho (2002) studies impacts of indirect taxes in its broad context through prices on welfare. The focus is on private consumption within a SAM framework. Llop and Pié (2008) follow and advance the price formulation in Cardenete and Sancho (2002) and present simulations to see price effects not only of taxes on intermediate energy uses but also of energy coefficients.[4]

Fullerton (1996) incorporates single tax rates by origin sector in intermediate transactions (i.e. a_{ij} $(1+t_i)$) as well as an environment tax on the value added in the Leontief price model. Metcalf (1999) follows Fullerton (1996) and introduces tax rates on the basis of origin and destination sectors (i.e. a_{ij} $(1+t_{ij})$). The tax accounting in the early INFORUM model outlined in Bardazzi et al. (1991) provides general hints for our modeling exercise here, however in our case we have data for net indirect taxes, with subsidies accounted for (as in Abildgren, 2007). Furthermore, we focus on impacts on technical coefficients at a given time. In this sense, our approach is an *ex post* version of the approach in Kratena (2005) as we do not introduce price shocks to study coefficient changes, but study the sources of coefficient changes with special reference to realized net indirect taxes. We should also note that uniform tax (and subsidy) rates are not usually applicable.

Referring to valuation concepts for compilation of input-output data in the ESA 95 (EC, 2008:53):

$$\text{Price}_{Producers} = \text{Price}_{Basic} + \text{(indirect taxes-subsidies (on products))}$$

Therefore, intermediate transactions between sectors *i* and *j* valued in producers' prices equal to intermediate transactions between sectors *i* and *j* valued in basic prices plus net indirect taxes incurred in transactions between *i* and *j*:

$$X_{Pij} = X_{Bij} + T_{ij} \qquad (1)$$

where P : producers' prices, B : basic prices i : supplying sector $i = 1,\ldots.n$, j : buying sector $j = 1,\ldots..n$

Net indirect taxes on non-intermediate components (e.g. imports and value added) (v_j) also lead to deviations between total sectoral output values:

$$x_{Pj} = x_{Bj} + t_j \qquad \text{where} \qquad t_j = \sum_i T_{ij} + v_j \qquad (2)$$

Then

$$a_{Pij} = \frac{X_{Pij}}{x_{Pj}} \qquad \text{in matrix notation} \qquad \boldsymbol{A_P} = \boldsymbol{Z_P}\,\hat{x}_P^{\,\mathbf{-1}} \qquad (3)$$

$$a_{Bij} = \frac{X_{Bij}}{x_{Bj}}, \qquad \text{in matrix notation} \qquad \boldsymbol{A_B} = \boldsymbol{Z_B}\,\hat{x}_B^{\,\mathbf{-1}} \qquad (4)$$

$$a_{Pij} = \frac{X_{Bij} + T_{ij}}{x_{Bj} + t_j} \qquad \text{in matrix notation} \qquad \boldsymbol{A_P} = (\boldsymbol{Z_B} + \boldsymbol{T})\left(\widehat{x_B + t}\right)^{\mathbf{-1}} \qquad (5)$$

where ^ indicates a diagonal matrix.

It follows that $a_{Pij} = a_{Bij}$ for every *i* and *j*, i.e. $\boldsymbol{A_P} = \boldsymbol{A_B}$ <u>iff</u> $\boldsymbol{T} = 0$ <u>and</u> $\boldsymbol{t} = 0$. Otherwise technical coefficients valued in producers' and basic prices differ and so do multipliers based on them. Our attempt is to express these differences in terms of net indirect taxes:

$$a_{Pij} = \frac{X_{Bij} + T_{ij}}{x_{Pj}} = \frac{T_{ij}}{x_{Pj}} + \frac{X_{Bij}}{x_{Pj}} = \frac{T_{ij}}{x_{Pj}} + \frac{X_{Bij}}{x_{Pj}} \cdot \frac{x_{Bj}}{x_{Bj}} = \frac{T_{ij}}{x_{Pj}} + \frac{X_{Bij}}{x_{Bj}} \cdot \frac{x_{Bj}}{x_{Pj}} \qquad (6)$$

$$a_{Pij} = \frac{T_{ij}}{x_{Pj}} + a_{Bij}\left(\frac{x_{Bj}}{x_{Pj}}\right) \qquad \text{in matrix notation} \qquad \boldsymbol{A_P} = \boldsymbol{T}\,\hat{x}_P^{\,\mathbf{-1}} + \boldsymbol{A_B}\,\hat{x}_B\,\hat{x}_P^{\,\mathbf{-1}}$$

$$\boldsymbol{A_P} = (\boldsymbol{T} + \boldsymbol{A_B}\,\hat{x}_B)\,\hat{x}_P^{\,\mathbf{-1}} \qquad (7)$$

$$a_{Pij} = \frac{T_{ij}}{x_{Pj}} + a_{Bij}\left(1 - \frac{t_j}{x_{Pj}}\right) \qquad \text{in matrix notation} \qquad \boldsymbol{A_P} = \boldsymbol{T}\,\hat{x}_P^{\,\mathbf{-1}} + \boldsymbol{A_B}\,(\boldsymbol{I} - \hat{t}\,\hat{x}_P^{\,\mathbf{-1}})$$

(8)

$$\Delta = a_{Pij} - a_{Bij} = \frac{T_{ij}}{x_{Pj}} - a_{Bij}\frac{t_j}{x_{Pj}}$$

in matrix notation $\Delta = \boldsymbol{A_P} - \boldsymbol{A_B} = \boldsymbol{T}\ \hat{x}_P^{-1} - \boldsymbol{A_B}\ \hat{t}\ \hat{x}_P^{-1}$ (9)

Hence, deviations between a_{Pij} and a_{Bij} have two components:

1. sector pair specific intermediate net taxes in proportion to buyer sector j output, $\frac{T_{ij}}{x_{Pj}}$

2. a_{Bij} weighed by the ratio of buyer sector output in basic prices to its output in producers' prices. Any deviation of this ratio from 1 implies the contribution of total net indirect taxes in sectoral output, namely $\pm\frac{t_j}{x_{Pj}}$.

The direction of deviations between a_{Pij} and a_{Bij} subject to the signs of T_{ij} and t_j are summarized in Table 1. Positive values of T_{ij} and t_j imply dominance of indirect taxes over subsidies and vice versa. There are two indeterminate cases. The distance depends on the magnitudes of the components when $a_{Bij} > 0$, $T_{ij} < 0$ and $t_j < 0$. The same applies when $a_{Bij} > 0$, $T_{ij} > 0$ and $t_j > 0$.

Table 1. Conditions for discrepancies between a_{Pij} and a_{Bij} subject to net indirect taxes

If $a_{Bij} = 0$ and $T_{ij} = 0$	then $a_{Pij} = 0$	then $\Delta = 0$
$T_{ij} > 0$	then $a_{Pij} > 0$	then $\Delta > 0$ [5]
If $a_{Bij} > 0$ and $T_{ij} = 0$ and $t_j = 0$	then $a_{Pij} = a_{Bij}$	then $\Delta = 0$
$t_j > 0$	then $a_{Pij} < a_{Bij}$	then $\Delta < 0$
$t_j < 0$	then $a_{Pij} > a_{Bij}$	then $\Delta > 0$
$T_{ij} < 0$ and $t_j = 0$	then $a_{Pij} < a_{Bij}$	then $\Delta < 0$
$t_j > 0$	then $a_{Pij} < a_{Bij}$	then $\Delta < 0$
$t_j < 0$	then a_{Pij} ? a_{Bij}	then Δ ? 0
$T_{ij} > 0$ and $t_j = 0$	then $a_{Pij} > a_{Bij}$	then $\Delta > 0$
$t_j > 0$	then a_{Pij} ? a_{Bij}	then Δ ? 0
$t_j < 0$	then $a_{Pij} > a_{Bij}$	then $\Delta > 0$

The above discussion on total input-output coefficients obviously applies to domestic (D) input-output coefficients and to import (M) input-output coefficients with corresponding intermediate taxes, i.e. T_{ij} accounted for. In other words, for domestic (import) coefficients, T_{ij} will capture net indirect taxes levied on domestic (import) transactions.

Since $\Delta = \Delta_D + \Delta_M$ we can redefine (9) for both cases:

$$\Delta_D = \boldsymbol{A_{DP}} - \boldsymbol{A_{DB}} = \boldsymbol{T_D}\ \hat{x}_P^{-1} - \boldsymbol{A_{DB}}\ \hat{t}\ \hat{x}_P^{-1} \qquad (10)$$

$$\Delta_M = \boldsymbol{A_{MP}} - \boldsymbol{A_{MB}} = \boldsymbol{T_M}\ \hat{x}_P^{-1} - \boldsymbol{A_{MB}}\ \hat{t}\ \hat{x}_P^{-1} \qquad (11)$$

The import dependency (or import generation) matrix $\boldsymbol{S} = \boldsymbol{A_M}\ (\boldsymbol{I} - \boldsymbol{A_D})^{-1}$ can be expressed in producers' prices and basic prices as follows:

$$\boldsymbol{S_P} = \boldsymbol{A_{MP}}\ (\boldsymbol{I} - \boldsymbol{A_{DP}})^{-1} \qquad (12)$$

$$\boldsymbol{S_B} = \boldsymbol{A_{MB}}\ (\boldsymbol{I} - \boldsymbol{A_{DB}})^{-1} \qquad (13)$$

The discrepancy between $\boldsymbol{S_P}$ and $\boldsymbol{S_B}$ is therefore a composed of domestic and imported technical coefficients and the Leontief inverse matrices in basic prices weighed by the tax components:

$$\boldsymbol{S_P} - \boldsymbol{S_B} = \boldsymbol{A_{MP}}\ (\boldsymbol{I} - \boldsymbol{A_{DP}})^{-1} - \boldsymbol{A_{MB}}\ (\boldsymbol{I} - \boldsymbol{A_{DB}})^{-1} \qquad (14)$$

$$= [\boldsymbol{T_M}\ \hat{x}_P^{-1} + \boldsymbol{A_{MB}}\ (\boldsymbol{I} - \hat{t}\ \hat{x}_P^{-1})]\ [\mathrm{I} - (\boldsymbol{T_D}\ \hat{x}_P^{-1} + \boldsymbol{A_{DB}}\ (\boldsymbol{I} - \hat{t}\ \hat{x}_P^{-1})]^{-1} - \boldsymbol{A_{MB}}\ (\boldsymbol{I} - \boldsymbol{A_{DB}})^{-1}$$

In this case, $\boldsymbol{S_P} = \boldsymbol{S_B}$ iff $\boldsymbol{T_M} = 0$ and $\boldsymbol{T_D} = 0$ and $t = 0$.

Import generation (dependency) multipliers are defined as column sums of the $\boldsymbol{S}$ matrix,

$$S_j = \Sigma_i\ S_{ij} \qquad (15)$$

which denotes the direct and indirect import demand generation of a unit increase in the final demand of sector j.

Although normally statistical offices disseminate input-output data in basic prices only, we will illustrate the above methodology using the data set for 1998 for Turkey: an I-O table in producers' prices (domestic and imports) and an I-O table in basic prices (domestic and imports). The difference is net indirect taxes. The unavailability of data separately for indirect tax and subsidy components limits the analysis to net indirect taxes.

IV. Findings

We applied the above methodology to the 1998 I-O data for Turkey. These data are produced for 97 sectors. The calculations were done with the 97×97 tables, however since our focus is on energy, we report here only our findings for crude oil, petroleum products and natural gas. We first discuss the patterns of net indirect taxes for both domestic and import transactions. Then we assess the implications of valuation difference on the basis of deviations in domestic coefficients, in import coefficients and in import generation multipliers.

1. Patterns in net indirect taxes

We get net indirect taxes by subtracting the I-O flow matrix in basic prices from the I-O flow matrix in producers' prices both for domestic and imports matrices. Net indirect taxes with respect to buyers and suppliers are given in Tables 1a-1d.

Patterns are different for crude oil and petroleum products. Net indirect taxes are higher for petroleum products as a supplier sector in domestic transactions while they are higher for crude oil as a supplier sector in import transactions. This is a reflection of the energy supply composition for Turkey. As would be recalled natural gas was penetrating into the market in 1998, hence tax payment is less significant.

As Table 1a shows, leading sectors in net indirect tax payments on domestic intermediate petroleum products consumption are all transportation sectors (land transport being a far outlier, a reflection of the dominance of highways in transportation in Turkey) followed by agriculture, construction, electricity, financial institutions, glass products, petroleum products itself etc. Figure 3 depicts the sectoral distribution for domestic petroleum products column in Table 1a. Note that deviations are much greater and the number of buyer sectors is much higher when the supplying sector is petroleum products (see Table 1a for the whole picture).

Table 1b shows net indirect taxes for energy sectors as buyers. Net indirect taxes are higher for domestic transactions between crude oil and petroleum products, highest being within the petroleum products sector. We also note that transactions between energy sectors (supplier) and other sectors are subject to subsidies overriding indirect taxes.

Table 1c and 1d indicate the clustering of sectors with respect to net indirect taxes in import transactions. Domestic petroleum products as a buyer sector from foreign oil sector dominate as well as air transport as a buyer from foreign petroleum products. Again transactions between petroleum products (buyer) and other sectors are subject to subsidies overriding indirect tax (Table 1c). An interesting feature is that high net indirect taxes are incurred in transactions between natural gas (buyer) and foreign cereal sector (supplier) (Table 1d).

Table 1a-1d, Figure 3.

1. Patterns in domestic coefficients: $a_{DPij} - a_{DBij}$

Row wise distribution of differences in domestic technical coefficients (in line with eq.10) is listed in Table 2. For users of crude oil, coefficients in producers' prices are higher than those in basic prices mainly for fertilizers and mill products. The deviation is greater and in the opposite direction for petroleum as a buyer. For users of petroleum products, coefficients in producers' prices are higher than those in basic prices for land transport. The deviation is positive for rail transport, water transport, quarrying, air transport and agro-chemicals, while it is negative for leasing and travel agency activities. Discrepancies are minor for users of natural gas.

Table 2

As for the technical coefficients in the oil, petroleum products and gas columns, we again note from Table 3 deviations subject to valuation, though not very big in the positive direction. However note that coefficients in producers' prices are much lower than those in basic prices for purchases made by crude oil from fruit and R&D sectors. For the case of petroleum products sector being both the supplier and the buyer, technical coefficient in producers' prices is lower than in basic prices.

Table 3

2. Patterns in import coefficients: $a_{MPij} - a_{MBij}$

Import coefficients in producers' prices are significantly lower than those in basic prices for sales of crude oil and petroleum products. Highest negative discrepancies are observed in Table 4 for purchases from crude oil of R&D, gas and petroleum products, the last one being an outlier. There are no notable deviations for gas.

Table 4

There are no significant deviations for import coefficients for purchases of crude oil as shown in Table 5. The import coefficient in producers' prices is significantly lower than those in basic prices for purchases of petroleum products from oil. Similarly the deviation is highly negative for purchases of gas from oil.

Table 5

3. Patterns in import generation multipliers: $S_{Pj} - S_{Bj}$

We summarize in Table 6 the impact of differences in valuation (i.e. producers' prices versus basic prices) on import generation multipliers defined in (15). The most important finding is that import multipliers in producers' prices are almost exclusively lower than those in basic prices. This implies that we might have significantly underestimated the import dependency of the Turkish economy in our previous work with the pre-1998 data in producers' prices.

The ranked values in Table 6 show that the deviation is highest for the R&D sector. The next highest discrepancy is found with petroleum products.

Table 6

V. Conclusions

We have shown in this paper how valuation (i.e. producers' prices versus basic prices) affects input-output coefficients. Therefore multiplier analysis based on data of different valuations will not be identical. We have illustrated the proposed methodology on import generation multipliers for Turkey with 1998 data. We find that these multipliers were seriously underestimated with data in producers' prices compared to basic prices. Our focus was especially on petroleum taxes which serve as a significant basis for indirect taxes.

Since we do not have separate data for indirect taxes and subsidies, it is not clear whether this tax policy follows the reasoning in Zhang (1998:152) where an overall lowering of indirect taxes is called upon to reduce the adverse effects of a carbon tax if fossil fuels are taxed more heavily by carbon taxes, It is neither clear in the Turkish case whether key sectors where tax incidence is concentrated are also compensated preferential tax treatments as in Labandeira and Labeaga (2002:610). Challenges posed by these issues for further research notwithstanding, the dominating function of petroleum taxes in Turkey is contribution to government revenues. On the other hand, recent fast penetration of natural gas in energy supply deserves further attention, especially in terms of cost, tax and environment issues. Besides, the fact that it is fully imported also should be accounted for.

Our case might be a peculiar one, as TURKSTAT switched to producing input-output data in basic prices only recently. However it has serious implications for long term analysis. When sequential data in the same valuation are not available, comparative analysis of especially structural change suffers from differences in measurement.

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Figure 1. Consumption of oil and gas in Turkey
(million tonnes of oil equilavent)

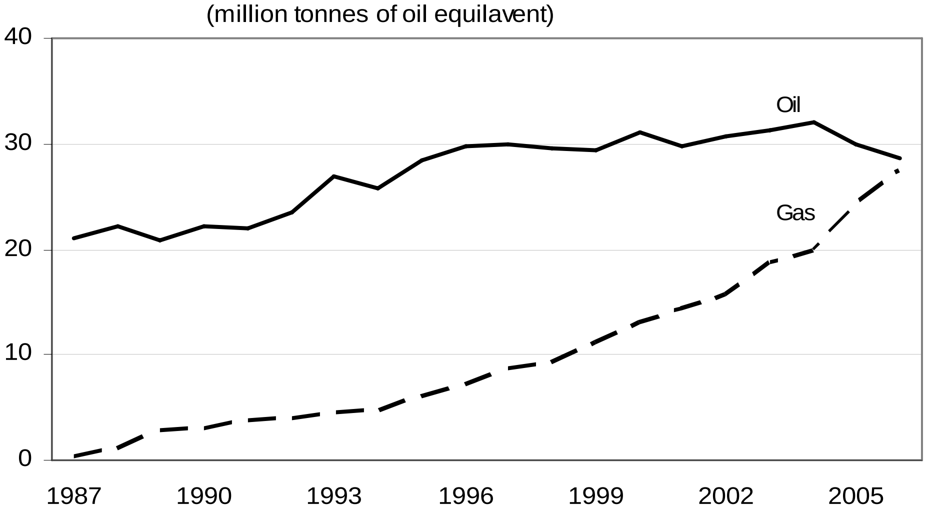

Figure 2. Oil and gas consumption (tonnes) / GNP (TL in 1987 prices)

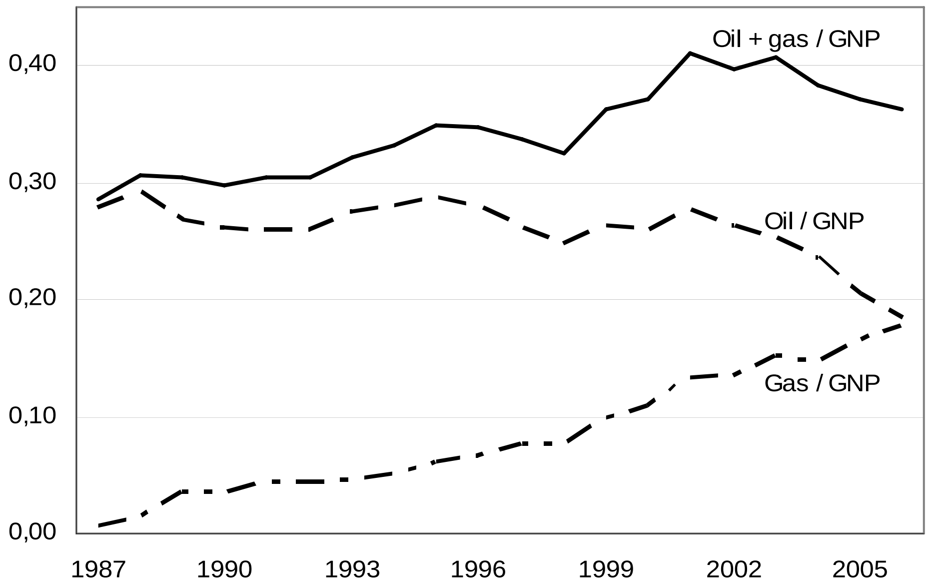

Figure 3. Net Indirect Taxes (domestic) 1998 (m. TL)
Supplier: Petroleum Products

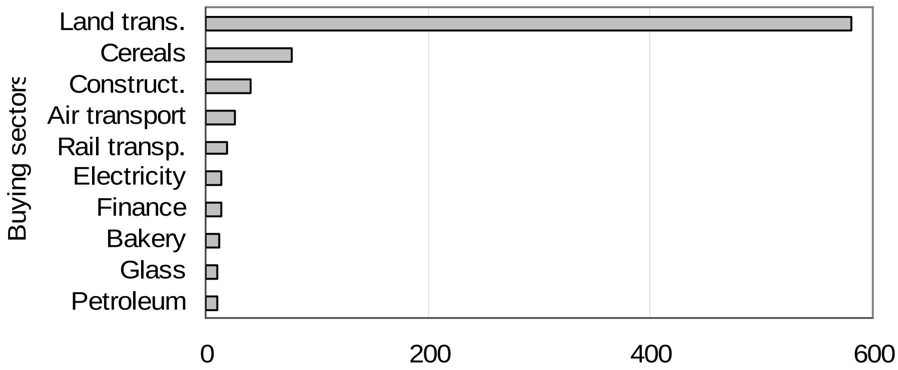

Table 1a. NET Indirect taxes T_{Dij} (domestic)1998 (million TL)							
Supplier Crude oil		Supplier Petroleum products				Supplier Natural gas	
buyer	tax	buyer	tax	buyer	tax	buyer	tax
38	2	79	581	59	2	76	1
70	1	1	78	4	2	84	1
40	1	72	41	92	1	90	1
18	1	81	26	10	1	72	1
90	-1	80	19	93	1	26	1
		69	14	94	1	75	1
		84	13	83	1	77	-1
		20	13	15	1		
		48	10	6	1		
		38	10	53	1		
		41	9	16	1		
		50	9	95	1		
		39	7	90	1		
		11	7	54	1		
		75	7	45	1		
		78	7	28	1		
		7	6	13	1		
		43	6	17	1		
		8	6	34	1		
		76	5	40	1		
		26	5	12	1		
		35	4	52	1		
		74	4	23	1		
		73	4	57	1		
		47	3	68	1		
		91	3	27	1		
		3	2	9	1		
		51	2	49	1		
		44	2	42	1		
		21	2	31	1		
		29	2	67	1		
		2	2	89	-1		
		46	2	86	-1		
		56	2	87	-4		
		22	2	18	-4		
		62	2	82	-11		

Table 1b. Columns:NET indirect taxes T_{Dij} (domestic)1998 (mnTL)					
Buyer: Crude oil		Buyer: Petroleum products		Buyer: Natural gas	
supplier	tax	supplier	tax	supplier	tax
38	1	38	10	9	1
3	-1	15	5	15	1
89	-3	9	2		
		84	1		
		53	-1		
		39	-1		
		75	-1		
		80	-1		
		10	-1		
		79	-1		
		74	-1		
		52	-2		
		69	-3		
		50	-9		

Table 1c. Rows: NET indirect taxes T_{Mij} (imports) 1998 (mn TL)					
Supplier: Crude oil		Supplier: Petroleum products		Supplier: Natural gas	
buyer	tax	buyer	tax	buyer	tax
38	4	81	1		
40	1	87	-1		
79	-1	82	-2		
87	-1				
89	-2				
90	-5				

Table 1d. Columns: NET indirect taxes T_{Mij} (imports) 1998 (mnTL)					
Buyer: Crude oil		Buyer: Petroleum products		Buyer: Naturalgas	
supplier	tax	supplier	tax	supplier	tax
		9	4	1	9
		10	-1	16	2
		52	-1	42	1
		8	-1	19	1
		39	-2		
		50	-6		

Table 2. Row wise distribution $(a_{DPij} - a_{DBij})$*1000 1998 domestic coefficients											
Supplier: Crude oil				Supplier: Petroleum products				Seller: Gas			
buyer	Δ	buyer.	Δ	buyer	Δ	buyer	Δ	buyer	Δ	buyer	Δ
40	3	14	-1	79	**77**	84	2	87	1	23	-1
18	2	87	-1	78	**34**	73	2	90	1	40	-1
17	1	89	-3	80	**30**	34	2	10	1	89	-1
15	1	38	**-12**	11	**23**	15	2				
22	1			81	**21**	56	2				
47	1			41	**20**	40	2				
				1	**17**	85	2				
				7	**17**	22	2				
				10	**14**	31	2				
				86	**14**	75	2				
				8	**13**	54	2				
				39	**13**	71	1				
				20	**13**	65	1				
				48	**11**	53	1				
				69	8	13	1				
				47	7	37	1				
				51	6	59	1				
				17	6	3	1				
				70	6	2	1				
				91	6	16	1				
				49	6	27	1				
				43	6	88	1				
				12	6	92	1				
				72	5	83	1				
				9	5	74	1				
				46	5	90	1				
				52	5	45	1				
				35	4	29	1				
				44	4	33	1				
				6	4	60	1				
				95	4	57	1				
				14	4	19	1				
				50	4	66	1				
				26	3	67	1				
				64	3	42	1				
				63	2	89	-1				
				94	2	23	-1				
				28	2	38	-2				
				76	2	18	-6				
				30	2	82	**-12**				
				93	2	87	**-24**				
				21	2						

Table 3. Column wise distribution $(a_{DPij} - a_{DBij})$*1000 1998 domestic coefficients

Buyer: Crude oil				Buyer: Petroleum products				Buyer: Natural gas			
seller	Δ	seller	Δ	seller	Δ	seller	Δ	seller	Δ	seller	Δ
38	5	29	-1	15	1	35	-1	15	4	86	-1
62	3	84	-1			52	-1			79	-2
53	3	80	-1			53	-1				
26	2	74	-1			73	-1				
5	1	90	-1			75	-1				
72	1	75	-1			38	-2				
55	1	69	-2			79	-2				
45	1	15	-2			80	-2				
82	1	2	-4			74	-2				
23	1	79	-4			84	-3				
42	1	3	**-13**			69	-3				
56	1	89	**-31**			50	-4				
19	1					9	**-12**				
36	1										

Table 4. Row wise distribution $(a_{MPij} - a_{MBij})$*1000 1998 import coefficients

Seller: Crude oil				Seller: Petroleum products		Seller: Gas
buyer	Δ	buyer	Δ	buyer	Δ	
17	3	59	-1	18	-1	
18	3	86	-1	11	-1	
		39	-1	82	-2	
		49	-1	87	-4	
		46	-1			
		22	-1			
		69	-3			
		90	-3			
		14	-4			
		40	-4			
		87	-6			
		89	**-16**			
		70	**-19**			
		38	**-75**			

Table 5. Column wise distribution $(a_{MPij} - a_{MBij})$*1000 1998 import coefficients

Buyer: Crude oil	Buyer: Petroleum products				Buyer: Natural gas	
	seller	Δ	seller	Δ	seller	Δ
	81	6	8	-1	9	-19
			43	-1		
			39	-1		
			50	-3		
			80	-3		
			9	**-75**		

Table 6. Deviations in Import dependency multipliers 1998							
No	$S_{Pj} - S_{Bj}$	No	$S_{Pj} - S_{Bj}$	No	$S_{Pj} - S_{Bj}$	No	$S_{Pj} - S_{Bj}$
96	0	1	-6	31	**-10**	55	**-30**
97	-1	84	-6	50	**-11**	36	**-30**
75	-1	20	-6	94	**-12**	42	**-31**
83	-1	48	-6	51	**-12**	45	**-33**
3	-1	8	-6	90	**-14**	86	**-36**
6	-1	64	-6	29	**-14**	39	**-37**
28	-1	88	-6	78	**-14**	61	**-37**
72	-2	69	-7	21	**-14**	58	**-41**
79	-2	95	-7	46	**-15**	68	**-42**
15	-2	53	-7	30	**-15**	32	**-43**
73	-3	56	-7	14	**-16**	40	**-45**
12	-3	37	-7	67	**-16**	25	**-46**
7	-3	92	-7	60	**-17**	87	**-50**
80	-3	77	-7	35	**-19**	62	**-58**
52	-3	91	-8	54	**-19**	38	**-92**
5	-4	19	-8	70	**-19**	89	**-160**
18	-4	63	-8	16	**-21**		
85	-4	26	-8	41	**-21**		
4	-4	9	-8	82	**-21**		
10	-4	47	-8	44	**-21**		
34	-4	27	-8	43	**-23**		
17	-4	11	-8	59	**-26**		
76	-5	22	-8	23	**-26**		
71	-5	49	-8	57	**-26**		
2	-5	81	-8	65	**-28**		
93	-5	74	-9	24	**-29**		
33	-5	13	-9	66	**-29**		

[1] For example the government levied in April 2008 an additional tax on oil consumption in order to finance the organisations in 2010 for which Istanbul is nominated as the European Capital of Culture.

[2] Yildirim (2003:69)

[3] e.g. see Kibritcioglu and Kibritcioglu (1999) which uses the Leontief price model to study inflationary effects of oil prices in Turkey. Their main finding is that price increases of oil is not significant in generating inflation.

[4] By keeping sectoral and total bill of intermediate energy use unchanged, they assume that sectoral and hence total bill of energy use is inversely proportional to prices,

$$X_{Ej}^{S} = \frac{X_{Ej}}{p_E^S}$$

This is a rather unrealistic assumption since it implicitly expects a uniform and simultaneous pattern of adoption of energy saving technology for all sectors, but in reality change in energy use might not be proportional to compensate for price increase rate.

[5] Incurrence of net taxes when no intermediate transaction occurs is a rather peculiar case; however we include this option due to such cases in our data set, the probable source of which is stated by TURKSTAT to be the derivation process of the I-O data from Supply and Use data.