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GASOLINE PRICING, TAXATION AND ASYMMETRY: THE CASE OF TURKEY

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Abstract

This study analyzes the role of tax policy in gasoline prices in Turkey by utilizing time series techniques. It provides and compares empirical results by using daily gasoline prices between January 2005 and July 2012, with and without the effect of taxation. Our results, based on the standard asymmetric error-correction model, indicate no evidence of asymmetry in retail gasoline prices, which implies that the government does not benefit from the adjustment of gasoline prices through taxation. However, one can miss the big picture in gasoline pricing by concentrating only on the short term price adjustment dynamics via error-correction models. Therefore, we analyzed the long-run relationships between crude oil and gasoline prices with and without taxes. The results indicate that Turkish government succeeded at implicitly imposing an exceptionally high tax burden on gasoline (about 70%) over the longer term by adjusting non-salient excise tax amounts on gasoline and benefited from the resultant tax revenues as means of public finance.

Keywords: Gasoline Pricing, Taxation, Asymmetry

1. Introduction

In many oil importing economies retail prices of gasoline depend largely on changes in crude oil prices and exchange rate movements. Retail prices in response to international crude oil prices tend to rise faster than they fall; a phenomenon, Bacon (1991) calls "*rockets and feathers"*. Several theoretical explanations; such as oligopolistic pricing, asymmetric consumer searching behavior, and the role of inventories, are used to explain this phenomenon (Bacon and Kojima, 2010). Price asymmetries are important because the existence of such asymmetries imply that consumers are not benefitting from price reductions as in the case of symmetric price adjustment. Therefore, price asymmetries have important welfare implications (Meyer and Cramon-Taubadel, 2004: 582).

Bacon and Kojima (2010) note that asymmetric pricing in oil products is observed in all studies conducted on eight developing countries.[1] For developed countries, however, the empirical evidence on rockets and feathers pricing is mixed as a result of differences in econometric specification, data frequency (daily, weekly, monthly), the time period, the scope of the transmission chosen and whether the prices include taxes or not (Grasso and Manera, 2007). Two seminal studies conducted on the US economy exemplify the importance of these differences. Borenstein et al. (1997) used a non-standard error correction model and weekly data over the 1986-1998 period to test the asymmetry of the US gasoline prices. They found that retail gasoline prices rose quickly after an increase in the price of crude oil, but fell slowly following a decrease. Contrarily, Bachmeier and Griffin (2003: 772) noted that "daily data may provide more reliable estimates than weekly data … [since] aggregation over time can create a type of omitted variables bias problem". They used a standard Engle-Granger error correction model with daily data over the 1995-1998 period, and found no evidence of asymmetry in the wholesale gasoline prices. They found similar results when they employed Borenstein et al.'s non-standard specification on daily data, and reached the conclusion that Borenstein et al.'s

(1997) results are fragile.[2] Their studies demonstrate that econometric choices are highly influential on study outcomes, and confirm Geweke's (1978) conviction that daily data mitigate estimation bias of aggregated (e.g. monthly) data, when available.

In Turkey, prices of oil products have been high for a long time and this is considered as a serious problem by the society. [3] Despite the importance of this topic, Alper and Torul (2009) appears to be the only research that analyzed the rockets and feathers pricing in Turkish economy.

Alper and Torul (2009) used monthly data covering the 1991-2007 period, and employed an admittedly *uncommon* method; structural VAR.[4] They found that retail gasoline prices in Turkey respond more and significantly to increases in international crude oil prices, compared to decreases. Authors concluded that the source of asymmetry was mainly attributable to the government's price setting policies via taxation. They pointed to a common belief among economists and public that Turkey's fiscal authorities use high gasoline taxes to create resources for financing the budget. It is true that Turkey has a tax system which relies heavily on indirect taxes and an important share of it is coming from the taxes levied on petroleum products. However, as is explained in the following sections, their analysis may not provide clear and robust answer to the existence of asymmetry.

In this study, we analyze the role of tax policy in gasoline pricing in Turkey with daily data from January 2005 to July 2012. In order to identify the role of taxation in the possible asymmetry of gasoline pricing, we provide and compare empirical results by employing the standard Engle and Granger's approach on gasoline prices data with and without the taxes. However, we give a particular emphasis to *the long-run* relationships between crude oil prices and gasoline prices with and without taxes, which is a neglected issue in the existing literature on gasoline pricing.

The rest of the paper is organized as follows. Section 2 provides an overview of the role of oil and its taxation in the Turkish economy. The sources and definitions of the data are provided in Section 3. The model and empirical results are provided in Section 4. Finally, Section 5 provides the concluding remarks.

2. The Role of Oil and Its Taxation in the Turkish Economy: An Overview

Turkey is an emerging market economy and a net importer of oil. As is seen in Table 1, Turkey produced only 6.9-8.3 % of its total petroleum consumption between 2005 and 2011. As a consequence of high dependency on oil imports, crude oil price movements in international energy markets have a direct impact on domestic retail prices of oil products. This dependency also contributes to the high current account deficit that the Turkish economy registers (about 10% of GDP in 2011).

Table 1. Daily Petroleum Production and Consumption of Turkey (Thousand barrels per day)

	2005	2006	2007	2008	2009	2010	2011
Daily Petroleum Production	45.5	43.9	44.8	47.6	53.6	56.8	56.5
Daily Petroleum Consumption	659.3	677.6	689.8	677.7	703.2	730.2	679.9
Production/Consumption (%)	6.9	6.5	6.5	7.0	7.6	7.8	8.3

Source: U.S Energy Information International Energy Statistics (www.eia.gov)

In Turkey, retail gasoline prices were determined by the government prior to 2005.[5] With the Petroleum Market Law No: 5015, which became effective in 2003, Energy Market Regulatory Authority (EMRA) became responsible from guiding, monitoring and surveilling the energy market. From January 2005 and onwards, refinery prices are determined freely in the market while regulated by the EMRA to reflect the developments in international oil markets and exchange rate movements. Licensed refineries and distributors are required to notify the EMRA of their ceiling prices.

Nevertheless, as Table 2 shows, the total share of refineries, distributors and retailers was less than the share of taxes in retail (final) gasoline[6] prices in 2011.[7] When one examines the

most recent annual EMRA reports on the petroleum market, it becomes clear that this situation is not unique to 2011.[8] In sum, tax is the single largest component of retail prices in gasoline and other oil products (EMRA, 2012).

Table 2. The Share of Final Price Components of Gasoline[a] in 2011

	Refinery (Tax Free) (%)	Distributors' Share (%)	Retailers' (Vendor) Share (%)	Special Consumption Tax, SCT (%)	Value Added Tax, VAT (%)	Total Tax (Burden) (%)
2011	30.5	4.8	4.3	45.1	15.3	60.4

[a] Unleaded 95 octane gasoline.
Source: EMRA (2012: 140)

Considering the high tax burden on gasoline, one can say that the *retail* prices of oil products are still regulated by the government. However, it is important to underline that total tax burden comprises of two different taxes; the special consumption tax (SCT) and the value added tax (VAT). In order to better explain the role of government in gasoline pricing, it is worthwhile to provide some information on SCT and VAT and their role in the taxation of oil products. SCT on gasoline was introduced in 2002 in order to harmonize Turkey's indirect tax system to the European Union *acquis communautaire*. SCT is an excise or specific tax and charged only once. It is imposed on specific goods and there are different SCT amounts for different products. The main purpose of SCT in European Union is to maximize the social welfare and, therefore, it is imposed on luxury, unhealthy and polluting goods.[9] On the other hand, the Turkish tax system levies VAT at each stage of the production and the distribution process.[10] In case of oil products, SCT is imposed first on importers and/or producers (including refineries) and then VAT is levied on the refinery price, distributor and vendors' share as well as on special consumption tax. This referred to taxation of an already taxed item. Moreover, while the VAT is an ad valorem tax and its rate is fixed (18%), SCT is levied on "per unit" basis and adjusted over time. The fact that VAT rates are fixed but SCT amounts are changeable leaves SCT changes as the only way government can affect gasoline prices. Predictably, SCT amounts have been changed five times since 2005 (Table 3).

Table 3. Special Consumption Tax Adjustments Since 2005

Date	TRY[a] per liter
01.01.2005	1.3625
01.07.2008	1.4915
15.07.2009	1.6915
01.01.2010	1.8915
18.05.2012	1.8765
22.10.2012	2.1765

[a] TRY=Turkish Lira.

Table 4 provides solid evidence that the government can use SCT as an "instrument" to affect retail gasoline prices by affecting the *effective tax rate*, which is the total tax over retail price. As is clear from this table, the effective tax rate on gasoline is very high in Turkey, fluctuating between 60% and 75% with an average of 66.4% since 2005. However, as is explained in the following sections, the effective tax rate is not clearly perceptible to the final users since only VAT rate (18%) is shown on the gasoline bills of the consumers.

Table 4. Effective Tax Rates on Gasoline

Year	Retail Price After Tax (TRY)	Total Tax (TRY)	*Effective* Tax Rate (%)[a]
2005	2.30	1.71	74.49
2006	2.58	1.76	68.09
2007	2.78	1.79	64.33
2008	3.09	1.95	63.07
2009	2.79	1.92	68.77
2010	3.74	2.46	65.94
2011	4.19	2.53	60.40

[a] Effective tax rate = (Total taxes paid /retail price including taxes)*100, where total tax=VAT+SCT.
Source: EMRA (2012: 139)

The main motivation behind imposing excessive tax on gasoline is clearer when one considers the role of indirect taxes on oil products in public finance in Turkey. Taxes levied on oil products are an important source of tax revenue for Turkish government (Table 5). The two indirect taxes (SCT and VAT) on these products constituted 19.3% and 13% of the total tax revenues in 2005 and 2011, respectively. Although the share of these taxes seems to be decreasing, nominal value of the total taxes increased from 23.1 billion TRY in 2005 to 39.2 billion TRY in 2011. Yet the share of these taxes in GDP is a better indicator of the importance of

indirect taxes in the total budget. Table 5 reveals that the indirect oil tax revenues to GDP ratio remained stable, fluctuating between 3% and 3.6%.

Table 5. Indirect Taxes on Oil Products (billion TRY)

Indicator	2005	2006	2007	2008	2009	2010	2011
SCT Collected from Oil Products	17.5	18.1	19.0	20.0	21.9	25.9	27.6
VAT Collected from Oil Products	5.6	6.7	7.4	8.4	7.5	9.7	11.6
Total Indirect Tax: SCT + VAT	23.1	24.8	26.4	28.3	29.4	35.6	39.2
Total Tax Revenue	119.6	150.3	169.5	190	200.6	248.3	301.7
The Share of Indirect Taxes From Oil Production Total Tax Revenues (%)	19.3	16.5	15.6	14.9	14.7	14.3	13.0
The Share of Indirect Taxes From Oil Products in GDP (%)	3.6	3.3	3.1	3.0	3.1	3.2	3.1

Source: EMRA (2012: Table 3.42, p.141)

3. Data

Daily data are used in this study. As noted before, daily data are preferred to aggregated weekly or monthly data since aggregated data can create substantial econometric problems (Geweke 1978) and daily data provide more information for eliciting effects from lagged changes.

Our data span from 04/01/2005 to 31/07/2012, and totals to 2,766 observations for each variable.[11] Definitions and sources of the variables used in this study are given below.[12]

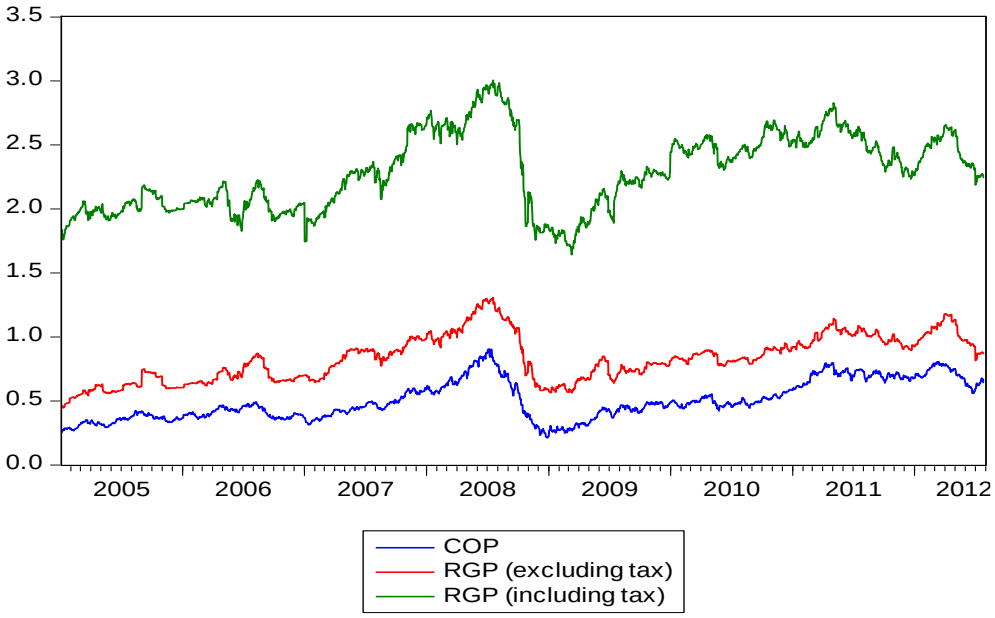
COP: Crude oil prices of gasoline, in USD per liter (Fob Europe Brent spot price).Source: US Energy Information Administration (http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm)[13]

RGP (excluding taxes): Net retail price of unleaded 95 octane gasoline price, in USD per liter (vendor/sale station price without taxes). Source: EMRA[14]

RGP (including taxes): Gross retail price of unleaded 95 octane gasoline price, in USD per liter (vendor/sale station price with taxes). Source: EMRA[15]

Figure 1 shows the time plot of the three variables of interest. As expected, these variables are non-stationary,[16] and they tend to move closely.

Figure 1. Time Plot of COP, RGP Including Taxes, RGP Excluding Taxes



4. Model and Empirical Results

4.1. Model and Methodology

The standard Engle and Granger (EG) approach is used due to the non-stationarity in the data (see Bacon and Kojima, 2010; and Bachmeier and Griffin, 2002). Initially, the long run equilibrium relationship between the retail price of gasoline (RGP) and crude oil (COP) is estimated by the following equation:

$$RGP_t = \beta_0 + \beta_1 COP_t + u_t, \quad (1)$$

where RGP and COP are as defined in Section 3, and u is the error term.

Since Equation (1) relates the output price (RGP) to the input price (COP), β_1 is expected to be 1 to show that input costs are passed fully to the final (retail) prices (Bacon and

Kojima, 2010; and Bachmeier and Griffin, 2002). However, as will be explained in more detail in the next sub-section, β_1 can exceed unity when sales taxes such as VAT and SCT levied. For this reason, we find it important to provide and compare empirical results by using retail (output) prices with and without the taxes.

In order to provide a *benchmark,* consider the following *symmetric* ECM specification.[17]

$$\Delta RGP_t = \sum_{i=1}^{k1} \delta_{hi} \Delta RGP_{t-i} + \sum_{i=0}^{k2} \delta_{ni} \Delta COP_{t-i} + \phi(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1}) + \varepsilon_t \quad (2)$$

where Δ is the difference operator, ε is the error term and all variables are as defined earlier.

Equation (2) gives us the basic error correction model without any asymmetry. Here δ_{hi} measures the short-run impact of the lagged (*t-i*) prices of gasoline and δ_{ni} measures the short-run impact of crude oil prices (at *t-i*) on the price of gasoline. ϕ is the long-run equilibrium adjustment parameter and the disequilibrium term $RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1}$ (or u_{t-1}) is derived (and estimated) from the long run relation between retail price of gasoline and crude oil (see Equation 1). The parameter ϕ is also interpreted as the adjustment speed to correcting short-run disequilibrium.

In the case of asymmetric pricing, the adjustment process could be different for increases than for decreases in input prices. Following Granger and Lee (1989), in order to allow for asymmetries, the first differences on the variables are decomposed into their positive and negative components at each time (t). Considering all these, ECM for the asymmetric case can be specified as follows:

$$\Delta RGP_t = \sum_{i=1}^{k1} \delta_{hi}^{+} \Delta RGP_{t-i} + \sum_{i=0}^{k2} \delta_{ni}^{+} \Delta COP_{t-i} + \varphi^{+}(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1})$$

$$+ \sum_{i=1}^{k1} \delta_{hi}^{-} \Delta RGP_{t-i} + \sum_{i=0}^{k2} \delta_{ni}^{-} \Delta COP_{t-i} + \varphi^{-}\left(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1}\right) + \varepsilon_t \quad (3)$$

where the superscript + (–) for the coefficient of ΔRGP implies that this variable takes the actual value if positive (negative) or equals to zero, otherwise. δ_{ni}^{+} and φ^{+} (δ_{ni}^{-} and φ^{-}) apply when crude oil prices increase (decrease).

As mentioned above, in order to capture the asymmetries in the short run, $\delta_{hi}^{+}\Delta RGP_{t-i}$ and $\delta_{hi}^{-}\Delta RGP_{t-i}$ (the lagged gasoline price increases and decreases, respectively) $\delta_{ni}^{+}\Delta COP_{t-i}$ and $\delta_{ni}^{-}\Delta COP_{t-i}$ (the lagged crude oil price increases and decreases, respectively) are used. The asymmetry in the adjustment speed is also checked by defining disequilibrium terms using $\varphi^{-}\left(RGP_{t-1}-\beta_0-\beta_1 COP_{t-1}\right)$ and $\varphi^{+}\left(RGP_{t-1}-\beta_0-\beta_1 COP_{t-1}\right)$. We can check for the presence of asymmetry by performing a standard Wald test both on the speed and magnitude of the adjustment with following null hypothesis: H_o: $\delta_{hi}^{+}=\delta_{hi}^{-}$, $\delta_{ni}^{+}=\delta_{ni}^{-}$ and $\varphi^{+}=\varphi^{-}$ *for all* i.

4.2 Empirical Results

As in most empirical studies, we examine the asymmetry by considering only the results of the specified error-correction model. We, therefore, initially estimate the asymmetric error correction model as specified in Equation (3). Table 6 provides the empirical results on the asymmetric ECM for both gasoline prices with and without taxes.[18,19] The results from Table 6 suggest that the estimates on asymmetry parameters, especially those on adjustment speed, are quite similar. Furthermore, Wald test results do not provide empirical evidence on asymmetric pricing for both cases.[20]

Table 6. Asymmetric ECM: With and Without Taxes

Dependent Variable →	**ΔRGP *(including taxes)***		**ΔRGP *(excluding taxes)***	
Independent Variable	***Coeff.***	***Std. Error[a]***	***Coeff.***	***Std. Error[a]***
ΔCOP^{-}	0.0037	0.0825	-0.0168	0.0394
ΔCOP^{-}_{t-1}	0.4111	0.1000	0.1645	0.0482
ΔRGP^{-}_{t-1}	0.0184	0.0540	0.0193	0.0292
ΔCOP^{+}	0.0338	0.0695	-0.0133	0.0418
ΔCOP^{+}_{t-1}	0.2118	0.0706	0.0589	0.0322
ΔRGP^{+}_{t-1}	0.0281	0.0265	0.0937	0.0253
$(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1})^{-}$	-0.0183	0.0058	-0.0369	0.0090
$(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1})^{+}$	-0.0156	0.0050	-0.0241	0.0055

[a] Newey-West HAC consistent standard errors.

This implies that there is no evidence of rockets and feathers pricing in Turkey, a finding that contrasts with the results found by Alper and Torul (2007). However, these results are in line with those of Bachmeier and Griffin's (2003) study, which argued that aggregated (e.g. monthly) data and the choice of different specification and estimation methods can create fragile results (asymmetry).

Considering these results, symmetric ECM specification in Equation (2) seems to be the right specification. For a complete picture, Table 7 provides the OLS estimates of Equation (2) for both cases.

Table 7. Symmetric ECM: With and Without Taxes

Dependent Variable ->	**ΔRGP *(including taxes)***		**ΔRGP *(excluding taxes)***	
Independent Variable	***Coeff.***	***Std. Error[a]***	***Coeff.***	***Std. Error[a]***
ΔCOP	0.0253	0.0503	-0.0103	0.0258
ΔCOP_{t-1}	0.3107	0.0596	0.1116	0.0278
ΔCOP_{t-2}	0.1756	0.0628		
ΔRGP_{t-1}	0.0127	0.0228	0.0547	0.0191
ΔRGP_{t-2}	0.0097	0.0192		
$(RGP_{t-1} - \beta_0 - \beta_1 COP_{t-1})$	-0.0120	0.0028	-0.0252	0.0039

[a] Newey-West HAC consistent standard errors.

The standard ECM analysis typically ends here. However, as we will explain below, this would lead to a serious loss of information if the long-run relations are not considered.

Now, we analyze the long-run relations and, for this purpose, Table 8 provides the OLS estimates of the cointegration relations as shown in Equation (1) for gasoline prices with and without the taxes.

Table 8. Long Run Relations

RGP (excluding taxes)[a]			RGP (including taxes)[a]		
Variable	***Coeff.***	***Std. Error***	***Variable***	***Coeff.***	***Std. Error***
Constant	0.2788	0.0041	**Constant**	1.4425	0.0097
COP	1.1006	0.0078	**COP**	1.6803	0.0183

[a] Dependent variable.

As noted in Section 4.1, the retail price of gasoline (RGP excluding taxes) is expected to fully adjust to the changes in crude oil prices (COP), and accordingly, estimated parameter of COP (β_1) is expected to be 1. The actual value of this parameter is 1.1 (close to 1), and therefore, it is in line with the theoretical expectation. However, the estimated response of gasoline prices (including taxes) to crude oil price changes is much higher (1.68), and it exceeds unity. This means that *one dollar increase in the price of crude oil reflects on the retail price as an increase of 1.68 dollars, 68 cents of which go to the tax authority*. Ironically, Turkish government succeeded at implicitly imposing an *exceptionally high* tax rate of 68% $[(1.68 - 1)*100]$[21] on gasoline over the longer term *by adjusting the SCT* amounts on gasoline as explained in Section 2. This, in turn, implies that SCT is the main policy instrument in the price setting process of gasoline. It should be recalled that VAT is an ad valorem tax and its rate is fixed at 18% in Turkey but SCT is levied on "per unit" basis and it is not salient to final users. In line with this observation, the SCT amounts have been altered five times since the beginning of 2005, which confirms that the ruling governments have preferred to adjust SCT over the long run.

In sum, the above results provide explanation to the persistence of high gasoline prices in Turkey, which is arising from the reliance of Turkish government on indirect taxes as an instrument of public finance. Therefore, Turkish governments benefited from crude oil price increases in the long-run by adjusting the SCT amounts in such a way that the tax burden on

gasoline is *implicitly* fixed at around 70%. It is also important to note, in passing, that this result is consistent with the recent empirical evidence that individuals underreact to taxes when they are not salient and this limited attention to taxes may have serious welfare consequences (Chetty et al., 2009).

5. Conclusion

This study investigated the role of taxation in gasoline prices in Turkey by using daily data between January 2005 and July 2012. Our results from the standard error correction model do not provide empirical evidence on *rockets and feathers pricing* argument. No evidence on the asymmetry of gross gasoline prices implies that the government does not benefit from short-term price adjustments by means of taxation. However, one can miss the big picture in gasoline pricing by concentrating only on the price adjustment dynamics, e.g. via error correction models, which is a commonly used method in this literature. Departing from the scope of existing studies, we also analyzed the long-run relationships between crude oil prices and gasoline prices with and without taxes. This is important because Turkish Tax Authority seems to have a preference on the type of taxes (to be used as a policy instrument) with the aim of maximizing the tax revenue from oil products including gasoline. As a result of this preference, the nature of the taxation of gasoline is complicated and its effects on the retail prices are not trivial. Therefore, the long-run analysis of price dynamics with and without the effect of taxation is a valuable empirical exercise.

Our results indicate that one dollar increase in the price of crude oil leads to an increase of 1.68 dollars on the gross retail price of gasoline over the long-run. This, in turn, implies that 68 cents (or 68 %) goes to the tax authority. Nevertheless, it is important to stress that 68 cents comprises of the tax revenues arising from the imposition of SCT and VAT, including the VAT on

SCT amounts. For an uninitiated reader, this composition of taxes on gasoline could be puzzling. However, the explanation is simple: only VAT amount is visible to the final users but the amounts of SCT and VAT part of SCT (although included in VAT) are masked within the retail price of gasoline.

To sum up, Turkish government implicitly imposed an exceptionally high tax rate (about 70%) on gasoline over the long-run, by frequently adjusting the excise tax amounts which are not salient to final consumers. The main motivation behind this behavior is the over-dependence of Turkey on the indirect taxes as a means of public finance and this has several unfavorable effects, including welfare effects, on the society and the economy.

Our findings suggest that comparing empirical results by using gasoline prices with and without taxes would be a more appropriate approach in the analysis of gasoline pricing. Furthermore, *analyzing* long-run (cointegration) relations, with and without the taxes, promises to reveal valuable information, as in the Turkish case investigated in this study.

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References

Al Gudhea, S., Kenc, T., Dibooglu, S., 2007. Do retail gasoline prices rise more readily than they fall? A threshold cointegration approach. Journal of Economics and Business, 59, 560-574.

Alper, C.E., Torul, O., 2009. Asymmetric adjustment of retail gasoline prices in Turkey to world crude oil price changes: the role of taxes. Economics Bulletin, 29(2),789-802.

Bacon, R. W., 1991. Rockets and Feathers: The Asymmetric Speed of Adjustment of U.K. Retail Gasoline Prices to Cost Changes. Energy Economics, 13, 211-218.

Bacon R.W., Kojima M., 2010. Rockets and Feathers: Asymmetric Petroleum Product Pricing in developing Countries. Extractive Industries for Development Series #18, June 2010, The World Bank.

Bachmeier, L.J., Griffin, J.M., 2003. New evidence on asymmetric gasoline price responses. The Review of Economics and Statistics, 85(3), 772-776

Borenstein, S., Cameron, A.C., Gilbert, R., 1997. Do gasoline prices respond asymmetrically to crude oil prices? Quarterly Journal of Economics, 112(Feb), 305-39.

Chetty, R., Looney, A., Kroft, K., 2009. Salience and taxation: theory and evidence. American Economic Review, 99(4), 1145-1177.

Energy Market Regulatory Authority (EMRA), 2012. Petroleum Market Sector Report 2011. Petroleum Market Department, Ankara.

Geweke, J., 1978. Temporal aggregation in the multiple regression model. Econometrica 46(3), 643-61.

Granger, C.W.J., Lee, T.H., 1989. Investigation of production, sales and inventory relationships using multicointegration and non-symmetric error correction models. Journal of Applied Econometrics 4, 145–159.

Grasso, M., Manera, M., 2007. Asymmetric error correction models for the oil-gasoline price relationship. Energy Policy, 35, 156-177.

Meyer, J., Cramon-Taubadel, S.v, 2004. Asymmetric price transmission: a survey. Journal of Agricultural Economics, 55(3), 581-611.

Notes

[1]See Bacon and Kojima (2010) for more detail on these eight studies.

[2]A more recent study by Al-Gudhea et al. (2007) investigated crude, spot, wholesale and retail gasoline adjustments in the US. They have used daily data for the period from December 1998 to January 2004 and tested for asymmetries by using a set of cointegration and error correction models with non-linear adjustment. They have found that prices were cointegrated and long run equilibrium adjustments were asymmetric.

[3]As of the end of January 2013, Turkey has the highest retail gasoline prices in the world. In August 2012, Turkey was the second in the world –closely behind Norway whose real average income is more than three times that of Turkey. (*http://www.bloomberg.com/slideshow/2012-08-13/highest-cheapest-gas-prices-by-country.html#slide1*)

[4]Specifically, they stated that the span of time period in their study is 17 years and it cannot justify long-term relation properly (Alper and Torul, 2009: footnote 10). Even though this concern seems to be right, when one considers the other studies in the literature (i.e. those cited in Grasso and Manera, 2007), including monthly data, the span of time period is less than 20 years and usually not more than ten years in the case of weekly and daily data. Therefore, from this point of view, Alper and Torul's justification is not valid.

[5]During the 1998-2004 period, *Automatic Pricing Mechanism* was used. This system determines the ceiling prices for oil products based on CIF Mediterranean Market spot prices.

[6]Unless stated otherwise, *gasoline* refers to *the unleaded 95 Octane gasoline* throughout this study.

[7]The retail price is calculated by adding the refinery price, the distributors' profit, retailers' (sale stations) share, the special consumption tax and the value added tax.

[8]During 2009-2011 period, the distributors and the vendors' total share is about 9.5%, the refinery price is around 27.5% and the remaining lion's share of 63% belongs to the taxes.

[9]However, SCT is imposed even on basic consumption goods in Turkey.

[10]It is a general consumption tax that covers all goods and services and applied to all stages from producer and consumer and calculated from the transaction value.

[11]For the missing data concerning the weekends and the national holidays, the latest figure (i.e. before the weekend/holiday) is used, considering the fact that gasoline is also used during holidays.

[12]Considering the purpose of the study and the role of taxation in oil products, we have used two different data sets. The first set consists of gasoline retail prices (excluding taxes) and the second one includes taxes (gross retail prices). We also converted the TRY-denominated prices to US Dollar in order to eliminate the role of exchange rate changes on pricing (see Alper and Torul, 2009). The exchange rate data, for the conversion, is taken from Turkish Central Bank.

[13]For the sake of consistency and comparison, we have converted the unit of the original series from barrel to liter.

[14]The daily prices are the average prices of eight distribution companies with the highest market share in İstanbul (the European Side) and are obtained from EMRA's annual reports.

[15]See the previous footnote.

[16]These variables have unit roots. Formal (ADF) tests are available upon request from the authors.

[17]Of course, ECM is formed after checking and estimating the long-run (cointegration) relationship and this should be done after (formally) confirming that both variables, RGP and COP, are integrated of the same order, e.g. they have unit roots.

[18]Engle-Granger cointegration tests confirm the existence of a cointegration relation. Test results are available upon request from the authors.

[19]The Schwarz criterion is used to determine the lag length.

[20]P-values are 0.33 and 0.10 in with and without tax cases, respectively. These results are based on the Wald tests as explained in Section 4.1.

[21]In this case, β_1 is expected to be *1+effective tax rate* over the long-run. In fact, 68% is very close to the arithmetic average of effective tax rate on gasoline, 66.4% , from 2005 to 2011 (Table 3).