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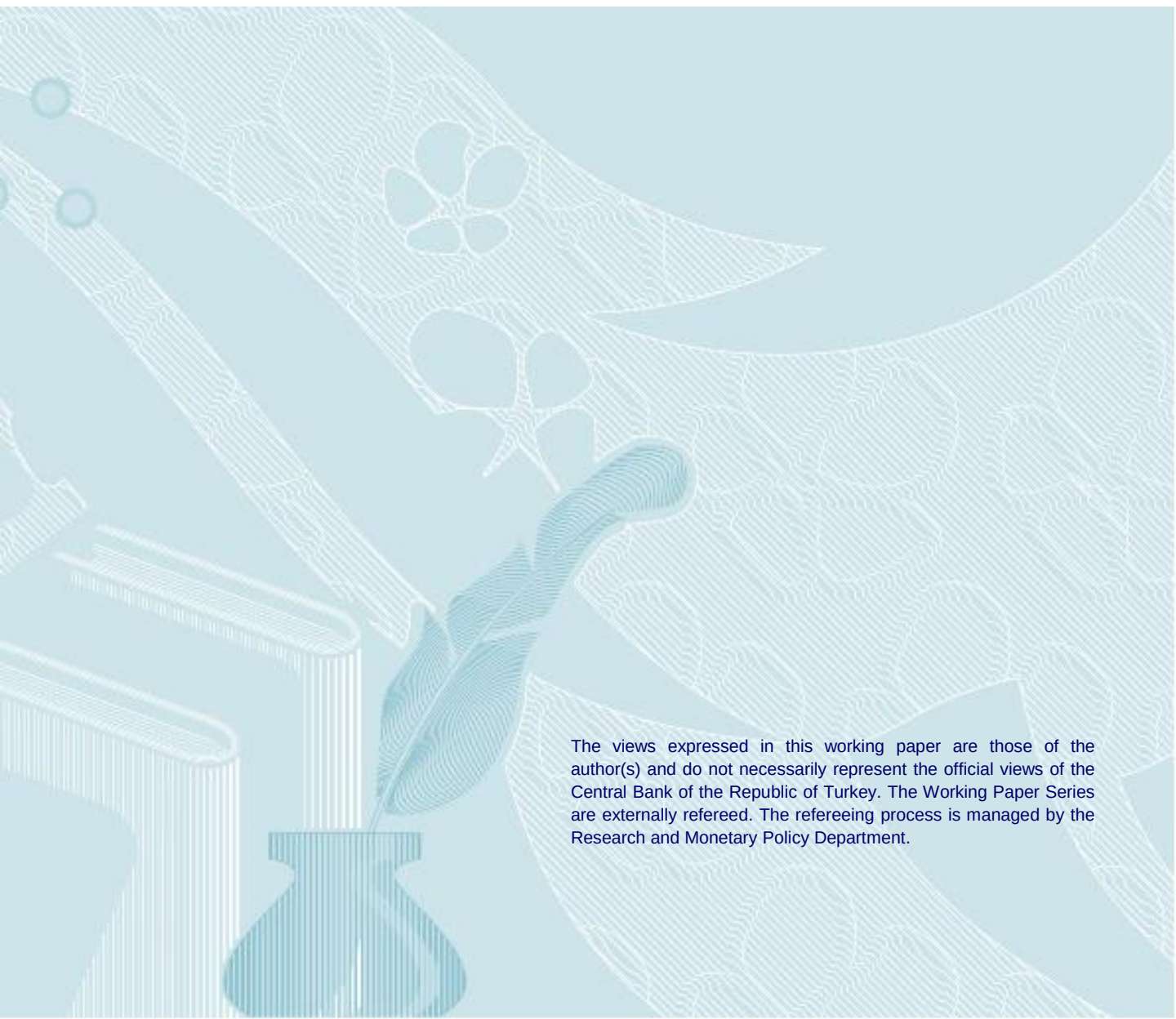

Firm Strategy, Consumer Behavior and Taxation in Turkish Tobacco Market

Oğuz ATUK[*] and M. Utku ÖZMEN[*1]

Abstract

Tobacco taxation policy is not only a tool for discouraging smokers but also an important source of budgetary income. Given that many entities are interested in tobacco policy ranging from the fiscal authority to health authority, from firms to economic policy authority the design of the appropriate tax scheme is of utmost importance. The current tobacco taxation scheme in Turkey is very complex and contains incentives both for firms and consumers to deviate from a certain equilibrium. Therefore, appropriate tax policy should take into account firm pricing strategy, consumer behavior, health and industry related issues as well as fiscal concerns. With this perspective, using the current framework in Turkey, this paper proposes a strategy for appropriate tobacco taxation through a simulation analysis. The strategy can be formulized as the tax combination yielding minimum average price change, for a given tax revenue and the desired sectoral composition. Such a tax scheme will not only reduce price volatility but will also improve welfare of the entire society through lowering inflation given the high share of tobacco products in consumption basket.

Keywords: *tobacco products, taxation, firm strategy, consumer behaviour, Turkey.*
JEL Classification: *E22, H21, H31, H32*

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1. Introduction

Tobacco consumption is a global source of serious public health issues. Public policy makers constantly seek ways to discourage individuals from consuming tobacco products. Strict regulation of sales and advertising activity, promotion of public awareness campaigns and provision of incentives for quitters are among the actively used non-price methods by policy makers. On the other hand, no policy seems more effective than taxation as rational consumers are responsive to monetary incentives. This responsiveness, however, also changes with the income level of the country. Studies focusing on developed countries reveal that the effectiveness of taxation on smoking prevalence may be limited (Dunlop et al. (2011) for Australia, Bogdanovica et al. (2012) for European Union countries and Martire et al. (2011) for the US). In a similar fashion, Verdonk-Kleinjan et al. (2011) show that the tax increases per se are not very effective, but they work better when combined with non-price policies in Netherlands. The price-prevalence correlation is much more pronounced for developing countries. Kostova et al. (2014) document that higher price is associated with lower cigarette demand in low and middle income countries.

Main reason that reduces the effectiveness of tax policy is the availability of price minimization strategies. Ross et al. (2011) show that consumers would react more aggressively when faced with price hikes if cheaper cigarette options were not available. Dunlop et al. (2011) point out that product switching in case of price hikes is another price minimization strategy pursued by consumers. Such motivations may also be fueled by pricing strategies of the tobacco industry. Gilmore et al. (2013) put forward firm behavior as a factor undermining the effectiveness of tax policy, given that the firms provide incentives for consumers to switch between price segments rather than to reduce the amount consumed. Another reason for subdued efficiency of tax policy is the emergence of illicit trading of tobacco products. Such an activity not only undermines tax policy but also brings about health related concerns. Joossens et al. (2010) show that the effects of illicit trade on public health and revenue reduction are more detrimental for low and middle income countries.

Since an aggressive tax policy is widely used across countries in order to provide disincentives for smokers, determining the tax structure for tobacco products is an

important public policy issue. Chaloupka et al. (2014) suggest that simpler tax structures exhibit less price variability, providing an interim objective of tax policy. Gilmore et al. (2013) emphasize the need for considering the pricing strategies of the tobacco industry and tracking prices by segments while setting tobacco tax scheme. In a recent study, Van Walbeek et al. (2013) analyze the price, tax and trade measures in the framework of tobacco control and highlight several further research agenda. Among those, assessment of the effectiveness of the tax structure and improvement of the understanding of the political economy of tobacco tax policy stand out. Building on this, our study contributes to the literature by focusing on the political economy of taxation through analyzing the incentives of various parties related to tobacco and by generating a framework for policy that would increase the effectiveness of the tobacco taxation considering firm strategy and consumer behavior.

To analyze tobacco taxation policy we study the market and tax structure in Turkey, where the prevalence of smoking is considerably high. Historically, several measures have been taken to reduce that figure. In recent years, such efforts have become more aggressive as considerable tax hikes are accompanied by other measures taken including the ban on indoor smoking. Although aggressive taxation of tobacco products is in parallel with the rest of the world, what makes Turkey special is the considerable reliance of public finance on tax revenue from tobacco products. Thus, implementation of tobacco taxation is even more crucial for Turkey. Another aspect of the discussion is the presence of tobacco production industry. Hence, many parties are concerned with tobacco regarding its production, consumption and taxation. Therefore, the determination of appropriate tax rate is a task that will not be accomplished without extensive cooperation between related parties.

Tobacco taxation scheme is quiet complex in Turkey as there are two interconnected indirect taxes levied on tobacco products: Value Added Tax (VAT) and Special Consumption Tax (SCT). The SCT has also two components: *ad valorem* and specific. What makes it even more complex is that the tax base is defined as the final consumption price, which is a rather unconventional practice. Current tax system provides different incentives to firms to change prices depending on the choice of the ruling tax combination which is a mixture of *ad valorem* and specific rates. As much as producers, consumers also respond to price incentives. Generally, when prices change

due to tax adjustments, consumers tend to switch between different price segments of cigarettes. Hence, change in prices of firms introduces price volatility and the corresponding change in consumption patterns induces tax revenue volatility.

Overall, Turkey provides a good environment to discuss tax policy. Considering tax complexity, firm behavior, and consumer choice, and keeping in mind the tax revenue, an appropriate tax scheme can be designed. We first observe that consumers switch between segments in response to price changes induced by taxes. Building on this observation, we design a simulation analysis where we simulate different segment shares depending on alternative *ad valorem* and specific tax combinations. Following that, considering the fixed-weight nature of the yearly Consumer Price Index (CPI), we formulate a strategy that would yield lowest possible price inflation for a given pre-specified average tax revenue and a market segmentation.

We conduct the simulation analysis by using a large data set of monthly sales price and quantity of entire brands of cigarettes spanning from 2005 to 2013. Results are in line with the predictions of our theoretic framework, where minimum inflation generating tax combination, given tax revenue and market segmentation, is also the balanced mixture of *ad valorem* and specific rates. The results of the analysis provide important implications for policy makers. First, a considerable level of cooperation and coordination is essential between parties interested in tobacco when setting the tax rates. Second, balanced SCT combinations are more efficient as they warrant flexibility of the finance authority. Third, a balanced SCT combination also generates a more transparent and predictable path for future tax rates. Fourth, proposed tax combination also entail welfare gains as it points to lowest price inflation possible. Finally, our results may also shed light on policies that would help reduce smoking prevalence.

The rest of the study is organized as follows: In Section 2 a brief overview of tobacco consumption and production patterns along with taxation policy in Turkey is presented. In section 3 and 4, firm strategy and consumer behavior are discussed respectively. A proposed definition of appropriate tobacco taxation is introduced in section 5. Design and results of the simulation based empirical analysis is given in section 6. Finally, section 7 discusses policy implications and concludes the study.

2. Consumers, Producers and Governmental Control of Tobacco in Turkey

Before the 1990s, Turkey accounted for 4 percent of the world's tobacco production. Until the 1980s the market was controlled (from tobacco farming to pricing and sale of tobacco products) by the state-owned monopoly (TEKEL). Along with the privatization of the market and the entrance of the multinational companies, the tobacco production began to fall. In 2006, Turkey's share in the world's tobacco production fell to 1.7 percent. The number of tobacco farming families in 2000 dropped significantly through 2006, from 583,000 to 207,000 due to relative low levels of profitability with the reduced government support (Yürekli et al., 2010). Similarly, following the privatization of TEKEL, the total number of workers in the tobacco manufacturing dropped by nearly 50% from 2000 to 2008.

With the entrance of the multinational firms in the market, an era of intense advertisement and promotion increased the cigarette consumption significantly (Bilir et al., 2009) that necessitated control measures to be taken. In 1996, with the introduction of the Tobacco Control Law, prohibiting sales of tobacco products to youngsters less than 18 years of age and banning partial indoor smoking and advertisements had shown its effect and the increase in the consumption of cigarettes had eased. According to the Global Adults Tobacco Survey (GATS)[2], the smoking prevalence rate in Turkey in 2008 was 31.2 percent among adults, corresponding to nearly 16 million in population. From 2009, Turkey started implementing more comprehensive smoke-free policies including prohibiting of all indoor smoking, public education and pictorial warning labels in packs. With the help of these control policies the prevalence rate dropped to 27.1 percent (14.8 million) in 2012[3].

This high prevalence rate results in a serious health burden in Turkey. A significant increase in the diagnosis of tobacco related diseases is observed in the last decades. For example, according to calculations of Ministry of Health and TurkStat, from 1998 to 2008 the percentage of deaths caused by lung cancer to all deaths among men increased from 6.04 to 8.18 percent. The economic burden of tobacco use is also striking. According to GATS 2008, the 16 million adult smokers in Turkey spent an

[2] GATS is a nationally representative household survey on people of age 15 and over, implemented by the Turkish Statistical Institute (TurkStat) under the coordination of the Ministry of Health.

[3] The prohibition of indoor smoking had immediate positive health effects as shown by Caman et al. (2013).

average of 58 US dollars a month on cigarettes. The total annual amount spent was thus approximately 11 billion US dollars. Moreover, according to the Social Security Institution (SSI), 9% of all healthcare expenditures between April 2010 and March 2011 was spent on tobacco-related illnesses. On the other hand, besides all these economic and healthcare costs, the increased consumption of tobacco products is an important source of tax revenue in Turkey. The tax amount from tobacco products accounted for 8% of total taxes collected in 2014.

All in all, despite the control polices which proved to be effective, consumption of tobacco products is still at very high levels in Turkey. The high share of taxes from tobacco products on the other hand, necessitates building of an effective tax system which takes into account a unique multi-dimensional approach for Turkey.

2.1. Current tobacco tax scheme in Turkey

The main funding resource for governments is tax revenues. To this end, two types of taxes are collected. First type is made up of direct taxes like income tax collected on a certain ratio of income, whereas the second is indirect taxes levied on purchases of goods and services irrespective of the consumer's income. The most common example to indirect taxes is the Value Added Tax (VAT). In addition to VAT, Special Consumption Tax (SCT) is also collected in Turkey on some products including automobiles and technological products like mobile phones as well as other products such as alcoholic drinks, tobacco products and fuel oil.

For the majority of the products under this scope, the base to apply for the calculation of the SCT is defined as the tax base excluding the amount of special consumption tax in Article 11 of the Law on Special Consumption Tax No.4760. In other words, the final consumer price is obtained by first adding SCT to the price set by the producer and then applying the VAT. However, for tobacco products, this rule is different such that the SCT base for tobacco products stated in the above law is not the producer's price, but the product's retail price for final consumers. The calculation of *ad valorem* SCT from final consumer price introduces a complex and a nonlinear (in SCT and VAT rates) taxation scheme which entails the collection of VAT on the calculated SCT, as well as the collection of SCT on the calculated VAT, since VAT is already included in the final consumer's price. A further alteration of the SCT Law was

mandated in 2012 introducing a specific SCT amount as well, in addition to the *ad valorem* rate.[4]

Hence, under current practice, there are two types of SCT applied on tobacco products in Turkey. First one is the *ad valorem* rate, where the SCT amount is calculated as a proportion of the final consumer price on condition that it is not less than a certain (minimum specific) amount. The second type is the specific SCT amount which is same for all the products regardless of the retail sales price. Finally, the total SCT paid per pack is the sum of *ad valorem* and specific amounts. Using the information mandated in the law, it is possible to follow the price formation in tobacco products. However, introducing both types of SCT one by one will be helpful for illustration. First, let's assume that there is only specific SCT. Then we can summarize the price formation as follows:[5]

Final Consumer Price (FCP):	Y
Producer's Price:	X
SCT Amount:	M
VAT Amount:	$(X + M) * vat$
$FCP = \ Producer\ price + SCT\ amount + VAT\ amount$	
$Y = X + M + (X + M) * vat = (X + M) * (1 + vat)$	

Here, *vat* stands for VAT rate (%) and *M* stands for specific SCT amount. As can be seen in this case, the final consumer price is a linear function of the producer's price, specific SCT amount and VAT rate. For instance, a 1 TL increase in specific SCT (*M*) will increase the final consumer price by (1+*vat*) regardless of the level of other determinants. Second, let's assume that there is only *ad valorem* SCT. Then:

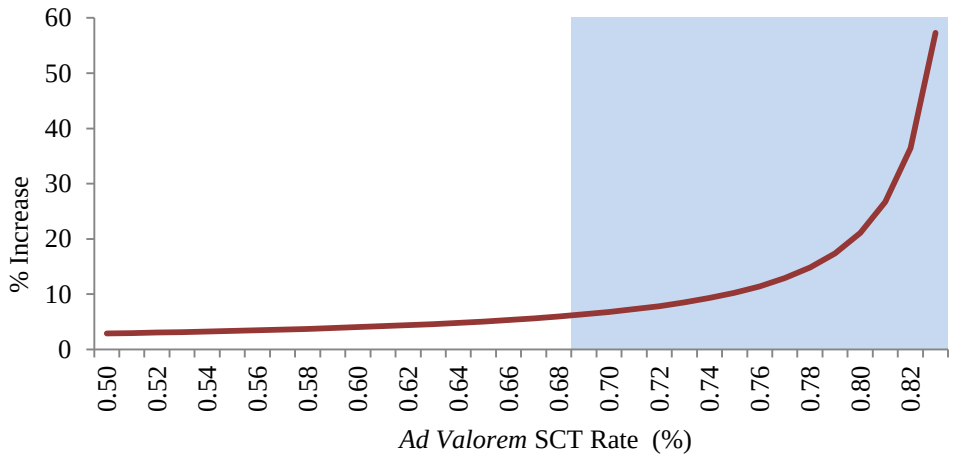
Final Consumer Price (FCP):	Y
Producer's Price:	X
SCT Amount:	$Y * sct$
VAT Amount:	$(X + Y * sct) * vat$
$FCP = \ Producer\ price + SCT\ amount + VAT\ amount$	
$Y = X + (Y * sct) + (X + Y * sct) * vat = \frac{(1 + vat) * (X)}{1 - (1 + vat) * sct}$	

[4] The SCT Law was amended by as per the Law No.6322 Amending the Procedure Law on the Collection of Public Claims and Some Other Laws passed on 05.31.2012. Paragraph 5 of the Article 11 of the SCT Law was amended as "besides the specific tax to be applied on the goods listed in the section B (Tobacco products), *ad valorem* tax shall apply, no less than the minimum specific tax amount".

[5] The calculation methodology and its implications are discussed in Atuk et al. (2011) and CBRT (2013).

where *sct* denotes the *ad valorem* SCT rate. The final consumer price can be written as a function of *ad valorem* SCT rate, VAT rate and the producer price. As can be seen, there is a non-linear relationship between the final consumer price and the *ad valorem* rate. This relationship can be shown clearly by holding the producer price and the *vat* rate constant (Figure 1). For example, under the above assumptions, raising the *ad valorem* rate from 50% to 51%, from 69% to 70% and from 79% to 80% yield increases of 3%, 7% and 21% in the final consumer price respectively. Therefore, the higher the level of *sct*, the higher the price response will be.[6]

Figure 1: Sensitivity of Final Consumer Prices of Tobacco Products to a 1 Percentage Point Increase in *Ad valorem* SCT Rates*



Notes: Authors' calculation.

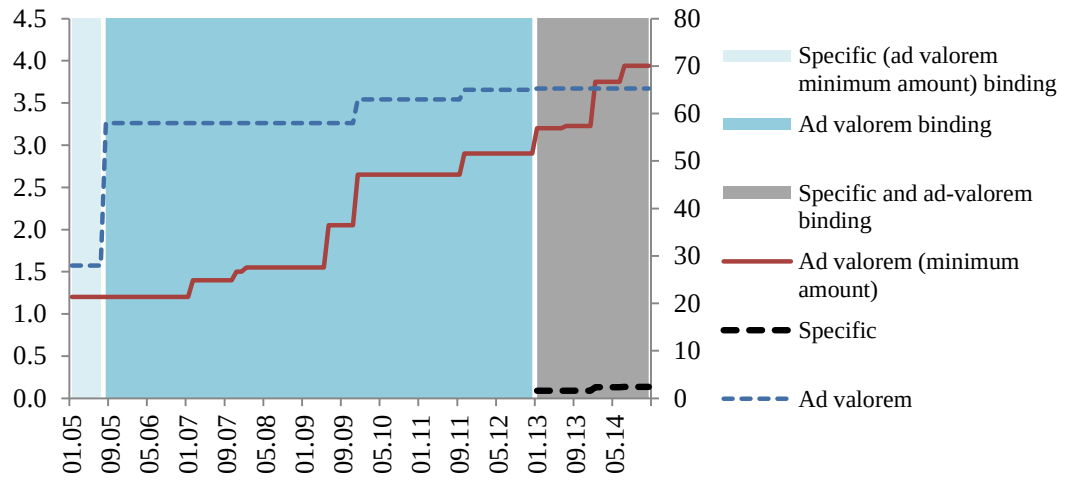
Now let's consider the more relevant case where both *ad valorem* and specific SCT are binding. So we will reconcile previous equations and consider the distributor share as well in order to arrive at current price formation. As seen from Eq.1, the effect of changes in specific SCT (*M*), is linearly correlated with final consumer price. On the other hand, changes in *ad valorem* SCT (*sct*) non-linearly affect the final consumer price, where the impact also depends on the level of the *sct*.

[6] Evidently, in late 2011, the *sct* was increased from 63% to 69%. Such a rapid rise caused final consumer prices to jump about 40%, an unintentionally large figure. Consequently, the *sct* hike was partly withdrawn.

Final Consumer Price (FCP):	Y
Producer's Price:	X
Distributor's Share:	$Y * p$
Ad valorem SCT amount:	$Y * sct$
Specific SCT amount:	M
Total SCT amount:	$Y * sct + M$
VAT amount:	$(X + Y * p + M + Y * sct) * vat$
$FCP = Producer\ price + Distributor\ share + SCT\ amount + VAT\ amount$	
$Y = X + Y * p + (Y * sct + M) + (X + Y * p + M + Y * sct) * vat$	
$FCP = Y = \frac{(1 + vat) * (X + M)}{1 - (1 + vat) * sct - (1 + vat) * p}$	(Eq.1)

The experience of Turkey in fact includes three different episodes, where a specific amount is binding; followed by a period where *ad valorem* rate is binding; and recently a period where both specific amount and *ad valorem* rate are binding as seen in from the evolution of the tax rates (Figure 2).

Figure 2: Evolution of Special Consumption Tax in Turkey



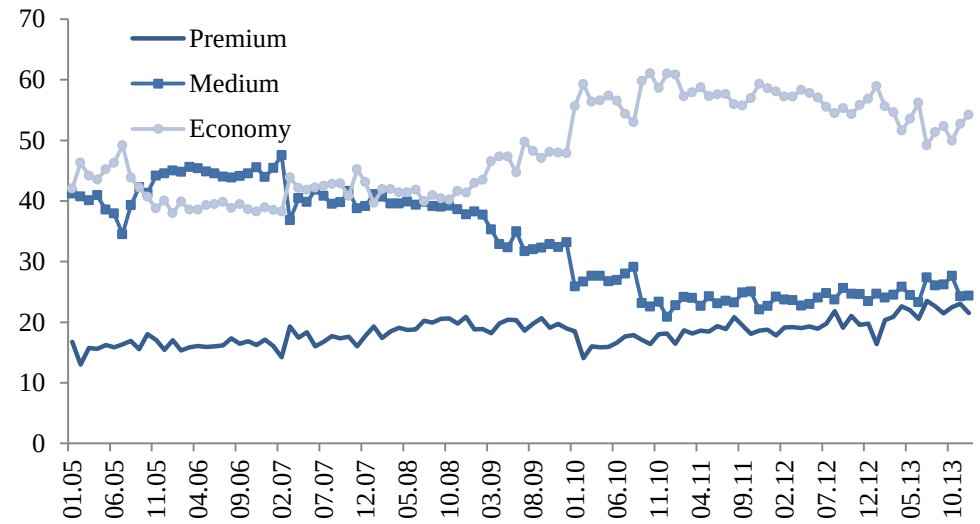
Colored areas refer to three distinct periods where different forms of SCT were binding.

2.2. Tobacco Product Segments

The tobacco products can be grouped into three main categories by their price: economy, medium and premium. The price range of the product groups are determined by the prices of all products within each category. For example, in 2012 following a

significant price increase across all categories, the lower price bound of the premium segment increased from 5.5 TL to 7 TL. Although the classifications can be determined judgmentally, in this study we use the classification provided by the Tobacco and Alcohol Market Regulation Board (TAPDK). The evolution of the sales volume of each category across years is given in Figure 3.

Figure 3: Evolution of Sales Shares of Product Segments (%)



Source: Tobacco and Alcohol Market Regulation Board.

3. Firm strategy

Tax structure is the major driver for the price formation in tobacco market. But, final consumer prices are set by the firms. Thus, it is important to understand what sort of incentives tax structure provides to the firms in the market. Here, we discuss the issue via two measures that would represent incentives for increasing and decreasing the final consumer price of tobacco products.

3.1. Incentive for price increase

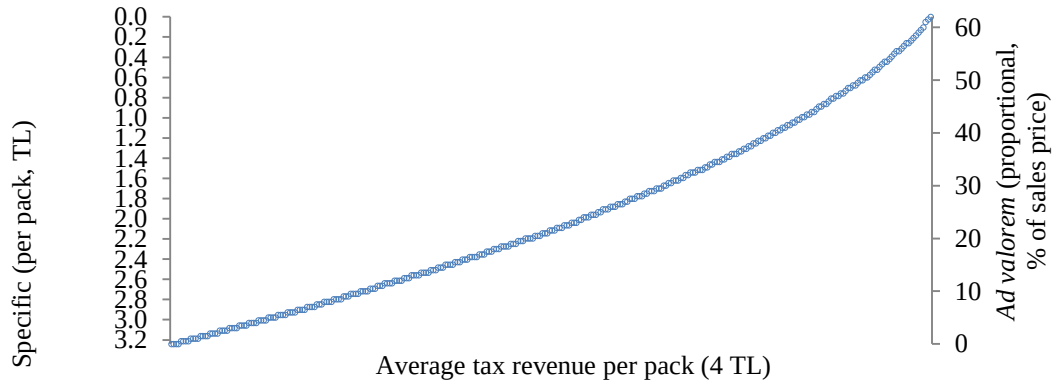
Consider a tax scheme inducing final consumer prices in a way that the price gap between different segments is low. Such an outcome is possible if the specific (per pack) component of the SCT is dominant. Then, the tax collected from each segment will be the same. Such an environment provides incentives to firms to increase the prices in the premium and middle segment. First of all, the price increase in the

premium segment will be reflected as a net increase in profits since the amount of tax paid per pack does not change. Second, since the price gap between segments is low, consumers will be willing to switch to a higher segment if the marginal utility of consuming a higher segment product is more than the price differential.

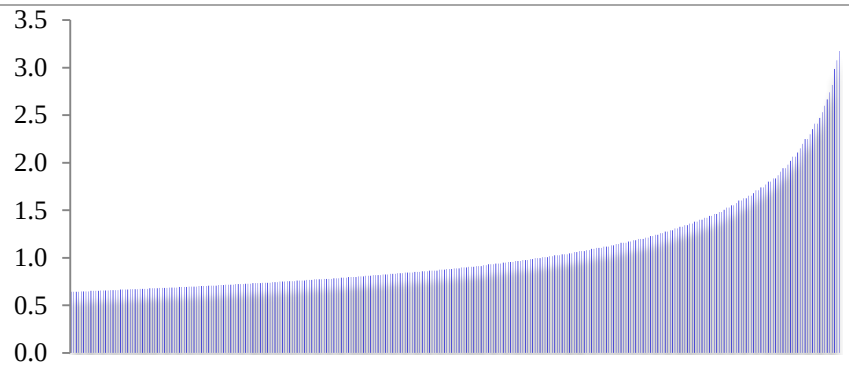
In this framework, the "price gap between premium and economy segment" will be a good measure to look at. We may track this price gap for various specific and *ad valorem* SCT combinations that would give the same average tax revenue per pack. Using Equation 1, we can determine the average producer prices for each segment. Then, using these producer prices we can calculate the final consumer prices and average tax revenue per pack by alternating the specific and *ad valorem* rates under the assumption of fixed producer prices. For illustration purpose, we consider all the combinations that would provide 4 TL of average tax revenue per pack.

Figure 4: Firm Strategy-Incentive for Price Increase *

a. Specific and *Ad valorem* SCT combinations yielding 4 TL of average tax revenue per pack



b. Price gap between Premium and Economy segment (TL) at each tax combination



*The calculations are based on Equation 1. Each dot in Panel (a) corresponds to combination of specific (left axis) and *ad valorem* (right axis) rate. Each column in Panel (b) corresponds to price gap for the tax combination above.

Figure 4 (panel a) shows all the combinations of SCT that yield 4 TL tax revenue per pack on average under current producer prices. While, Figure 4 (panel b) shows the premium-economy price gap that emerges from the corresponding tax combinations in panel (a). We may read the figure as follows: 0% *ad valorem* combined with 3.18 TL specific SCT (leftmost dot) and 62% *ad valorem* combined 0 TL specific SCT (rightmost dot) both generate the same tax revenue. However, the outcome in terms of price gaps is very different, ranging from 0.6 TL to 3.2 TL.

For the sake of our argument, then, tax combinations with higher (lower) *ad valorem* (specific) induce larger price gaps, and thus, reduce the incentives for price increases. That is, if the purpose of the tax authority is to minimize the price increase incentives, the optimal tax scheme would be the one with maximum *ad valorem* possible and minimum specific SCT.

The argument for such a prediction has also roots in the real data. One good example of a period with price increase incentives is January-July 2005.[7] In this period, the specific tax was 1.2 TL, while the *ad valorem* rate was 28%. Given that for all the products specific tax was binding, this period resembles a situation where upper segment prices are induced to increase. Table 1 presents the average prices for each segment in that period.

Table 1: Average Price per Segment (TL)

	January 2005	July 2005	Change in price (%)
Economy	1.63	1.58	-3.4
Medium	2.51	2.68	6.6
Premium	3.45	3.66	6.2

As expected from the predictions of firm strategy analysis, this period is indeed characterized by price increase incentives for medium and premium segments. Over the period, while the average price in economy segment decreased, prices in other segments increased. Thus, given that the tax rate was unchanged all the increase was absorbed by the firms as profit.

[7] The choice of this period is not arbitrary. Given that the price increase incentives were high and firms indeed increased prices, tax authority did not benefit from the price increases and consequently the *ad valorem* rate was hiked in August 2005 in response to that.

3.2. Incentive for price decrease

Consider a tax scheme where the sensitivity of final consumer price to changes in producer price is high. Such an outcome is possible if the *ad valorem* (proportional to sales price) component of the SCT is dominant. Then, as discussed with Equation 1, the sales price and the tax revenue will depend extensively on the strategy of the firms. Such an environment provides incentives to firms to decrease the prices in any segment in order to capture a higher market share. First of all, firms can reduce the sales price substantially by reducing the producer price. For instance, since the current multiplier (the coefficients affecting X in Equation 1) is about 8, a firm can bring down the sales price by 0.8 TL foregoing its revenue per pack by only 0.1 TL. Second, if the market share of the firm increases sufficiently, then, overall, firm may enjoy a higher profit regardless of declining sales price, while tax revenues are declining due to price cut.

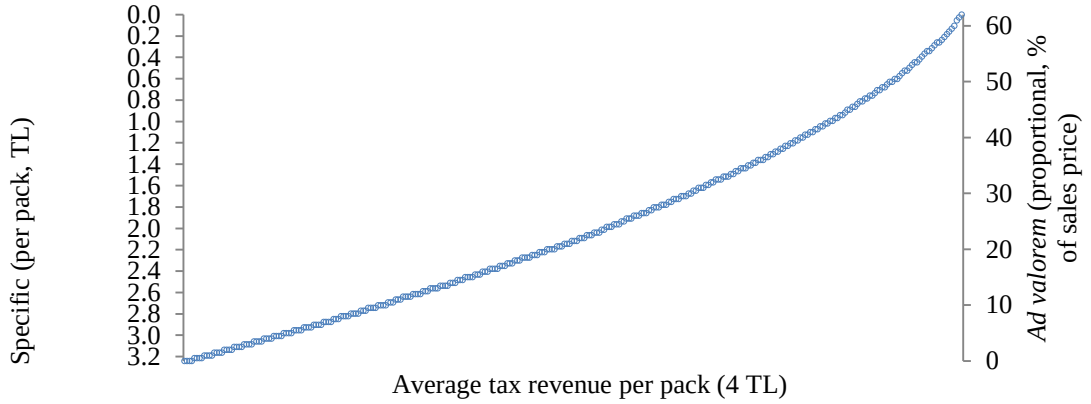
In this framework, the "elasticity of sales price to producer prices" will be a good measure to look at. We may track this elasticity for various specific and *ad valorem* SCT combinations that would give the same average tax revenue per pack. Similarly, for illustration purpose, we consider all the combinations that would provide 4 TL of average tax revenue per pack.

Figure 5 (panel a) shows all the combinations of SCT that yield 4 TL tax revenue per pack on average under current producer prices. While Figure 5 (panel b) shows the percent reduction in tax revenue (sales price) given a 10% cut in producer prices under the corresponding tax combinations in panel (a). Once again, 0% *ad valorem* combined with 3.18 TL specific SCT (leftmost dot) and 62% *ad valorem* combined 0 TL specific SCT (rightmost dot) both generate the same tax revenue. However, the outcome in terms of tax revenue loss from a 10% reduction in producer price differs, ranging from 0.5% to 10%.

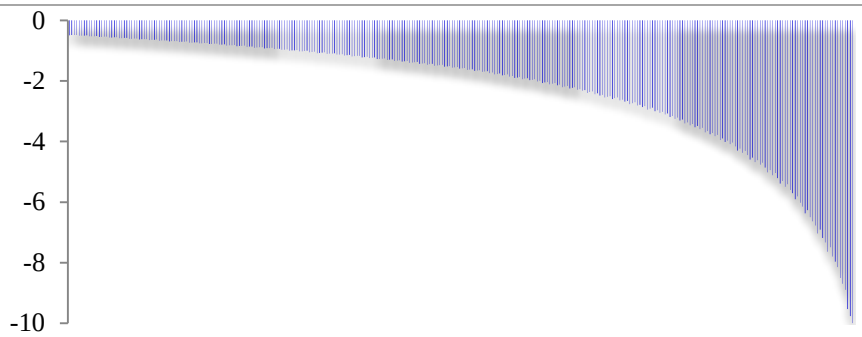
For the sake of our argument, then, tax combinations with lower (higher) *ad valorem* rate (specific) induce a smaller elasticity, and thus, reduce the incentives for price decreases. That is, if the purpose of the tax authority is to minimize the price decrease incentives, the optimal tax scheme would be the one with minimum *ad valorem* possible and maximum specific SCT.

Figure 5: Firm Strategy-Incentive for Price Cut (Producer price elasticity of tax revenue)*

a. Specific and *Ad valorem* SCT combinations yielding 4 TL of average tax revenue per pack



b. Loss in tax revenue incase producer prices fall by 10% at each tax combination



*The calculations are based on Equation 1, where changes in tax revenues are calculated under the assumption that only the producer price changes, ceteris paribus. Each dot in Panel (a) corresponds to combination of specific (left axis) and *ad valorem* (right axis) rate. Each column in Panel (b) corresponds to revenue loss for the tax combination above.

The argument for such a prediction has also roots in the real data. The recent period of January-December 2013 is a good example of a period with price decrease incentives. In this period, the specific tax was 0.09 TL per pack, while the *ad valorem* rate was 65.25%[8]. Given that for majority of the products *ad valorem* SCT tax was binding, this period resembles a situation of very high *ad valorem* and very low minimum specific SCT and thus, where prices are induced to decrease. Table 2 presents the average prices for each segment in that period.

Table 2: Average Price per Segment (TL)

	January 2013	December 2013	Change in price (%)
Economy	5.77	5.34	-7.6
Medium	7.62	7.34	-3.7
Premium	9.21	9.20	-0.1

[8] Specific rate is only binding for very low priced products, for majority, *ad valorem* SCT rate is valid.

As expected from the predictions of firm strategy analysis, this period is indeed characterized by price decrease incentives for all segments. Over the period, the average price declined. Thus, given that the tax rate was unchanged the price cuts transferred into a reduction in tax revenue.

3.3. Implications of firm strategy

As documented above, the choice of the tax scheme introduces certain price incentives to firms. Those incentives, however lead to price volatility on one hand, and tax revenue volatility on the other. Hence, the tax authority may be concerned with such fluctuations in the revenue. For this respect, the Turkish case provides evidence for both price increase and decrease episodes as the tax scheme moved between two extreme cases. Before August 2005, the dominant tax component was the specific SCT. In this case, once the firms increased their prices, the tax authority did not fully benefit from that. Considering this, the tax scheme has been moved to the other extreme where *ad valorem* part of SCT is dominant where the rate is proportional to final sale price, as in the current period. By this, tax authority guarantees that any increase in consumer prices will reflect to tax revenue as well. However, given the non-linear structure of the *ad valorem* rate, in this case, firms have an incentive to enter into price cut wars, as it may be profitable for them. This will in turn lead to a reduction in tax revenue.

Overall, price change incentives in any direction may be harmful both for price and tax revenue stability. Hence, the prediction of firm strategy analysis suggests that eliminating both incentives will be optimal in this sense. As we showed, eliminating both incentives require opposite actions. The tax combination minimizing one incentive maximizes the other incentive. Therefore, the tax authority should attach probabilities to both incentives and decide on a combination. Given the Turkish experience, we argue that both incentives are almost equally important. Therefore, based on our theoretic predictions, a good tax scheme should involve a balanced combination of *ad valorem* and specific SCT, away from corner solutions.

4. Consumer choice

Consumers respond to price incentives as being rational economic agents. The general tendency of consumers is to consume the tobacco products in the highest segment

possible. However, if the prices of tobacco products increase consumers may choose to transfer their consumption across price segments. Likewise, if a product of the upper segment sees a price cut, consumers are willing to switch to that relatively cheaper product. The change in consumer choice is shown in various studies previously. For instance, Yılmaz and Yusufoğlu (2014) conduct a survey in Turkey among university students and find that following the tax rate hike at the beginning of 2013, 39% of the participants consuming a medium price cigarette previously, switched to economic segment. Similarly, some premium segment consumers also switched to lower segments.

As seen in Figure 3, over the sample period, we see that the share of premium segment shows a relatively stable course, with a few discrete jumps. On the other hand, the transition between medium and economy segment is much more pronounced. Especially after 2009, the gap between the two segments dramatically expanded as consumers switched from medium to economy segment. A major reason for such a shift is the rapid increase in prices due to aggressive tax adjustment backed by public health and fiscal concerns. As the relative price of cigarettes rise, consumers are more tempted to switch to cheaper segments. The effects of tax adjustments on segment shifts can be traced. For instance, following the *ad valorem* SCT hike in December 2009, consumers switched from medium to economy segment. Similar movements are seen in September 2010, December 2011 and January 2013 as well, where an increase in *ad valorem* SCT induced consumers to switch down.

Regarding consumer behavior, two issues deserve further discussion. First is the price elasticity of demand for tobacco products. The main argument for increasing tobacco tax relies on the fact that demand for cigarettes is elastic. Hence, a given price increase will reduce overall consumption. In fact, this has been the case for Turkey as well, where amount of cigarettes consumed dropped in 2000s (Yürekli et al. 2010). The reduction in consumption is directly related to the extent of the elasticity. Various studies have estimated the price elasticity of demand for Turkey. Önder (2002), using the 1994 Household Expenditure Survey, estimate the price elacticity as -0.41. Önder and Yürekli (2007) replicate the micro study with 2003 Household Expenditure Survey and estimate the elasticity as -0.67. Yürekli et al. (2010) provide evidence from annual time series estimation and report a price elasticity of -0.39. At this point, we use

monthly price and quantity information for entire brands of cigarettes and estimate the price elasticity within a range of -0.55 and -0.90 for a period of 2006-2014 (Table 3).

Table 3: Price Elasticity of Demand Estimations (All cigarettes)

Dependent Variable: Ln(Q)			
	OLS	OLS with Year FE	OLS with Brand FE
Sample:	All cigarettes	All cigarettes	All cigarettes
Ln(P)	-0.546***	-0.708***	-0.896***
	(0.0402)	(0.0685)	(0.0427)
Constant	16.70***	16.84***	16.62***
	(0.0621)	(0.0861)	(0.135)
Observations	18,108	18,108	18,108
R-squared	0.010	0.013	0.356

Notes: Ln(Q) and Ln(P) denote natural logarithm of the quantity sold and price of a product, respectively. FE stands for fixed effects. Sample includes all cigarettes. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The figures estimated for all cigarettes are higher than the elasticity estimates found in the above mentioned previous studies. We may go further and analyze the elasticity based on price ranges of cigarettes. Data gives us the opportunity to disentangle the segments based on the price level.[9] The estimation results reveal that price elasticities of demand for cheaper products are much higher than the figures reported previously (Table 4, columns 1 and 2). Meanwhile, results show that the demand for cigarettes in relatively expensive price segment is inelastic, which sheds light into the relatively stable course of the market share of this segment.

Table 4: Price Elasticity of Demand Estimations (According to price interval)

Dependent Variable: Ln(Q)			
	OLS with Brand FE	OLS with Brand FE	OLS with Brand FE
Sample:	Prices Below the Median	Prices between the Median and the 75th Percentile	Prices Above the 75th Percentile
Ln(P)	-1.279***	-1.449***	0.0357
	(0.0529)	(0.113)	(0.105)
Constant	17.08***	16.40***	15.01***
	(0.141)	(0.254)	(0.194)
Observations	10,218	3,778	4,112
R-squared	0.393	0.423	0.330

Notes: Ln (Q) and Ln(P) denote natural logarithm of the quantity sold and price of a product, respectively. FE stands for fixed effects. Sample includes all cigarettes. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[9] For this analysis, the price segments are defined as follows: Prices less than the median price, prices between the median and 75th percentile and prices higher than 75th percentile at each period.

These results indicate that the response of consumers consuming cigarettes in different price segments indeed differs considerably. The outcome of these tables may point to two related explanations. First, over the last decade, prices of cigarettes have increased considerably. It may be possible that when the prices are already high, any further increase may induce a much higher reduction in consumption, especially of products whose prices are less than the 75th percentile in comparison to previous periods (noting that the demand of products with prices in the highest quartile are found to be inelastic). Second, given higher prices, consumers may give up smoking duty-paid cigarettes on the market and switch to consuming duty-non-paid cigarettes brought in through illicit trade. The sales of cigarettes in the legal market were around 107.6 billion units in 2009 just before the significant hike in prices due to tax adjustment. In the years to follow the legal market sales dropped to 90-95 billion units levels according Tobacco and Alcohol Market Regulation Board figures. In fact, the segment-level differences in price elasticity of demand may indicate such a behavior. The drop in the legal market sales are thought to be substituted by the duty-non-paid sales. This issue has serious consequences, first for public health given the unknown harm of the duty-non-paid cigarettes, second for public finance given the reduction in tax revenues and third for the efficient functioning of the market.

5. Determining the appropriate tax combination: A multi-party interaction

In most of the advanced countries, the tobacco taxation policy is in place in order to provide disincentives to consumers with health concerns being the main driver. However, in countries like Turkey, where fiscal revenues depend to a large extent on indirect taxes, tobacco taxation becomes an important fiscal issue too. In addition, tobacco cultivation and cigarette production are business activities that employ a non-negligible number of workers. Moreover, not all cigarette producers operate in each price segment. Thus, the sectoral composition and employment concerns are also valid for Turkey. Besides, health authorities and non-governmental organizations constantly lobby for actions that would reduce cigarette consumption, as much as firms lobby for a predictable and less aggressive taxation policy. Finally, tobacco prices constitute a good share of the consumption basket. So, excessive movements in tobacco prices reflected in inflation figures complicate the monetary policy communication. Therefore, tobacco

taxation in Turkey is more of an important issue concerning various parties. In this section we will explore the nature of a good taxation policy by examining the objectives and concerns of various parties, and to formulate an appropriate taxation strategy.

5.1. Interest groups

Fiscal Authority: The main actor in this case is the Fiscal Authority (FA), i.e. Ministry of Finance, which is responsible for conducting budgetary activities and for proposing the tax scheme to the government. As discussed, tobacco taxation constitutes an important share of the overall tax revenue in Turkey, as much as 8% as of 2014. Therefore, FA sets a revenue target for tobacco taxation. The first concern for FA is the movements (mostly downward) in prices of tobacco products as such movements introduce volatility in tax revenue. Hence FA aims to eliminate "unexpected" price changes of the firms. The second concern relates to Laffer curve relation, which proposes that the relation between the tax rate and tax revenue is inverse-U-shaped. Hence, if the tax rate is high enough, the drop in consumption will be larger than what is needed to keep the tax revenue increasing. Given these concerns, the prior optimal strategy for the FA is to set a tax combination that would limit the price change incentives of the firms and meet the budgetary needs at the same time.

Other related parties:

Health Authority: In simple terms, the Health Authority (HA), i.e. Ministry of Health, may be concerned only with reducing tobacco consumption in the country. From an economic perspective, the prior optimal strategy of HA is to keep the price of tobacco products as much as possible.

Economic Policy Authority: Economic Policy Authority (EPA) may consist of several governmental bodies, i.e. Ministry of Economics and Ministry of Development, and may be concerned with the production pattern of the sector. The number of firms in the market, the price segments that they are producing for, the share of each segment in total production and competition structure of the tobacco industry are of concern. Given

that, the prior optimal strategy for EPA is to ensure that a proposed market share in terms of price segments is maintained.[10]

Firms: Firms in tobacco industry are interested in having a predictable tax scheme and in keeping their price changing flexibility. They are willing to increase market share and are also concerned with (or interested in) switching of consumers between segments. The prior optimal strategy for the firms is to engage in lobbying activity.

Non-profit organizations: Having similar concerns with HA, non-profit organizations are also interested in promoting activities that would reduce consumption whether related to taxation policy or not. Their prior optimal strategy is to increase public awareness and to attract public support.

5.2. A two-stage decision

The Fiscal Authority may set the tax combination in two steps:

First step: Choosing the baseline/starting combination

In the first step, FA may choose the tax combination that would balance the price change incentives of firms. The decision should consider the relative probabilities of price increase and decrease incentives, which would depend on the dynamics of individual countries. For instance, in Turkey we have observed periods where both incentives took action. Thus, a balanced combination of *ad valorem* and specific SCT is proposed to be a good option. Likewise, considering countries like Denmark on the other hand, where the price level is already high, the tax authority may argue that price increase incentives are not that relevant and choose a combination (high specific and low proportional rate) that would reduce price reduction incentives.

Acting accordingly in the first step will also minimize price volatility as changing prices is not economically justified. Moreover, at the first stage choosing a balanced tax combination and aiming for tax revenue as much as to cover fiscal needs and to discourage consumption may be desirable for FA and HA accordingly.

[10] A recent example for the expression of similar concerns is discussed by Braillon (2011), where the author argues that the tobacco tax freeze policy introduced in France in 2004 was in place to protect the profits of the tobacco industry. This shows that the industry related concerns may also influence tax tobacco policy in addition to health and tax revenue.

Second step: Changing the baseline tax combination when an update in tax revenue is required

In the second step, a move to a new state is required. The FA at this stage may opt the "minimum inflation generating" as the selection criteria for combination. Such an outcome is desirable for welfare implications. However, taking into account the consumer behavior is of great importance here. The new tax combination may induce consumers to switch between segments. As discussed previously, when the gap between premium and economy segment increases (decreases) consumer may switch to lower (higher) segment. Such diversions may considerably affect the tax revenue and inflation. On the other hand, segment changes may not be desirable for some parties. For instance, EPA may wish to keep a balanced sectoral distribution where all three segments survive.

5.3. Proposed strategy

Before defining a strategy for determining tobacco tax rate, we first review the principles put forward in this respect. Most of the attempts of the economists focused on conceptualizing the framework. In a summary of the earlier approach, Warner et al. (1995) discuss the economist's perspective on optimal tobacco taxation taking into account various criteria. The traditional economics approach to taxation builds on two pillars: "efficiency" and "equity".

In terms of efficiency, minimization of distortions of the consumer choice and bearing of the consequences and costs of consumption decision stand out as two principles. Especially the second principle has been the center of debate of tobacco taxation. The taxation is proposed to be efficient if it can incorporate the negative externality caused by smoking, i.e. the social cost of smoking. In terms of equity, benefit and ability to pay principles stand out. The benefit principle builds on the idea that smokers use public health care and therefore, they should pay for their own future expenses. The ability to pay principle suggests that more able taxpayers should pay more of the tax burden. However, given that each individual pays the same tax rate and usually the prevalence of smoking is higher in poorer segments of the society, the tobacco taxation turns out to be regressive.

Overall, Warner et al. (1995) conclude that economic analysis can be informative; however, it will not be able to resolve the debate regarding how much the tobacco should be taxed by the society. In the meantime, authors also hint that another principle guiding the traditional economic perspective, which assumes that the consumption decisions are taken by informed, rational and mature individuals, is likely to fail given the addictive nature of tobacco use. Nonetheless, proponents of the traditional economic perspective advice lower tax rates on the grounds that estimated negative externality of smoking is small and taxes are disproportionally felt by low income consumers (i.e. Cnossen (2006), Crawford et al. (2010)).

The incorporation of behavioral aspects provides a modern look at the economic analysis of tobacco taxation. Gruber and Koszegi (2008) provide an analysis which incorporates the idea that people receive immediate pleasure from tobacco consumption while underrating the amount of future harm smoking would cause. This time inconsistency coming from the conflict between short run gains vs. long run costs, makes people over-smoke. In this regard, behavioral economists provide justification for higher taxes which would incorporate this internality (private costs of smoking) along with classical negative externalities (social cost of smoking).

In a recent study, Cherukupalli (2010) lays out the principles of optimal tobacco taxation, combining behavioral economics and informed policy making, as follows: (1) taxes should offset external costs of tobacco consumption; (2) while tax increases are generally initiated with an aim to increase revenue, higher prices also have additional effects on public health; (3) undervaluation of health costs that would prevail in the near future may induce over consumption; (4) tobacco markets are quite diverse country-wise, even though health related issues are global. The immediate practical implication of these principles is that any analysis n tobacco taxation should be based on country specific market structure.

A reconciliation of the literature on tobacco taxation suggests that it is quite difficult to formulate an optimal tax rate given the complexity of the consumer problem along with other fiscal and public policy concerns. Issues such as the possibility of illicit trade, consumption of non-duty paid cigarettes, and segmentation (according to price level) in the tobacco production industry imply further complications. Therefore,

defining the optimal tax policy through a full-fledged macroeconomic model where the FA chooses the tobacco tax rate in order to maximize the social welfare subject to a fiscal balance, consumer choice, firm strategy, as well as considering health and industry related issues is a fairly complicated task.

In this environment, we specifically simplify the problem in order to be able to incorporate firm strategy and consumer behavior in a tobacco market with product segmentation and with a unique tobacco taxation policy. This way, we will be able to evaluate the effectiveness and the sensitivity of the current tax policy. In a nutshell, we will consider what would be the best tax combination, under current tax scheme, given a tax revenue amount and a structure for the market (of three price segments). In short, we ask how the best tax scheme can be chosen satisfying predefined conditions. To this regard, we make use of another concept: the fixed-weight nature of the consumption basket. Even though consumption shares of different segments of cigarettes change due to a tax adjustment, the official inflation calculation does not incorporate this dynamically changing nature of shares. Hence, this situation produces a variation, which provides a range of options to choose from, given for different tax schemes that would comply with predefined conditions. Therefore, we put forward the idea that among possible options, FA can select the combination that would produce the lowest inflation rate.

Building a selection criteria based on inflation is not an arbitrary choice for the case of Turkey on several grounds. First, despite a high rate of prevalence, not the entire population smokes. Second the share of tobacco products in the consumption basket is considerably high compared to other countries. Therefore, any tobacco price increase induced by tax policy, not only affects smokers, but it also harms non-smokers as well. For instance, a 10 percent rise in tobacco prices will increase the inflation rate by about 0.5 percentage points, a figure that almost matches the headline inflation in several advanced countries. Hence, a rise in tobacco prices reduces the real income of non-smokers as well, creating another source of externality. In this perspective, selecting the minimum inflation generating tax scheme, among alternatives satisfying a predetermined tax revenue and a given market structure, will also be welfare improving for society in a certain respect. First, as discussed in the literature (i.e. Lucas (2000)),

reducing inflation improves welfare through an increase in real income. Second, this will also help satisfy the "equity" principle of taxation, an indirect impact on welfare.

As an outcome of above discussions, we may define a condition for tobacco taxation as follows: FA considers the relative importance of both price change incentive (up and down) of firms and sets the tax combination that would minimize price volatility at first, and that would reduce the inflationary impact later on, while keeping in mind the fiscal balance, health related issues and sectoral composition.

In sum, the appropriate tax scheme will be the outcome of the interaction of FA, HA and EPA and it can be formulized as the tax combination yielding minimum price change, for a given average tax revenue per pack and the desired sectoral composition.

With this condition in hand, it is also possible to design a future path of taxes as desired. Initially, choosing a starting point where price change motives are muted and a certain amount of revenue is secured, and then moving to a new tax combination in the neighborhood of the starting point, but yielding new level of tax revenue can be used as a guideline for a transparent and predictable future path for taxes. In fact, once at the appropriate level, firms will be able to adjust their prices based on the economic conditions. Hence, the FA may increase its tax revenue without the need of changing taxes. Yet, being at an appropriate condition also gives the FA the flexibility of changing rates in both directions incase unexpected price changes of the firms are observed.

Next subsection sketches the mathematical constrained optimization problem and lays out the final setup that will be used in simulation analysis.

5.4. Illustration of the strategy

Suppose that both *ad valorem* and specific SCT are excised for tobacco products; that firms produce cigarettes in three different price segment and total consumption of cigarettes will be the same in two periods, t and t+1. The Fiscal Authority is to set the tax scheme as a combination of *ad valorem* and specific tax for period t+1. While setting the tax rates, the Fiscal Authority has to consider tax revenues, health and industry related issues and cigarette price volatility. Under this framework, we may define the environment and an "optimality condition" in this environment.

Environment:

First, fiscal authority sets the tax combination:

$$\tau_{t+1}, m_{t+1}$$

where, $\tau_{t+1}$is the *ad valorem* (proportional) rate and m_{t+1} is the specific (additive) tax.

Second, Firms set the price for each segment:

Price of Economy segment: $P^{e}_{t+1}(\tau_{t+1}, m_{t+1}, X^{e}_{t}, \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$

Price of Medium segment: $P^{m}_{t+1}(\tau_{t+1}, m_{t+1}, X^{m}_{t}, \kappa^{+}_{t+1}(\tau_{t+1}, m_{t+1}), \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$

Price of Premium segment: $P^{p}_{t+1}(\tau_{t+1}, m_{t+1}, X^{p}_{t}, \kappa^{+}_{t+1}(\tau_{t+1}, m_{t+1}), \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$

where, X^{i}_{t} is the producer price at the initial period for each segment $i = \{e, m, p\}$. κ^{+}_{t+1} and κ^{-}_{t+1} terms measure the producer price increase and decrease incentives respectively. These price change incentives depend on the level of *ad valorem* rate and specific tax. Only for the Economy segment, we do not propose any incentives for price hikes. As discussed in Section 3, the relation can be shown as:

$$\frac{d\kappa^{+}_{t+1}}{d\tau_{t+1}} < 0, \frac{d\kappa^{+}_{t+1}}{dm_{t+1}} > 0 \; and \; \frac{d\kappa^{-}_{t+1}}{d\tau_{t+1}} > 0, \frac{d\kappa^{-}_{t+1}}{dm_{t+1}} < 0$$

In sum, the price is a function of the tax rates, producer price and additional price change incentives that may be induced by the selected *ad valorem* and specific tax combination.

Then, Consumers choose the quantity for each price segment:

$$Q^{e}_{t+1}(P^{e}_{t+1}, P^{m}_{t+1}, P^{p}_{t+1})$$

$$Q^{m}_{t+1}(P^{e}_{t+1}, P^{m}_{t+1}, P^{p}_{t+1})$$

$$Q^{p}_{t+1}(P^{e}_{t+1}, P^{m}_{t+1}, P^{p}_{t+1})$$

where, quantity of each segment depends on the prices of all three segments as consumers may switch between segments depending on the relative price.

Substituting prices into quantity:

$$Q^{e}_{t+1}(\tau_{t+1}, m_{t+1}, X^{e}_{t+1}, X^{m}_{t}, X^{p}_{t+1}, \kappa^{+}_{t+1}(\tau_{t+1}, m_{t+1}), \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$$

$$Q^{m}_{t+1}(\tau_{t+1}, m_{t+1}, X^{e}_{t+1}, X^{m}_{t}, X^{p}_{t+1}, \kappa^{+}_{t+1}(\tau_{t+1}, m_{t+1}), \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$$

$$Q^{p}_{t+1}(\tau_{t+1}, m_{t+1}, X^{e}_{t+1}, X^{m}_{t}, X^{p}_{t+1}, \kappa^{+}_{t+1}(\tau_{t+1}, m_{t+1}), \kappa^{-}_{t+1}(\tau_{t+1}, m_{t+1}))$$

Therefore, we may determine the prices and quantities in period t+1 only as a function of the tax rates, $\tau_{t+1}\ and\ m_{t+1}$.

Once prices and quantities are set, we may calculate the relevant (segment quantity-weighted) average prices in period t and t+1:

Average price at t:

$$P_t^{average} = (P_t^e * w_t^e + P_t^m * w_t^m + P_t^p * w_t^p)$$

$$w_t^e = Q_t^e/Q_t^{total}, w_t^m = Q_t^m/Q_t^{total}, w_t^p = Q_t^p/Q_t^{total}$$

$$w_t^e + w_t^m + w_t^p = 1$$

$$Q_t^{total} = Q_t^e + Q_t^m + Q_t^p$$

Average price at t+1:

$$P_{t+1}^{average} = (P_{t+1}^e * w_{t+1}^e + P_{t+1}^m * w_{t+1}^m + P_{t+1}^p * w_{t+1}^p)$$

Average price at t+1 with inflation basket fixed weights:

$$P_{t+1}^{average*} = (P_{t+1}^e * w_t^e + P_{t+1}^m * w_t^m + P_{t+1}^p * w_t^p)$$

Since by definition, the inflation basket weights are fixed from *t* to *t+1*, the average price relevant for inflation calculation in *t+1* is based on weights in period *t*.

Inflation at t+1:

$$(P_{t+1}^{average*} - P_t^{average})/P_t^{average} * 100$$

Tax revenue at t+1:

$$(P_{t+1}^e * \tau_{t+1} + m_{t+1}) * Q_{t+1}^e + (P_{t+1}^m * \tau_{t+1} + m_{t+1}) * Q_{t+1}^m +$$

$$\left(P_{t+1}^p * \tau_{t+1} + m_{t+1}\right) * Q_{t+1}^p$$

In real life, the prices and quantities are adjusted in a short while following a tax change. Thus, the average price and tax revenue occur accordingly. However, the reflection of the tax changes on inflation does not occur at the same proportion. Given that the weights are fixed for a certain period, the actual average price and the average price relevant for inflation measurement do not match. This discrepancy provides an opportunity to define a condition for appropriate tax scheme.

For this analysis we assume that total consumption is same in two consecutive periods. In this framework, our strategy may be considered as pointing to a "local optimum". However, this is in fact due to the structure of the problem since we try to find the appropriate rate on the domain of a given tax revenue and a market structure, which intrinsically defines a neighborhood for policy choice.

The mathematical constrained optimization problem:[11]

In this environment, the FA chooses tax rates:

$$\tau_{t+1} \text{ and } m_{t+1}$$

in order to minimize the inflation rate:

$$\textit{minimize}$$

$$(P_{t+1}^{average*} - P_t^{average})/P_t^{average} * 100$$

$$\textit{subject to}$$

a tax revenue per pack:

$$[(P_{t+1}^{e} * \tau_{t+1} + m_{t+1}) * Q_{t+1}^{e} + (P_{t+1}^{m} * \tau_{t+1} + m_{t+1}) * Q_{t+1}^{m} +$$

$$\left(P_{t+1}^{p} * \tau_{t+1} + m_{t+1}\right) * Q_{t+1}^{p}]/Q_{t+1}^{total} = \mathrm{A}$$

a desired market structure:

$$Q_{t+1}^{i}/Q_{t+1}^{total} > \alpha \;\; \forall\, i = \{e, m, p\}$$

and a minimal incentive for producer price change (lower price volatility):

$$|\kappa_{t+1}^{+}| < \varepsilon, |\kappa_{t+1}^{-}| < \varepsilon$$

Thus, for given target tax revenue, desired market structure, level of producer price change incentive and relevant functional forms, it is possible to solve the problem for the appropriate tax rate combination.

For simplicity, if we assume that the producer prices remained unchanged (i.e. producer price change incentives are muted: $\kappa_{t+1}^{+} = 0$; $\kappa_{t+1}^{-} = 0$) and simplify the inflation equation, we may rewrite the problem in a more compact way:

[11] Our approach constructs a mathematical constrained optimization problem. Therefore, the solution of this problem gives an optimum. This outcome should be considered as the "best" or "appropriate" tax combination that would be achieved under these constraints, and not as the "socially optimal tax rate".

The FA chooses tax rates:

$$\min_{\tau_{t+1}, m_{t+1}} P_{t+1}^{average*}$$

s. t.

$$[(P_{t+1}^{e} * \tau_{t+1} + m_{t+1}) * Q_{t+1}^{e} + (P_{t+1}^{m} * \tau_{t+1} + m_{t+1}) * Q_{t+1}^{m} +$$

$$\left(P_{t+1}^{p} * \tau_{t+1} + m_{t+1}\right) * Q_{t+1}^{p}]/Q_{t+1}^{total} = \mathrm{A}$$

and

$$Q_{t+1}^{i}/Q_{t+1}^{total} > \alpha \ \ \forall\, i = \{e, m, p\}$$

Given the setup and characterization of the appropriate tax combination, we proceed to the simulation analysis. Overall, as we will see in the next section, minimizing inflation rate, given a tax revenue and market structure, also produces the most balanced *ad valorem* and specific tax combination possible. Therefore, intrinsically, minimizing inflation objective satisfies the minimal price volatility condition as the balanced tax combination reduces the price change incentives of the firms.

6. Simulation analysis

6.1. Background of the analysis

In this section, we present an empirical exercise where we introduce a platform that enables us to test the theoretic predictions we made previously. For this purpose, first, we will simulate the segment shares for a range of different tax combinations using the variation in the shares due to tax changes based on past data. Second, we will try to determine the appropriate tax combination for a given *Average Tax Revenue* (per pack) (denoted as "A" in section 5.4) and a given *Market Structure* (sectoral composition) (denoted as "α" in section 5.4).

This simulation analysis is built on the observation that the shares of segments change in response to changes in tax scheme, as consumers switch segments. Such a switch between segments also changes the average price per pack of cigarettes, and thus the average tax revenue per pack. Assuming that the total packs of cigarettes do not change, then, segment switching will also change the total tax revenue.

In order to simulate the segment shares, we first run separate regression models of segment shares (in terms of quantities) and tax rates as follows:[12]

$$S(Economy) = c + \alpha * MinSpec_{t-1} + \beta * AdVol_t + \gamma * Spec_t + \varepsilon_t$$

$$S(Medium) = c + \alpha_1 * MinSpec_t + \alpha_2 * MinSpec_{t-1} + \beta * AdVol_t + \gamma * Spec_t + \varepsilon_t$$

$$S(Premium) = c + \alpha * MinSpec_t + \beta * AdVol_t + \gamma_1 * Spec_t + \gamma_2 * Spec_{t-1} + \varepsilon_t$$

Here, "S()" refers to the percentage of quantities sold of each segment in a given month. MinSpec, AdVol and Spec refer to minimum specific SCT, *ad valorem* SCT and specific SCT respectively. The estimation period is from January 2006 to December 2013. Using the estimated coefficients, we then simulate the segment shares for a broad range of *ad valorem* and specific SCT rates. Finally, we can calculate the average price and tax revenue per pack, under the assumption of constant total consumption. As the consumption shares change, dynamically adjusting the average price based on actual shares gives a better approximation of the tax revenue.

On the other hand, for calculating the inflationary effect, we have to rely on the fixed initial consumption shares. This is due to the fact that the Statistical Office uses a fixed weight basket for the entire year, where the weights are calculated based on the past expenditure shares. This static nature of relative weights in inflation calculation provides a good environment for our simulation analysis as well. Even though the actual consumption shares change within the year, and thus the average price and tax revenue, the consumption shares are fixed in inflation basket.

The simulations are generated for discrete increments in *ad valorem* SCT (from 0 to 100%, with increments of 0.5%) and specific SCT (from 0 to 4 TL, with increments of 0.02 TL). So, for 200 distinct *ad valorem* rates and 200 distinct specific taxes, we first simulate the segment shares for 40,000 SCT combinations. Next, for the same set of tax combinations we calculate the average price and average tax revenue per pack both with static inflation-basket weights and with simulated dynamic weights, under the assumption of constant producer prices using Equation 1. The inflation-basket weighted average price will be used for calculating the inflationary impact of a change in tax

[12] The equations are run with different lagged schemes for independent variables and only the significant variables are kept in the final specification. The minimum specific SCT is only used as a constant term in simulations, rather than an objective parameter.

structure. Meanwhile, simulation-based weights will be used for predicting realized average price and average tax revenue. The tax revenue simulation is based on the assumption of constant quantities sold.

6.2. A case study of proposed strategy

As discussed in the previous section, the decision includes determination of the average tax revenue required per pack and the sectoral composition based on the segment shares. Those two inputs, which will be considered as given for our analysis, should be decided by the interaction of FA, HA and EPA.

Once the desired initial conditions are set, then, the appropriate tax combination will be chosen among the combinations satisfying initial conditions and on the grounds of producing minimum inflation. That is, among the candidate combinations satisfying a certain amount of average tax revenue per pack (calculated from simulation-based weighted average price) and a certain sectoral composition, the one with the minimum average price (inflation-basket weighted average price) will be the desired option.

For the sake of argument let us consider a hypothetical initial combination. Assume that the required amount of average tax revenue per pack is set as 5 TL. Also, the condition for sectoral composition is determined as "each segment's share should be at least 10%". According to our simulation, 4041 different combinations satisfy the condition regarding the sectoral composition. Among those, the following 29 cases satisfy the tax revenue condition as well. The list of combinations satisfying both conditions is given in Table 5.

So, from the simulation analysis, we see that 29 tax combinations ranging from 49% *ad valorem* rate and 0.82 TL specific tax to 65.5% *ad valorem* and no specific tax guarantee 5 TL average tax revenue per pack, as well as a desired sectoral composition that each segment captures at least 10% of the quantities sold. Among those observationally equivalent combinations, which one will be the best? Based on our reasoning, the combination yielding the lowest rate of price change will be the best one. In this regard, achieving lowest inflation rate is equivalent to achieving the lowest average price (based on constant inflation-basket weights). Accordingly, the combination with the lowest average price is given by 49% *ad valorem* and 0.82 TL specific mix.

This appropriate tax scheme choice is also interesting from another aspect. The combination points to the lowest *ad valorem* rate possible and highest specific amount possible. In other words, combination secures a relatively more balanced *ad valorem* and specific mix. This exactly matches the predictions of our theoretical exercise on the grounds that both price change incentives are minimized with a balanced combination away from extreme cases of all-*ad valorem*-no specific and all-specific-no *ad valorem*.

Table 5: Results of the simulation analysis

Simulation inputs (SCT)		Simulated segment shares (%)					
Ad valorem SCT rate (%)	Specific SCT amount (TL)	Economy	Medium	Premium	Average price per pack (inflation-basket weighted)	Average price per pack (simulation-based weighted)	Average tax revenue
49.00	0.82	11.2	24.7	64.2	5.7	6.3	5
49.50	0.80	12.4	24.7	62.9	5.8	6.3	5
50.00	0.78	13.6	24.7	61.7	5.8	6.4	5
50.50	0.76	14.7	24.8	60.5	5.8	6.4	5
51.00	0.72	17.2	24.4	58.4	5.8	6.3	5
51.00	0.74	15.9	24.8	59.2	5.9	6.4	5
51.50	0.70	18.4	24.5	57.1	5.8	6.3	5
52.00	0.68	19.6	24.5	55.9	5.9	6.3	5
52.50	0.66	20.8	24.6	54.7	5.9	6.4	5
53.00	0.62	23.2	24.2	52.6	5.8	6.3	5
53.50	0.60	24.4	24.2	51.4	5.9	6.3	5
54.00	0.58	25.6	24.3	50.1	5.9	6.3	5
54.50	0.56	26.8	24.3	48.9	6.0	6.4	5
55.00	0.52	29.2	24.0	46.8	5.9	6.3	5
55.50	0.50	30.4	24.0	45.6	6.0	6.3	5
56.00	0.48	31.6	24.1	44.4	6.0	6.3	5
56.50	0.46	32.7	24.1	43.1	6.1	6.4	5
57.00	0.42	35.2	23.8	41.1	6.0	6.3	5
57.50	0.40	36.4	23.8	39.8	6.1	6.3	5
58.00	0.38	37.5	23.8	38.6	6.1	6.3	5
58.50	0.36	38.7	23.9	37.4	6.2	6.3	5
59.50	0.30	42.3	23.6	34.1	6.2	6.3	5
60.00	0.28	43.5	23.6	32.9	6.2	6.3	5
60.50	0.26	44.7	23.7	31.6	6.3	6.3	5
61.50	0.20	48.3	23.4	28.4	6.3	6.2	5
62.00	0.18	49.5	23.4	27.1	6.4	6.3	5
63.50	0.10	54.2	23.1	22.6	6.5	6.2	5
64.00	0.08	55.4	23.2	21.4	6.6	6.2	5
65.50	0.00	60.2	22.9	16.9	6.7	6.2	5

6.3. Sensitivity analysis

Given its high share among the overall tax income collected, the tax revenue obtained from tobacco products is of crucial importance in Turkey. Therefore to construct the tobacco tax scheme choice, a major constraint would be the predictable and sustainable revenue growth, along with health related concerns. Keeping revenue target as given, the best tax scheme would be the one yielding minimum tobacco price inflation (that is equivalent to minimum average tobacco price level in simulation analysis). On the other hand, the tax scheme choice not only determines the final consumption prices, but also the sectoral composition of the market, that is how much of the share of the sales would be in each segment (economy, medium and premium). Thus the appropriate tax scheme mix would also depend on the preference, if any, of the sectoral composition of the market.

Table 5 shows the 29 combinations that satisfy a tax revenue target (5 TL per pack) and a condition on the market share of each segment (each segment's share should not be less than 10 percent). The desired tax mix of the 29 combinations as discussed above, yielding the lowest average price level, is the one with the lowest *ad valorem* SCT. Table 6 presents the sensitivity of the appropriate tax combination (yielding minimum average price level per pack) to market segment share condition. For the same tax revenue target (5 TL per pack), the appropriate *ad valorem* SCT drops to 45.5%. Raising the minimum market share condition to 20% increases the same rate to 52.5%.

Table 6: Sensitivity of Appropriate Tax Combination to Market Segment Share Condition

Simulation inputs (SCT)		Simulated segment shares (%)					
Ad valorem SCT rate (%)	Specific SCT amount (TL)	Economy	Medium	Premium	Average price per pack (inflation-basket weighted)	Average price per pack (simulation-based weighted)	Average tax revenue
0.455	1.00	0.3	25.2	74.6	5.7	4.4	5
0.470	0.92	5.2	24.9	70.0	5.7	4.5	5
0.490	0.82	11.2	24.7	64.2	5.7	4.5	5
0.510	0.72	17.2	24.4	58.4	5.8	4.6	5
0.525	0.66	20.8	24.6	54.7	5.9	4.7	5

Notes: The minimum segment share is defined for the share of economy segment being larger than 5%, 10%, etc.

The sensitivity of the results on the targeted tax revenue level is presented in Table 7. With no further condition on the market share of the segments the results show that if the targeted tax revenue condition is dropped to 2.5 TL per pack, then the appropriate *ad valorem* SCT drops below 20 percent. As the targeted tax revenue increases to 7 TL per pack, then, *ad valorem* SCT increases to 54.5 percent. These simulation results suggest that the minimum inflation yielding *ad valorem* SCT is more sensitive to the targeted tax revenue level however, it would not be reasonable to consider the targeted tax revenues to deviate, especially drop, much from the current levels. As of December 2014, the average tax revenue per pack is around 6.7 TL with 65.25 percent *ad valorem* and 0.14 TL specific SCT. This study shows that the same amount of tax can be collected by having a 50 percent *ad valorem* and 0.98 TL specific SCT amounts with the resulting final average consumer price being approximately 10 percent less than that of the current. Therefore, moving from the current to the appropriate tax scheme levels would not only limit the contribution of tobacco products to inflation, but also limit the price change incentives of the firms by moving away from the current tax scheme of high *ad valorem* SCT.

Table 7: Sensitivity of Appropriate Tax Combination to Targeted Tax Revenue

Simulation inputs (SCT)		Simulated segment shares (%)					
Ad valorem SCT rate (%)	Specific SCT amount (TL)	Economy	Medium	Premium	Average price per pack (inflation-basket weighted)	Average price per pack (simulation-based weighted)	Average tax revenue
0.185	1.08	0.6	2.3	97.1	3.2	3.7	2.5
0.270	1.06	0.2	9.6	90.3	3.7	4.2	3.0
0.330	1.04	0.2	14.6	85.1	4.2	4.7	3.5
0.385	1.02	0.4	19.2	80.4	4.7	5.3	4.0
0.425	1.00	0.9	22.4	76.7	5.2	5.8	4.5
0.455	1.00	0.3	25.2	74.6	5.7	6.4	5.0
0.485	0.98	1.0	27.5	71.6	6.2	6.9	5.5
0.505	0.98	0.6	29.3	70.1	6.6	7.4	6.0
0.525	0.98	0.2	31.1	68.7	7.2	8.0	6.5
0.545	0.96	1.1	32.5	66.4	7.7	8.6	7.0
0.560	0.94	2.1	33.5	64.5	8.1	9.0	7.5

7. Conclusion

To conclude, this study provides a tool to determine the appropriate tax scheme on tobacco products that yield minimum inflation taking into account the targeted tax revenue and the desired market share of segments. The choice of the targeted tax revenue is to the Fiscal Authority. The main concern of FA is predictable and sustainable tax revenues. Therefore it would prefer a tax system which limits the price change incentives of the firms; as such movements introduce volatility in tax revenue. Health Authority, on the other hand, may only be concerned with keeping the prices of the tobacco products as high as possible to reduce tobacco consumption in the country. Thus the objectives of the above two parties do not differ too much as long as the FA targets a tax revenue growth each year. Although the average price per pack in the appropriate tax scheme, calculated in the simulations with relatively lower *ad valorem* SCT rates, suggests that the prices of tobacco products can be less than the current levels, gradual move to the selected scheme would limit this price decrease. After reaching the appropriate scheme the final consumer prices will increase as long as the targeted tax revenue increases, satisfying the objectives of the two parties. Fine tuning of tax scheme may be determined by the EPA, which would take into account issues such as the number of firms in each segment of the market, share of each segment in total production and the competition structure of the tobacco industry. As long as these preconditions are given, this study provides a guide to reach the appropriate tax mix.

One final point on this issue is the decision of the firms in setting their producer prices. The simulation analysis assumed that the producer prices remained stable. If the tax scheme becomes more predictable and the price change incentives of the firms are limited as a result, the producer prices may reflect the cost structure and the market would function more properly in return. If the cost increases (decreases) are reflected in the producer prices, the targeted tax revenue can be maintained by decreasing (increasing) the *ad valorem* SCT rate. Thus the *ad valorem* component of the SCT may be less (more) than that of the ones shown in the simulations if the producer prices increase (decrease). Finally, the selection of the appropriate tax scheme based on inflation minimization while securing a preferred level of tax income and market structure, will also improve the welfare for the entire society given the high share of tobacco products in the consumption basket.

References

Atuk, O., Çebi, C., Özmen, M. U. (2011). Special Consumption Tax on Tobacco Products (in Turkish). CBRT Research Notes in Economics, 11-16.

Bilir, N., Çakır, B., Dağlı, E., Ergüder, T., & Önder, Z. (2009). Tobacco control in Turkey. WHO Europe, 43-45.

Bogdanovica, I., Murray, R., McNeill, A., & Britton, J. (2012). Cigarette price, affordability and smoking prevalence in the European Union. Addiction, 107(1), 188-196.

Braillon, A. (2011). Reversing the taxes approach for a win–win tobacco control policy. Addiction, 106(11), 2047-2047.

Caman, O. K., Erguder, B. I., Ozcebe, H., & Bilir, N. (2013). Urinary Cotinine and Breath Carbon Monoxide levels among Bar and restaurant employees in Ankara. Nicotine & Tobacco Research, 15(8), 1446-1452.

CBRT (2013). Recent Changes to Taxing of Tobacco Products and the Effects of SCT Rate Hikes on Prices. Inflation Report 2013-I, Box 3.1.

Chaloupka, F. J., Kostova, D., & Shang, C. (2014). Cigarette excise tax structure and Cigarette Prices: evidence From the global adult tobacco survey and the Us national adult tobacco survey. Nicotine & Tobacco Research, 16(Suppl 1), S3-S9.

Cherukupalli, R. (2010). A behavioral economics perspective on tobacco taxation. American Journal of Public Health, 100(4), 609.

Cnossen, S. (2006). Tobacco Taxation in the European Union, FinanzArchiv, 62, (2), 305-322.

Crawford, I., Keen, M. & Smith, S. (2010). Value Added Taxes and Excises. In: James A. Mirrlees et al. (eds), The Mirrlees Review. Dimensions of Tax Design, ch. 4, Oxford: Oxford University Press, 275-422.

Dunlop, S. M., Perez, D., & Cotter, T. (2011). Australian smokers' and recent quitters' responses to the increasing price of cigarettes in the context of a tobacco tax increase. Addiction, 106(9), 1687-1695.

Gilmore, A. B., Tavakoly, B., Taylor, G., & Reed, H. (2013). Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. Addiction, 108(7), 1317-1326.

Gruber, J., & Koszegi, B. (2008). A modern economic view of tobacco taxation. Paris: International Union Against Tuberculosis and Lung Disease.

Joossens, L., Merriman, D., Ross, H., & Raw, M. (2010). The impact of eliminating the global illicit cigarette trade on health and revenue. Addiction, 105(9), 1640-1649.

Kostova, D., Tesche, J., Perucic, A. M., Yurekli, A., & Asma, S. (2014). Exploring the relationship between cigarette prices and smoking among adults: a cross-country study of low-and middle-income nations. Nicotine & Tobacco Research, 16(Suppl 1), S10-S15.

Lucas Jr, R. E. (2000). Inflation and welfare. Econometrica, 68(2), 247-274.

Martire, K. A., Mattick, R. P., Doran, C. M., & Hall, W. D. (2011). Cigarette tax and public health: what are the implications of financially stressed smokers for the effects of price increases on smoking prevalence?. Addiction, 106(3), 622-630.

Önder, Z. (2002). Economics of tobacco control in Turkey. HNP Discussion Paper, Economics of Tobacco Control Paper, Washington D. C.: The International Bank for Reconstruction and Development, The World Bank.

Önder, Z., & Yürekli, A. (2007). Regressivity of Cigarette Excise Taxes and Tobacco Control: A Case Study in Turkey. Working paper.

Ross, H., Blecher, E., Yan, L., & Hyland, A. (2011). Do cigarette prices motivate smokers to quit? New evidence from the ITC survey. Addiction, 106(3), 609-619.

TurkStat, Global Adult Tobacco Survey (GATS) 2008.

Van Walbeek, C., Blecher, E., Gilmore, A., & Ross, H. (2013). Price and tax measures and illicit trade in the framework convention on tobacco control: What we know and what research is required. Nicotine & Tobacco Research, 15(4), 767-776.

Verdonk-Kleinjan, W. M., Candel, M. J., Knibbe, R. A., Willemsen, M. C., & de Vries, H. (2011). Effects of a workplace-smoking ban in combination with tax increases on smoking in the Dutch population. Nicotine & Tobacco Research, 13(6), 412-418.

Warner, K. E., Chaloupka, F. J., Cook, P. J., Manning, W. G., Newhouse, J. P., Novotny, T. E., ... & Townsend, J. (1995). Criteria for determining an optimal cigarette tax: the economist's perspective. Tobacco Control, 4(4), 380.

Yılmaz, M. A., & Yusufoğlu, A. (2014). The Taxation of Tobacco Products and Effects on the Consumer Behaviour in Turkey. European Journal of Research on Education, 2(Special Issue), 99-107.

Yürekli, A., Önder, Z., Elibol, M., Erk, N., Cabuk, A., Fisunoglu, M., Erk, S.F., & Chaloupka, F. J. (2010). The economics of tobacco and tobacco taxation in Turkey. Paris: International Union Against Tuberculosis and Lung Disease, 5.

Appendix: Alternative Scenarios

Scenario A1:
Tax revenue: 4 TL & Market structure: All segments >0 and <=50

Table A1: Results of the simulation analysis

Simulation inputs (SCT)		Simulated segment shares (%)					
Ad valorem SCT rate (%)	Specific SCT amount (TL)	Economy	Medium	Premium	Average price per pack (inflation-basket weighted)	Average price per pack (simulation-based weighted)	Average tax revenue
0.51	0.52	30.1	19.9	50.0	4.9	5.2	4.0
0.51	0.50	31.3	20.0	48.7	5.0	5.2	4.0
0.52	0.48	32.5	20.0	47.5	5.0	5.2	4.0
0.52	0.46	33.6	20.1	46.3	5.0	5.3	4.0
0.53	0.44	34.8	20.1	45.1	5.0	5.3	4.0
0.53	0.42	36.0	20.1	43.9	5.0	5.3	4.0
0.54	0.40	37.2	20.2	42.6	5.1	5.3	4.0
0.54	0.38	38.3	20.2	41.4	5.1	5.3	4.0
0.55	0.36	39.5	20.3	40.2	5.1	5.3	4.0
0.55	0.34	40.7	20.3	39.0	5.1	5.3	4.0
0.56	0.32	41.9	20.4	37.8	5.1	5.3	4.0
0.57	0.26	45.5	20.1	34.5	5.1	5.1	4.0
0.57	0.24	46.7	20.1	33.2	5.1	5.1	4.0
0.58	0.22	47.8	20.2	32.0	5.2	5.1	4.0
0.58	0.20	49.0	20.2	30.8	5.2	5.1	4.0

Scenario A2:
Tax revenue: 3 TL & Market structure: All segments >=15

Table A2: Results of the simulation analysis

Simulation inputs (SCT)		Simulated segment shares (%)					
Ad valorem SCT rate (%)	Specific SCT amount (TL)	Economy	Medium	Premium	Average price per pack (inflation-basket weighted)	Average price per pack (simulation-based weighted)	Average tax revenue
0.50	0.30	44.2	15.0	40.7	4.1	4.1	3.0
0.51	0.28	45.4	15.1	39.5	4.1	4.1	3.0
0.51	0.26	46.6	15.1	38.3	4.1	4.1	3.0
0.52	0.24	47.8	15.2	37.1	4.1	4.1	3.0
0.52	0.24	47.7	15.6	36.7	4.1	4.2	3.0
0.53	0.22	48.8	15.7	35.5	4.1	4.1	3.0
0.53	0.20	50.0	15.7	34.3	4.1	4.1	3.0
0.54	0.18	51.2	15.7	33.1	4.1	4.1	3.0
0.54	0.16	52.3	15.8	31.9	4.1	4.1	3.0
0.55	0.14	53.5	15.8	30.7	4.2	4.0	3.0
0.55	0.14	53.4	16.3	30.3	4.2	4.1	3.0
0.56	0.12	54.6	16.3	29.1	4.2	4.1	3.0
0.56	0.10	55.7	16.4	27.9	4.3	4.1	3.0
0.57	0.08	56.9	16.4	26.7	4.3	4.1	3.0
0.57	0.06	58.1	16.5	25.4	4.3	4.0	3.0
0.58	0.04	59.2	16.5	24.2	4.3	4.0	3.0
0.58	0.04	59.1	17.0	23.9	4.4	4.1	3.0
0.59	0.02	60.3	17.0	22.7	4.4	4.1	3.0
0.59	0.00	61.5	17.1	21.5	4.4	4.0	3.0

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