UNIVERSITY OF PIRAEUS

SCHOOL OF ECONOMICS, BUSINESS AND INTERNATIONAL STUDIES

DEPARTMENT OF ECONOMICS

EMPIRICAL RESEARCH AND ANALYSIS ON CIGARETTE CONSUMPTION, EXCISE TAXATION AND GOVERNMENT REVENUES

Ph.D. Thesis

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Archontoula G. Armoutaki

Abstract

Tobacco use represents the largest preventable cause of serious diseases worldwide. Considering that cigarette consumption account for the overwhelming percentage of total tobacco consumption, the major part of the thesis is devoted to the study of cigarette smoking patterns and economics. Specifically, this dissertation studies the tobacco market in the European Union focusing on the determinants of cigarette consumption, government revenues accrued from cigarette excise taxation and the revenue analysis of stakeholders involved in tobacco supply chain.

Excise taxation is undeniably the most cost-effective policy tool for a government in order to achieve both health and economic goals. In particular, the inelasticity of cigarette demand has implications for the impact of tax increases on cigarette consumption and tax revenues. The Laffer Curve is a tax theory which discusses the relationship between tax rates and the amount of tax revenues collected by governments, suggesting an optimal rate of taxation for each economy. Acknowledging the optimal tax rate which maximizes the revenue collection is valuable for every government so as to pursue an effective policy strategy. Though, the level of cigarette substitution by other tobacco or nicotine products and the volume of illicit cigarette market are fundamental factors influencing the optimal point with the highest revenue streams of each country.

Through this framework, the present thesis extends the research upon the prevailing smoking patterns across the European Union, investigating several determinants affecting smoking behaviour, such as cigarette affordability, implementation of tobacco control policies and some socio-economic characteristics – i.e. unemployment rates and educational level. Moreover, the empirical analysis provides useful evidence on further possible factors associated to smoking habit, thus offering constructive insights for future research.

Finally, cigarette excise taxation has multiple implications not only in public health and government revenues but in the tobacco industry as well. For a thorough evaluation of a tax strategy imposed on cigarette consumption, all stakeholders involved in the tobacco supply chain should be considered. Therefore, an analysis of stakeholders' revenue shares with comprehensive empirical data is also provided.

Περίληψη

Η χρήση προϊόντων καπνού αποτελεί τη μεγαλύτερη αποτρέψιμη αιτία σοβαρών ασθενειών παγκοσμίως. Λαμβάνοντας υπόψη ότι η κατανάλωση των τσιγάρων αντιπροσωπεύει το συντριπτικό ποσοστό της συνολικής κατανάλωσης προϊόντων καπνού, το μεγαλύτερο μέρος της διατριβής αφιερώνεται στη μελέτη των καπνιστικών προτύπων και των οικονομικών συνεπειών των τσιγάρων. Συγκεκριμένα, αυτή η διατριβή μελετά την αγορά προϊόντων καπνού στην Ευρωπαϊκή Ένωση εστιάζοντας στους καθοριστικούς παράγοντες της κατανάλωσης των τσιγάρων, τα κρατικά έσοδα που προέρχονται από τη φορολογία των ειδικών φόρων κατανάλωσης στα τσιγάρα και την ανάλυση των εσόδων των εμπλεκόμενων μερών που συμμετέχουν στην αλυσίδα εφοδιασμού προϊόντων καπνού.

Οι ειδικοί φόροι κατανάλωσης είναι αναμφισβήτητα το πιο οικονομικά αποδοτικό εργαλείο πολιτικής για μια κυβέρνηση προκειμένου να επιτευχθούν τόσο οι στόχοι υγείας όσο και οι οικονομικοί στόχοι. Συγκεκριμένα, η ανελαστικότητα της ζήτησης των τσιγάρων έχει επιπτώσεις στον αντίκτυπο των φορολογικών αυξήσεων τόσο στην κατανάλωση των τσιγάρων όσο και στα φορολογικά έσοδα. Η καμπύλη Laffer είναι μια φορολογική θεωρία που συζητά τη σχέση μεταξύ των φορολογικών συντελεστών και του ποσού των φορολογικών εσόδων που συλλέγονται από τις κυβερνήσεις, υποδεικνύοντας έναν βέλτιστο συντελεστή φορολογίας για κάθε οικονομία. Η αναγνώριση του βέλτιστου φορολογικού συντελεστή που μεγιστοποιεί την είσπραξη των κρατικών εσόδων είναι πολύτιμη για κάθε κυβέρνηση, ώστε να ακολουθήσει μια αποτελεσματική πολιτική στρατηγική. Ωστόσο, το επίπεδο υποκατάστασης των τσιγάρων από άλλα προϊόντα καπνού ή νικοτίνης και το μέγεθος της παράνομης αγοράς τσιγάρων είναι θεμελιώδεις παράγοντες που επηρεάζουν το βέλτιστο σημείο με τις υψηλότερες ροές εσόδων κάθε χώρας.

Μέσα σε αυτά τα πλαίσια, η παρούσα διατριβή επεκτείνει την έρευνα αναφορικά με τα πρότυπα καπνίσματος που ισχύουν σε ολόκληρη την Ευρωπαϊκή Ένωση, διερευνώντας διάφορους καθοριστικούς παράγοντες που επηρεάζουν τη καπνιστική συμπεριφορά, όπως η οικονομική προσιτότητα των τσιγάρων, η εφαρμογή πολιτικών ελέγχου προϊόντων καπνού και ορισμένα κοινωνικοοικονομικά χαρακτηριστικά - δηλαδή ποσοστά ανεργίας και επίπεδο εκπαίδευσης. Επιπλέον, η εμπειρική ανάλυση παρέχει χρήσιμα στοιχεία για περαιτέρω πιθανούς παράγοντες που σχετίζονται με τη συνήθεια του καπνίσματος, προσφέροντας έτσι ένα εποικοδομητικό υπόβαθρο για μελλοντική έρευνα.

Τέλος, οι ειδικοί φόροι κατανάλωσης στα τσιγάρα έχουν πολλαπλές επιπτώσεις όχι μόνο στη δημόσια υγεία και στα κρατικά έσοδα αλλά και στην καπνοβιομηχανία. Για μια εμπεριστατωμένη αξιολόγηση μιας φορολογικής στρατηγικής που επιβάλλεται στην κατανάλωση των τσιγάρων, πρέπει να ληφθούν υπόψη όλα τα εμπλεκόμενα μέρη που συμμετέχουν στην αλυσίδα εφοδιασμού προϊόντων καπνού. Ως εκ τούτου, παρέχεται επιπλέον οικονομική ανάλυση των μεριδίων εσόδων των ενδιαφερόμενων μερών με ολοκληρωμένα εμπειρικά δεδομένα.

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Chapter 1 Introduction

1.1 Motivation

Understanding tobacco taxation is important for several purposes. The growing knowledge of the health consequences of smoking has made it a long-standing issue in the literature of tobacco economics. Evidence shows that a well-administered tobacco taxation leads to the desired goal of reducing smoking rates and mitigating the public health repercussion. On the flip side, the fact that tobacco taxation is an essential source of government revenues makes it an appealing topic for branches of economics.

Excise taxation is the single most efficient and cost-effective intervention for a government in order to achieve its primary objectives. Significant increases in tobacco taxes raise revenue streams owing to the inelasticity of cigarette demand. Though, variability in tobacco excises across the European Union (EU) reflects the differences in governments' priorities and political purposes. The research of the optimal tax rate which maximizes the revenue collection from states is a crucial instrument for policymakers in their effort to implement effective tax and price strategies. Laffer Curve is a generally accepted theory which discusses the relationship between tax rates and revenues and proposes an optimal tax rate, where the revenues reach their highest point, beyond which tax revenues eventually decline as the tax rates become more excessive. Although there are empirical studies supporting this theory with evidence from several countries worldwide, however, there are strong arguments opposing its effectiveness on other economies. Prompted by this controversy, our research focusing on the EU cigarette market, offers useful insights to an important political and economic issue.

Further, recognizing the major factors affecting cigarette consumption and consumer behaviour is fundamental for applying a comprehensive package of price and non-price policies controlling smoking rates in order to diminish them. Furthermore, tobacco control measures, especially pricing policies, aiming at curbing the smoking prevalence rates, are likely to influence significantly the revenue shares of the tobacco industry, including all stakeholders involved in the upstream and

downstream activities of tobacco supply chain. Our empirical evidence provided by our research can be constructive in designing more effective tobacco control programs and policies.

Through this context, the present thesis, first, reviews the relevant literature upon determinants of cigarette consumption and provides an empirical analysis which examines the association between smoking and other health behaviours among university students in Greece. Second, this dissertation aims to evaluate the contribution of excise taxation levied on cigarettes to the government revenues accrued from cigarette consumption across the EU researching the existence of a Laffer Curve on the EU cigarette market. Finally, the third empirical analysis studies the impact of cigarette excise tax changes on the revenue shares of the main tobacco stakeholders over time in Greece.

1.2 Structure of the thesis

The present thesis aims to study the tobacco market in the EU focusing on the cigarette consumption, government revenues accrued from cigarette excise taxes and the revenue shares of stakeholders involved in tobacco supply chain. To effectively research these issues, the dissertation is organized into three essays each one consisting a separate chapter, accompanied by the relevant theoretical and empirical review.

The second chapter focuses on contributing factors of tobacco use throughout the EU providing theoretical and up-to-date empirical evidence on smoking prevalence and the market of tobacco products. Through this context, it analyzes in detail some determinants of cigarette consumption, such as cigarette affordability, tobacco control implementation, unemployment and educational level, thus presenting current trends and data for extended evaluation. The empirical analysis presented at the last section of this chapter addresses the afore-mentioned issue, enriching the literature with additional empirical evidence. Particularly, our paper studies if and to what extent smoking rates in Greece are associated with several health factors, such as self-perceived health status, health habits and behaviours, i.e. workout and alcohol consumption, as well as the applied knowledge of people on health

issues, known as "health literacy". Therefore, our analysis is based on primary data derived from a survey which was conducted in Departments of Higher Tertiary Public universities and Technological Educational Institutes in Greece, located in six major cities of the country. The findings of our study can be constructive in designing more effective tobacco control programs and policies, which promote healthy behaviour and self-efficacy; both playing a key role in providing the necessary confidence to an adolescent so as not to engage in unhealthy behaviours like smoking.

The third chapter studies the economics of cigarettes, providing, first, an analytical theoretical and empirical background with respect to excise taxation levied on cigarettes, government revenues accrued from cigarette consumption and revenue losses as a result of fine-cut tobacco substitution or illegal market across the EU. The essay which frames this chapter investigates the existence of Laffer curve in the relationship between the cigarette excise duties and the government tax revenues in the EU. Our evidence clearly demonstrates a significant inverse U-shaped effect from the specific cigarette taxes on state excise revenues. However, an insignificant U-shaped form between ad valorem taxes and government revenues is also drawn. The contribution of this research lies on the separate impact of each excise component, i.e. specific tax and ad valorem, on the tax revenues with empirical application for the EU area which, thus far, has been poorly explored, thereby providing policy-makers with valuable evidence to implement effective tax and price strategies.

The fourth chapter considers the tobacco industry, discussing the major upstream and downstream activities taking place in tobacco supply and value chain. Further, it reviews theoretical and empirical evidence on the revenue shares of main tobacco stakeholders in order to introduce our empirical research at the last section of this chapter. This study estimates the impact of the changes of prices, excise taxes (specific and ad valorem) and Value Added Tax (VAT) on the revenues of each category of stakeholder involved in the cigarette supply chain in Greece, i.e. tobacco companies, wholesalers/ distributors and retailers. Based on a pooled time series from 1992 up to 2017, the research concludes to an empirical model that investigates the non-linear effect of the changes of tax and price

estimators on revenue shares of each stakeholder. The evidence provided is straightforward; prices and taxes do matter for changes in revenue shares of tobacco industries and retailers, whereas distributors' revenues seem unaffected, probably because selling cigarettes is not the unique or the main revenue source for this supply chain stakeholder.

Overall, the empirical analysis of tobacco economics undertaken in the present thesis offer useful and novel insights to important policy issues regarding the enforcement of tobacco control policies for achieving both economic and health objectives.

Chapter 2 Tobacco use in the EU

2.1 Introduction

Tobacco use is widely considered the world's leading cause of premature death (Frieden and Bloomberg 2007; Jha 2009) and the largest preventable cause of cancer worldwide (Phillips et al. 1996). In particular, tobacco smoking is epidemic and covers all ages causing around 25–30% of all cancer deaths in Europe (La Vecchia et al. 2003), killing more than eight million people every year (WHO, 2019). Doll et al. (2004) have estimated that long-term smokers lose more than ten years of life expectancy approximately. Undeniably, smoking poses an enormous threat to public health imposing a substantial financial burden on health system of each country (Chaloupka and Warner, 2000). The eradication of tobacco use can only be achieved by preventing children and adolescents from starting use. More countries are making tobacco control a priority saving lives, but there is much more work to be done.

This chapter, firstly, reviews the theoretical and empirical literature on tobacco use, smoking patterns, tobacco market value and the determinants of tobacco consumption throughout the EU. The first section describes current patterns and past trends in tobacco use across the EU, whereas, the last section carries out an empirical analysis researching the association between smoking and health behaviours among university students in Greece.

2.2 Smoking prevalence in the EU - Theoretical & Empirical Review

The health and economic effects of tobacco use are linked to both the number of people in a population who use tobacco and the amount that each person consumes. Thus, both smoking prevalence (i.e. the proportion of the population smoking tobacco at a given point in time) and consumption (i.e. the amount consumed per person) provide evidence of tobacco use in the EU-28. The prevalence of smoking in many countries has stabilized or declined in recent decades, as a result the average EU-28

smoking prevalence rates have been decreasing by 8% over the period 2010-2016 (see Appendix I, Figure I.1). Nevertheless, smoking remains the largest avoidable health risk in the EU and its consequences are a major burden on health care systems. It should be noted that the range in smoking prevalence rates varies significantly among the 28 EU member states. Indeed, the proportion of smokers range from 18.8 % in Sweden to 43.4 % in Greece and 37% in Latvia, Croatia and Bulgaria in 2016, as depicted in Figure 2.1.

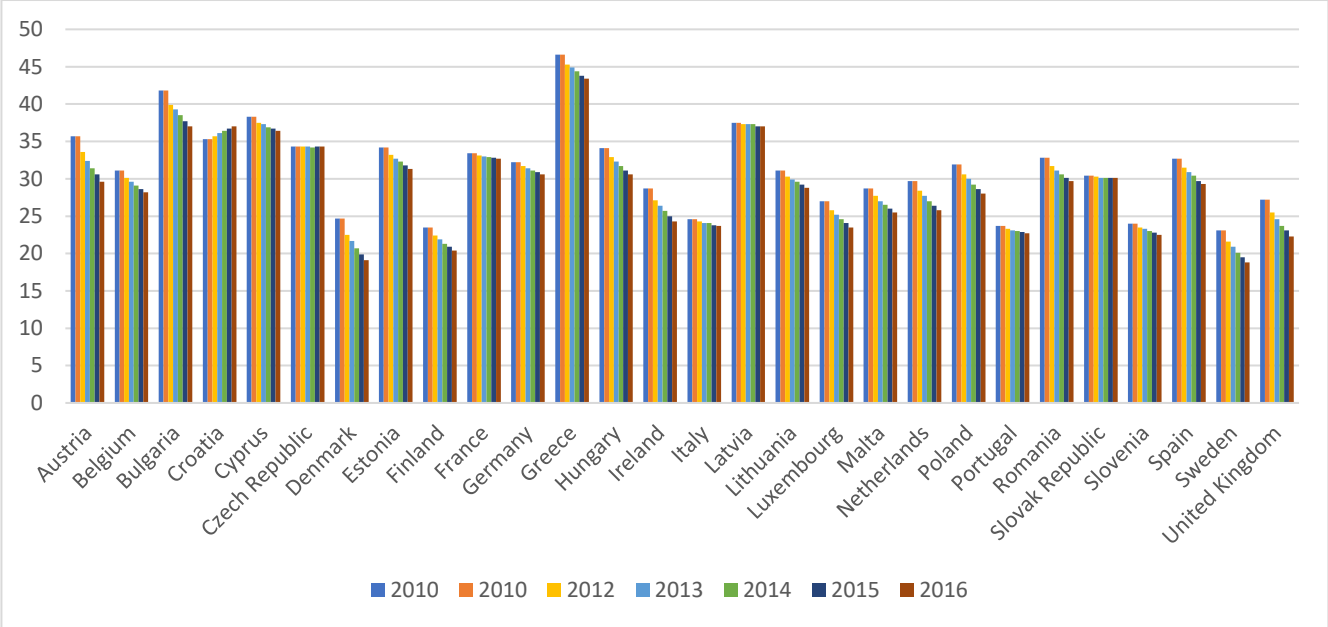

Figure 2. 1 Smoking prevalence rates across EU, 2010-2016. Percentage of regular smokers in the population, (age 15+).

Source: World Data Bank Indicators (WDI) and author's calculations.

2.2.1 Social inequalities of smoking

Smoking has been commonly seen as one important factor of social inequality in health (Mackenbach et al. 2004). Inequalities in smoking prevalence between socioeconomic groups vary between EU countries. Among all socioeconomic groups, individual cigarette consumption is estimated to vary between 15 and 30 cigarettes a day, with consumption levels corresponding to factors affecting affordability (Lopez et al., 1994). At a population level, smoking prevalence also varies between socioeconomic groups, changing in relative levels at different stages in the tobacco epidemic.

Lopez et al. (1994) constructed a four-stage model which describes the relationship between smoking prevalence and smoking-attributable mortality and summarizes the various phases of the smoking epidemic. The same research suggests that as countries progress through the tobacco epidemic, smoking prevalence will become more prominent among lower socioeconomic groups.

According to the European health interview survey (EHIS)[1] which was conducted between 2013 and 2015 and covered persons aged 15 and over, there are differences in smoking patterns by educational attainment level across EU countries. Particularly, people having completed tertiary education appear generally the lowest rates of daily smoking, while those having completed upper secondary or post-secondary non-tertiary education have the highest (see Appendix I, Figure I.2). In Greece, Cyprus and Romania the lowest smoking prevalence was among persons having completed lower secondary education. However, these patterns vary significantly by gender. Particularly, the lowest proportions of daily smokers among men were recorded for those having completed tertiary education, except for Romania. For women the results were different, both women having completed tertiary education and those having completed lower secondary education showed relatively low proportions of daily smokers.

Regarding the age profile of daily smokers, the patterns are similar for men and women. Most of the EU member states reported the highest proportions between the ages of 25 and 54 and the lowest in the age groups over 65. Over the last years, the smoking prevalence increased between age groups 15–24 and 25–34; the proportion of daily smokers remained generally high for the age groups from 25–34 to 45–54; and the lowest rates by far are reported among the older age groups.

[1] The European Health Interview Survey (EHIS) includes information from all European Union (EU) member states and is to be conducted every five years according to the Regulation (EC) No 1338/2008 on Community statistics on public health and health and safety at work. EHIS wave 2 is conducted in all EU member states between 2013 and 2015 according to the Regulation (EU) No 141/2013 as regards statistics based on the European Health Interview Survey (EHIS).

Considering the volume of tobacco consumption, according to the afore-mentioned survey (EHIS), in 2014, 5.9 % of the population over 15 years of age consumed at least 20 cigarettes per day and around 12.6 % consumed less than 20. The highest proportion of heavy smokers was reported in Greece, while in Sweden the share was 14 % and in Finland all daily smokers consumed less than 20 cigarettes a day. Daily, the proportion of light cigarette smokers as a percentage of the total adult population was almost similar, ranging from 7.5 % in Sweden, 8.3 % in Denmark and 8.8 % in Luxembourg to 16.5 % in Latvia, 17.6 % in Slovakia and 19.6 % in Hungary. On the flip side, there was a wider range as regards the proportion of heavy smokers in the adult population varying from 0.0 % in Finland, 1.2 % in Sweden and 3.6 % in the United Kingdom to 10.0 % in Poland, 11.8 % in Croatia, 12.1 % in Cyprus and 12.7 % in Bulgaria, peaking at 15.1 % in Greece. Note that men were more likely than women to be heavy smokers, as happened with the general pattern for all daily smokers (see Appendix I, Figure I.3).

2.2.2 Relative Market Values of Tobacco and Nicotine Products

The overall market value of tobacco products (cigarettes, fine-cut tobacco, cigars/ cigarillos and other smoking tobacco) was almost €139.8 billion in 2017, of which 85.12% consisted of cigarettes. Figure 2.2 provides an overview of the relative market value of a number of tobacco products in 2017.

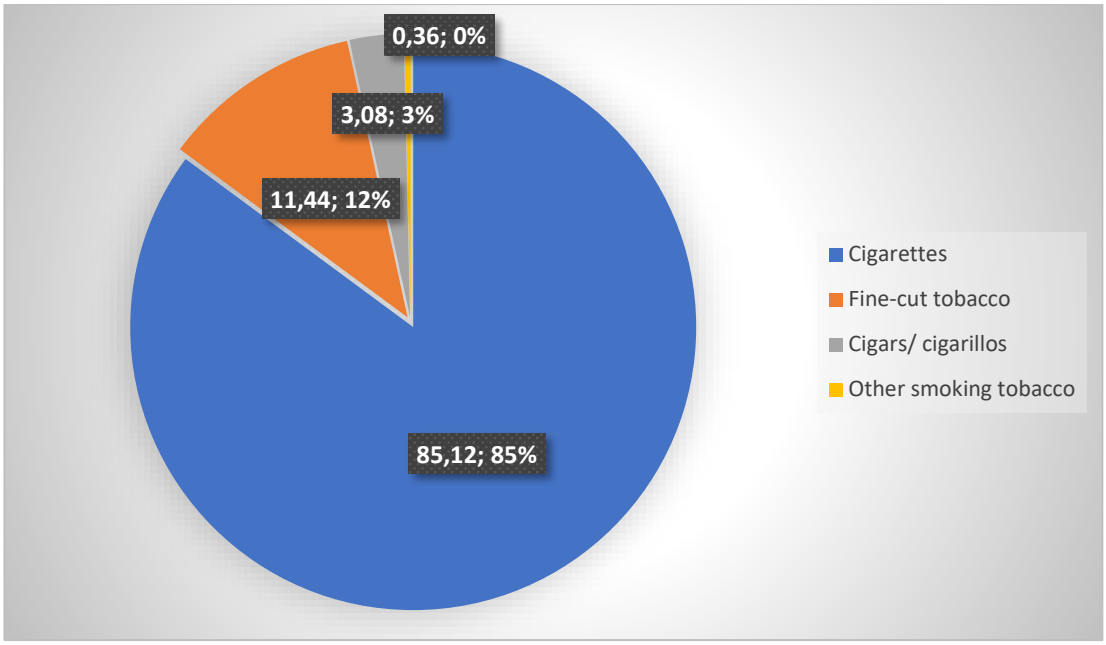

Figure 2. 2 Comparison of relative market value of tobacco products in 2017 (in billion EUR). Source: Euromonitor, Matrix report (2013).

As can been seen from Figure 2.2, although the sale volumes of cigarettes have declined in the last decade, the overall market value has increased owing to the tax increases and continuous development of premium brands sold at higher prices. Four large multinational companies (Philip Morris International, British American Tobacco, Japan Tobacco and Imperial Tobacco) control for the cigarette manufacturing accounting for around 90% of the EU factory-made cigarette (FMC) market, as analyzed in Chapter 5. The figure below illustrates the trends of tobacco products over the period 2000-2017.

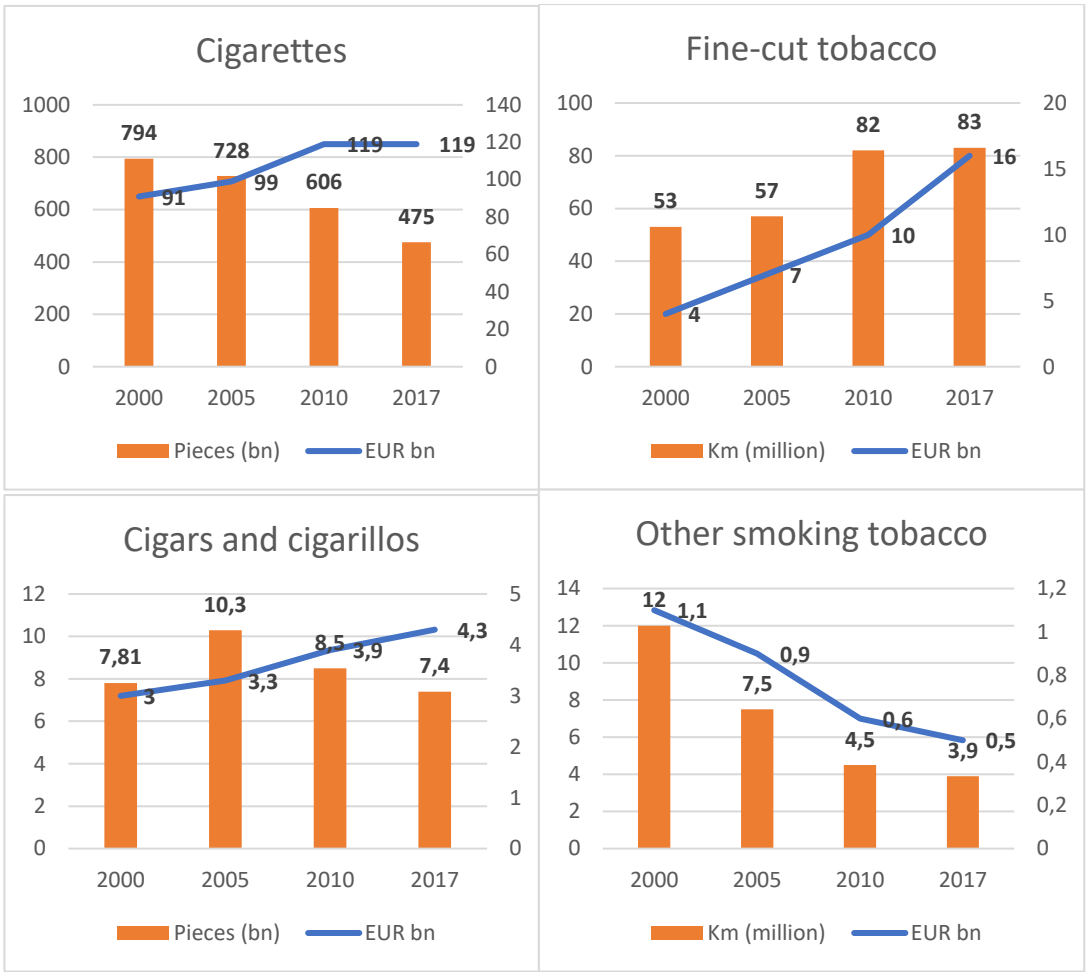

Figure 2. 3 Trends for tobacco products (consumption in pieces or km and revenues in € per tobacco product).

Source: Euromonitor, European Commission.

As illustrated in Figure 2.3, all tobacco products experience a decreasing trend during the period 2000-2017. A remarkable exception, though, is fine-cut tobacco, where the volumes are slightly growing while its market value has a sharp increase related to the tax increase. In particular, the fine-cut tobacco has increased significantly in recent years and accounts for almost 11,4% (€16 billion) of the total tobacco market in 2017. This market is also characterized by strong presence of the four afore-mentioned biggest fine-cut tobacco manufacturers accounting for about 70% of the market (see Appendix I, Table I.1).

The market value of cigars/ cigarillos and other smoking tobacco are considerably smaller representing just 3.5% of the total market value. These products as well as chewing and nasal tobacco

products are to a large extent manufactured by small-medium enterprises (SMEs). The pipe tobacco and the cigar markets have been decreasing consistently over the last ten years. On the other hand, the increase in cigarillo sales was partly due to the thriving sales of so-called eco-cigarillos which are not typical cigarillos but were re-classified as cigarettes[2].

2.2.3 E-cigarette market

E-cigarettes are currently not subject to a harmonized tax as the definitions of Articles 2-6 of Directive 2011/64/EU on structure and rates of excise duty applied to manufactured tobacco do not envision the application of excise duties on e-cigarettes. Actually, the wording of these articles contains neither tobacco nor do they imply combustion (hence cannot be considered as being "intended to be smoked"). Though, almost half of member states have introduced an ad hoc taxation at national level. Obviously, the differentiation of tax treatments between tobacco products and e-cigarettes may distort the function of tobacco market. A report of London Economics (2018) estimates the hypothetical excise duty loss caused by substitution between traditional cigarettes and e-cigarettes to be less than 2.5% (€2 billion) of the total revenue of excise duty on cigarettes in the EU.

Directive 2014/40/EU, which is so called Tobacco Products Directive (TPD) regulate the manufacture, presentation and sale of tobacco and related products, providing also a definition of e-cigarettes[3]. In line with its Article 20, e-cigarette is a product that can be used for consumption of nicotine-containing vapor via a mouth piece, or any component of that product, including a cartridge, a tank and the device without cartridge or tank. Electronic cigarettes can be disposable or refillable by means of a refill container and a tank, or rechargeable with single-use cartridges. The TPD aimed at diminishing the variation of policies implemented at every member state regarding e-cigarette use,

[2] Directive 2010/12/EC on the structure and rates of excise duty applied on manufactured tobacco.
[3] See article 20 of Directive 2014/40/EU (OJ L 127, 29.4.2014, p. 1–38).

introducing among others, specific requirements for the packaging, labelling, safety, monitoring and reporting of e-cigarettes.

Official data on the size of the e-cigarette market and consumption levels are unavailable so far. So, e-cigarette trends remain still unclear and depend on the source of the market estimates. Tobacco literature confirms this unavailability of data regarding the precise patterns of use (Beard et al., 2016; Farsalinos et al., 2016; Filippidis et al., 2017) and the ambiguous definitions i.e. regular e-cigarette use or the transition from experimentation to regular use (Amato et al., 2015; Pearson et al., 2017).

According to Euromonitor survey (2014)[4], the EU e-cigarette market increased more than tenfold from €0.2 billion in 2010 to €2.2 billion in 2014. Similarly, a study of European Commission (2020), based on solid estimates of various sources, suggests that the number of e-cigarette regular consumers in the EU has doubled between 2013 and 2017 from approximately 6 to more than 12 million users with most of them to use e-cigarettes daily. Considering all of them daily-equivalent users, the total number of users is estimated to be close to 10 million. As depicted in Figure 2.4, the United Kingdom and France report the highest prevalence which exceeds 4-5% of the population with market size of €776 million and €544 million respectively. The following largest national markets are Italy, Germany and Poland which worth between €100 and €300 million, while in other EU countries they amount on average to 1-2%. Recent research highlights that the UK is a clear outlier with high transition level experimentation to regular e-cigarette use, with this transition rate reaching ten times higher than in some member states like Bulgaria, Croatia, Italy, Romania and Sweden (McNeil et al., 2018). Overall, the value of the e-cigarettes market throughout the EU in 2017 is estimated at about €2.54 billion.

[4] Euromonitor International. Passport Database. London, United Kingdom: Euromonitor International; 2014.

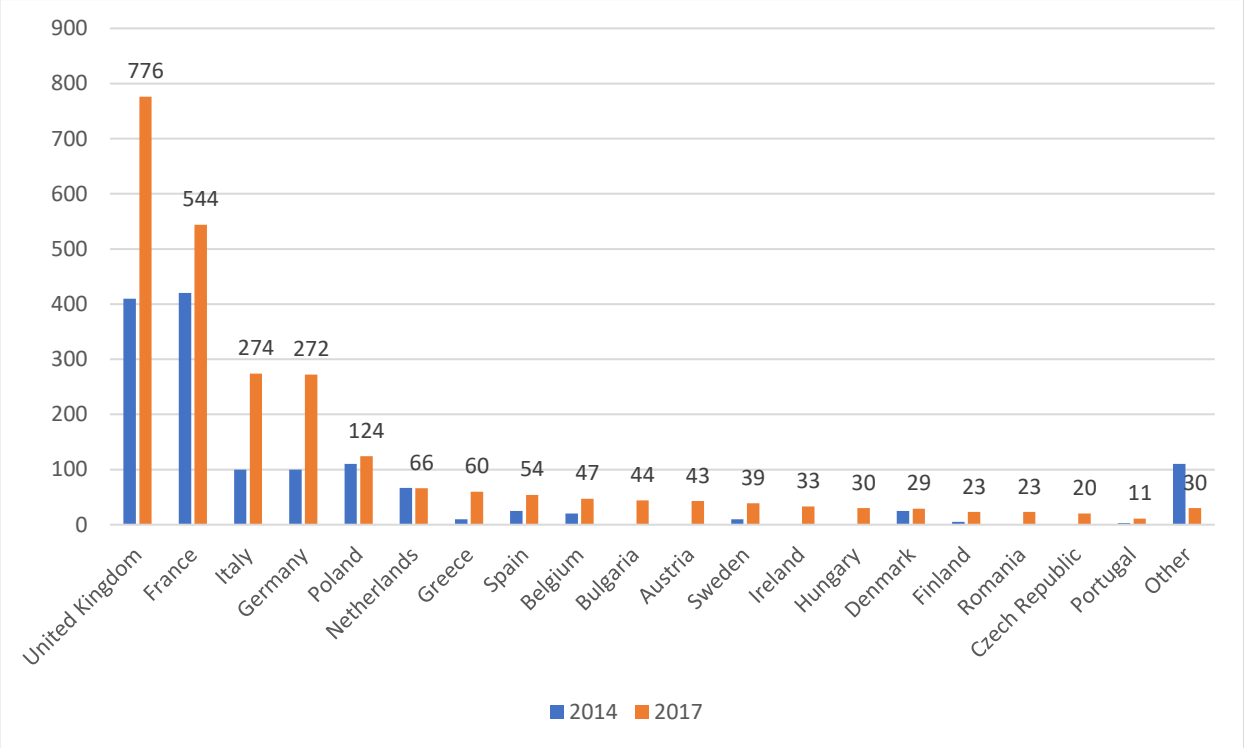

Figure 2. 4 Estimated market value of e-cigarettes in member states (€ million) in 2014 and 2017. Source: European Commission (2020).

As far as socio-economic characteristics of e-cigarette users are concerned, most European surveys find that the prevalence of e-cigarette use is highest among youth, current combustible tobacco users or past-year quit attempters (Gallus et al., 2014; Martínez-Sánchez et al., 2014; Vardavas et al., 2015; Kaufman et al., 2015; Vardavas et al., 2015). Nevertheless, there is evidence (Filippidis et al., 2017) advocating that e-cigarette use increases among non-smokers between 2012 and 2014; a finding that provokes concerns about the popularity in population groups not addicted to nicotine. Further, relevant evidence from European Commission (2015) suggests that a majority of smokers initiate e-cigarette as an effort for smoking cessation, although its effectiveness remains still unproved.

2.2.4 Heated Tobacco Products

Another emerging market is Heated Tobacco Products (HTP) which are also not explicitly mentioned in Directive 2011/64/EU since the product appeared on the market after its entry into force. Whether this novel product should be considered as an excisable manufactured tobacco product or not remains unanswered from member states. Its expansion is impressive as in less than two years, HTP have been introduced in 17 member states and further diffusion is expected.

The HTP market is dominated by three leading tobacco product manufacturers: Philip Morris International (PMI), Japan Tobacco International (JTI) and British American Tobacco (BAT). Since PMI launched iQOS in Japan at the end of 2014, iQOS has been introduced in 34 other countries[5] (as of April 2018). JTI was the first entrant into the global new generation HTP market with the 2013 launch of the Ploom HTP, while BAT was the third entrant into the new generation HTP market, with its introduction of iFuse, in Romania in 2015. Finally, Korea Tobacco (KT&G) also entered the HTP market with the launch of lil in 2017 in the Republic of Korea.

Market size of Heated Tobacco Products in 2017 was 1.9 billion pieces with a market value of €432 million and Euromonitor International (2018) expects HTP totals to increase more than six-fold by 2021, according to its 2018 forecast[6]. Profit margins for PMI's iQOS are 30%–50% higher than for conventional cigarettes, leading some analysts to project that iQOS sales will contribute up to 15% of PMI's profits in 2019 (Chaudhuri, 2017). Figure 2.5 illustrates the evolution of heated tobacco products' users between 2017 and 2018.

[5] Andorra, Bulgaria, Canada, Colombia, Croatia, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Guatemala, Italy, Israel, Kazakhstan, Republic of Korea, Lithuania, Monaco, the Netherlands, New Zealand, Palestine, Poland, Portugal, Romania, Russia, Serbia, Slovak Republic, Slovenia, South Africa, Spain, Switzerland, Turkey, Ukraine and the United Kingdom.
[6] Euromonitor International. Tobacco 2018.

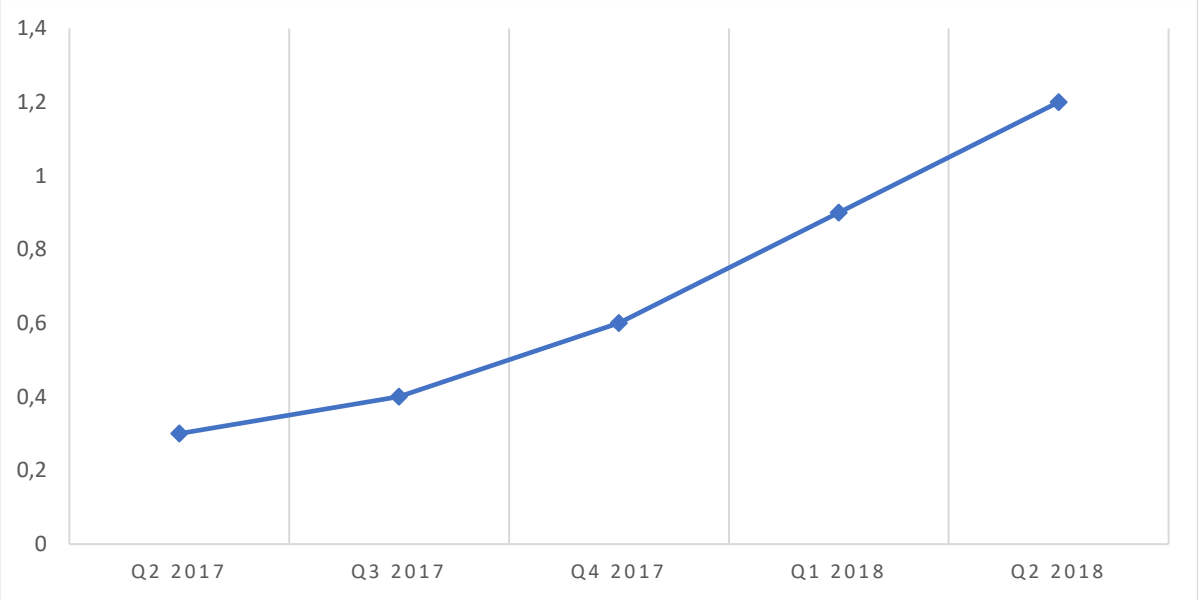

Figure 2. 5 Users of heated tobacco products in the EU in million.

Source: European Commission (2020).

Despite the fast expansion of novel tobacco products, it should be noted that the market value for e-cigarettes and heated tobacco products still remain small (around €3 billion) in comparison to the total cigarette market, valued at approximately €119 billion.

2.2.5 Determinants of cigarette consumption

2.2.5.1 Affordability

This section reviews the existing literature on cigarette consumption determinants. First contributor factor analyzed in this section is the cigarette affordability and its impact on the tobacco prevalence rates that has been well documented in tobacco control literature.

Affordability is defined as the ability of an individual to purchase a product, as a result of the effect of both the product price and the individual's income. Given that affordability considers the simultaneous effect of income and cigarette price on a person's buying decision, it is undeniably an efficient control policy tool, as it catches up with the pace of economic growth. Tobacco control

policies aiming at curbing the smoking epidemic should set the benchmark in terms of affordability, rather than in terms of real prices, especially for countries experiencing very rapid economic growth.

A number of measures have been developed to estimate the cigarette affordability. First, studies of Scollo (1996) and Lal A. and Scollo M., (2002) used Big Mac (McDonalds hamburger) prices for assessing affordability. Based on the Economist magazine, publishing the Big Mac Hamburger Standard and listing the price in US dollars of a Big Mac in 33 countries, Scollo calculated the "Big Mac Index", as a proxy index of cigarette affordability for each country. However, Scollo only investigates differences in relative prices between countries without accounting for differences in income levels between countries. To correct the drawback of previous measure, Guindon et al. (2002) calculated the average number of working minutes required to buy a pack of local brand or Marlboro (or equivalent) cigarettes, based on the Union Bank of Switzerland (UBS) survey of prices and earnings[7]. Despite the fact that Guindon provides a more direct way of estimating people's income, the weakness is that the UBS survey on earnings is performed only every three years and covers a much smaller sample of cities than the Scollo's survey on cigarette prices. A similar measure to Guindon's "minutes of labour" method was proposed by Kan (2007) defining affordability as the percentage of daily income required to buy a pack of cigarettes.

In order to create a more realistic measure of affordability of cigarettes, Blecher and Van Walbeek (2004) developed the Relative Income Price (RIP) which is defined as the percentage of per capita Gross Domestic Product (GDP) required to purchase 100 packs of cigarettes. The higher the RIP is, the less affordable cigarettes become and vice versa. The RIP ratio is a relative measure that allows for comparison reasons over time and across countries and thus having advantages in capturing and comparing the real cost of cigarettes. Besides, Blecher and Van Walbeek (2009) content that RIP is

[7] Union Bank of Switzerland. Prices and earnings around the globe, 2000 ed. Union Bank of Switzerland, 2000.

most appropriate when measuring affordability in low- and middle- income countries, whereas for high-income countries, the income measure is not significant.

Both economic theory and empirical evidence clearly underscore the affordability effect, rather than prices alone, on cigarette consumption. Cigarette affordability is a key determinant of the demand for cigarettes because the increase in income may erode the effects of taxes or prices by making cigarettes more affordable (He et al., 2018). A study of Kostova et al. (2014) upon smoking initiation and cessation in low- and middle- income countries shows that affordability mediates the effects of tax/price and income on tobacco use. A comparing research of Guindon et al. (2002) of 80 countries during the 1990s indicates that cigarette prices fail to keep up with increases in the general price level, rendering the cigarettes more affordable in many developing countries, but more expensive in most developed countries, with only some exceptions. Kan (2007) points out that the cigarette price hikes in newly emerging economies, such as China, India, and Singapore, have lagged behind the high speed of economic growth and as a result, there is room for further tax increases and government revenue generation.

Several studies examine the relation between cigarette affordability by estimating the affordability elasticities of demand. Blecher & Walbeek (2004) estimate the affordability elasticity of demand for seventy countries worldwide between 1990 and 2001 at -0.53[8] and He et al. (2018) estimate the same elasticity for seventy-eight countries worldwide over the period 2001-2014 at -0.20. Blecher & Walbeek (2009) find that in high-income countries cigarettes are significantly more affordable than in low- and middle-income countries. Moreover, they find that the effect of cigarette affordability on per capita consumption differs significantly between high-income countries and low- and middle-income countries. Further, Krasovsky (2012) also displays the decrease of tobacco affordability as a result of both tax hikes and economic recession leading to tobacco consumption decline. Similarly,

[8] A simple interpretation is that a 10% increase in the relative income price (RIP) decreases cigarette consumption per capita by 5.3%.

several other studies examine the trend in cigarette affordability in different parts of the world over different time periods (Guindon et al., 2002; Kan 2007; Kostova et al., 2014). The majority of researches conclude that per capita cigarette consumption is negatively associated with cigarette affordability, indicating that smokers consume less cigarettes as cigarettes become less affordable.

Figure 2.6 depicts the evolution of cigarette consumption and affordability, as measured by RIP ratio across the EU[9] for the time period 1995 to 2018.

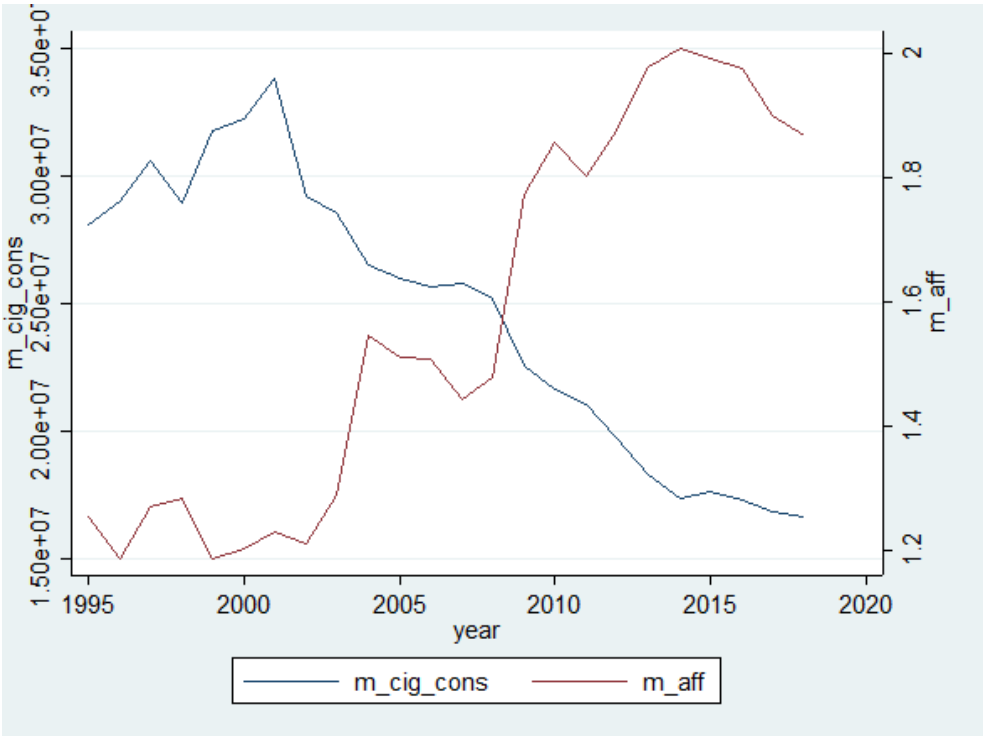

Figure 2. 6 Cigarette consumption and affordability across the EU, 1995 - 2018.

Notes: *m_cig_cons* is the median value of releases for consumption of cigarettes per 1,000 cigs; m_aff is the median value of cigarette affordability measured by RIP ratio. Data on consumption releases are obtained from the Excise Duties Tables series compiled by Directorate-General for Taxation and the Customs Union (DG TAXUD) and published in the European Commission data base, and RIP is calculated by dividing the price of 100 packs of cigarettes by GDP per capita.
Source: European Commission (DG TAXUD) and author's calculations.

As can been seen from Figure 2.6, cigarette consumption and affordability have opposite trrends, indicating that as cigarettes become less affordable (higher RIP), cigarette consumption declines; a finding which is in accordance with the prevailing evidence.

[9] There are missing data for countries respectively for the years that they had not yet joined to the EU.

2.2.5.2 Tobacco control - Law framework on tobacco control in the EU

The EU's main policy measures related to tobacco consumption aim to protect people from the hazardous effects of smoking and other forms of tobacco use, including against second-hand smoke. First, these policies intend to regulate the general framework of tobacco products in terms of packaging, labeling, and ingredients, through the Tobacco Products Directive 2014/40/EU and to fulfil the approximation of the laws, regulations and administrative provisions of the member states relating to the advertising and sponsorship of Tobacco Advertising Directive 2003/33/EC[10] of the European Parliament and of the Council. Further, they enforce limitations where people may smoke, as supported by the 2009 Council Recommendation on smoke-free environments; they impose tax measures and activities against illicit trade, through the 2010 Directive 2011/64/EU on excise duty on tobacco which amended the structure and rates of duty with public health goals in mind; or carry out anti-smoking campaigns, such as the 2011–13 'ex-smokers are unstoppable' campaign.

Since the adoption of Directive 2014/40/EU, a number of regulatory changes happened. The Directive lays down rules governing the manufacture, presentation and sale of tobacco and related products aiming to improve the functioning of the internal market for tobacco and related products, while ensuring a high level of health protection for European citizens. The Directive entered into force on 19 May 2014 and became applicable in the EU member states on 20 May 2016. The primary object is to approximate the laws, regulations and administrative provisions of the member states concerning, as described by the Directive: (a) the ingredients and emissions of tobacco products and related reporting obligations, including the maximum emission levels for tar, nicotine and carbon monoxide for cigarettes; (b) certain aspects of the labelling and packaging of tobacco products including the health warnings to appear on unit packets of tobacco products and any outside packaging as well as

[10] Directive 2003/33/EC of the European Parliament and of the Council of 26 May 2003 on the approximation of the laws, regulations and administrative provisions of the Member States relating to the advertising and sponsorship of tobacco products.

traceability and security features that are applied to tobacco products to ensure their compliance with this Directive; (c) the prohibition on the placing on the market of tobacco for oral use; (d) cross-border distance sales of tobacco products; (e) the obligation to submit a notification of novel tobacco products; and (f) the placing on the market and the labelling of certain products, which are related to tobacco products, namely electronic cigarettes and refill containers, and herbal products for smoking.

The Directive sets as a priority to smooth the function of the internal market for tobacco and related products, providing a high level of human health protection and to meet the obligations of the Union under the World Health Organization Framework Convention for Tobacco Control (WHO FCTC**).** Union and its member states have all ratified the FCTC adopting a set of guidelines for the implementation of FCTC provisions by consensus during various Conferences. The FCTC provisions are relevant to Directive 2014/40/EU and particularly refer to the regulation of the contents of tobacco products and tobacco product disclosures, the packaging and labelling of tobacco products, advertising and illicit trade in tobacco products. The effective implementation of the WHO FCTC focuses on the strategies contained in the MPOWER measures introduced by WHO to assist in the country-level implementation of tobacco demand reduction measures contained in the WHO FCTC. The six components of MPOWER are: 1) Monitor tobacco use and prevention policies; 2) Protect people from tobacco smoke; 3) Offer help to quit tobacco use; 4) Warn about the dangers of tobacco; 5) Enforce bans on tobacco advertising, promotion and sponsorship; and 6) Raise taxes on tobacco.

In a broader context of tobacco control, it should be noted that current Directive regulates the introduction of an EU-wide tracking and tracing system for the legal supply chain. This system, consisted of visible and invisible elements (e.g. holograms), intends to help law enforcement bodies, national authorities and consumers detect illicit products. The entry into force of the track and trace system for cigarette packs and fine-cut tobacco in 2019 aimed to contribute to effective controls against tax fraud. The traceability system obliges the economic operators to mark all unit packets of tobacco products with a unique identifier in order to track and trace the movement of legal tobacco products

and allow public authorities to determine when a product is diverted into the illegal market. However, of particular importance remains the lack of control of the supply chain notably for raw tobacco and the risk of fiscal evasion due to the growing illicit production of cigarettes within the EU, as the upstream part of the supply chain (i.e. from raw tobacco to the manufacturing site) is left without effective control.

2.2.5.3 Implementation and evaluation of tobacco control policies in the EU

The tobacco prevention policies set the foundation for reducing both demand and supply of tobacco use and are crucial to control the tobacco epidemic. Even though there is strong evidence relating tobacco control measures with tobacco consumption, there have been relatively few attempts so far to measure the implementation of tobacco control policies systematically at country level.

In 2008, WHO introduced MPOWER, as mentioned before, a package of measures intended to assist in the country-level implementation of the following articles of the WHO Framework Convention on Tobacco Control (WHO FCTC): Article 20 – Research, surveillance and exchange of information (Monitoring); Article 8 – Protection from exposure to tobacco smoke (Smoke-free environments); Article 14 – Demand reduction measures concerning tobacco dependence and cessation (Cessation programs); Article 11 – Packaging and labelling of tobacco products (Warning labels); Article 12 – Education, communication, training and public awareness (Mass media); Article 13 – Tobacco advertising, promotion and sponsorship (Advertising bans); Article 6 – Price and tax measures to reduce the demand for tobacco (Taxation). WHO reports on data collected measuring the success of MPOWER and assessing progress made by countries in its Report on the Global Tobacco Epidemic. International Tobacco Control Policy Evaluation Project (ITC Project) is the first international research program for the systematic evaluation of key policies of the WHO FCTC at the population level. Besides, Fong et al., (2006) developed a conceptual model that is a hypothesized causal chain which measures how tobacco control policies exert their influence on tobacco use behaviours (See

Appendix I, Figure I.4). Additionally, the European Network for Smoking and Tobacco Prevention (ENSP), an international non-profit organization active in coordinated actions in tobacco control, created in 1997 under Belgium law (identification number 16377/97), represents a large network of healthcare professionals academics, researchers and experts, and supports its members in their involvement with implementation of the WHO FCTC. In cooperation with ENSP, the European Respiratory Society (ERS), an international organization of healthcare professionals, scientists and other experts working in respiratory medicine aim to raise awareness of tobacco-related diseases and promote the adoption and implementation of tobacco control policies.

In terms of EU tobacco control evaluation, Joossens and Raw (2006) introduced the Tobacco Control Scale (TCS) in their effort to measure the implementation of six tobacco control policies at country level, based on six policies described by the June 2003 World Bank fact sheet[11]: (1) price increases through higher taxes on cigarettes and other tobacco products; (2) bans/restrictions on smoking in public and work places; (3) better consumer information, including public information campaigns, media coverage, and publicizing research findings; (4) comprehensive bans on the advertising and promotion of all tobacco products, logos and brand names; (5) large, direct health warning labels on cigarette boxes and other tobacco products; and (6) treatment to help dependent smokers stop, including increased access to medications.

The national-level implementation of tobacco control policies was evaluated for every MS, through a scoring system developed by a panel of experts. The scale was developed by means of a questionnaire sent to European Network for Smoking and Tobacco Prevention (ENSP) correspondents in the participant 28 countries EU MS who had agreed to fill in their country data. They were the official country representatives to ENSP and members of their national coalition and thus cognizant of tobacco control. The Tobacco Control Scale (TCS) shows the points allocated to each policy, with a maximum potential score of 100. Hence, the six components of the TCS and their corresponding score

[11] World Bank. Tobacco control at a glance. Washington DC, 2003. www.worldbank.org/tobacco

are: price (30 points), public place bans (22 points), public information campaigns spending (15 points), advertising bans (13 points), health warnings (10 points) and treatment (10 points). Joossens and Raw have reported TCS data for the years 2005, 2007, 2010, 2013 and 2016. The results of these reports show that most of countries accordingly implement the recommended control policies, but with considerable differences across EU (Thyrian et al., 2008; Bosdriesz et al. 2015).

2.2.5.4 Impact of tobacco control policies on cigarette consumption

According to theoretical and empirical evidence, comprehensive tobacco control measures reduce smoking prevalence (World Bank, 2003; Joossens and Raw, 2006; Hublet et al., 2009; Currie et al., 2013;). The most challenging issue is that these control attempts have to counter with the social acceptability of smoking as well as the maintenance of smoking behaviour among established smokers (Ling and Glantz, 2000, 2004; Pollay, 2000). Indeed, the tobacco industry has recognized since the 1970s that the most serious threat it faces is declining social acceptability of smoking that creates an environment where non-smoking is the normative and desirable lifestyle (The Roper Proposal, 1972; Glantz, 1987). More so, the tobacco industry's concern is corroborated by a body of studies demonstrating that adolescent smoking uptake and progression are significantly influenced by tobacco advertising affecting smoking perceptions (Pierce et al., 1998; Biener and Siegel, 2000; Choi et al., 2002). In the same lines, Sly et al., (2001; 2002) finds correlation between tobacco control policies focusing on making tobacco use an unacceptable and abnormal practice with remarkable success in reducing youth smoking. So, given the well-established normative influences on both thought and behaviour (Aarts and Dijksterhuis, 2003), the policy makers ought to design programs that deliver normative information as a primary tool for changing smoking behaviour.

A handful of studies suggest a process describing the steps involved in designing a social norms campaign and depict this mechanism underlying how one's perceptions might be influenced so as to change his behaviour (Haines, 1996; Berkowitz, 2003c; Perkins, 2003; Linkenbach et al., 2003).

Econometric and ecological studies contend that strong state and local restrictions on smoking is likely to reduce smoking participation and consumption among youths (Chaloupka and Grossman, 1996; Siegel et al., 2005) and overall tobacco use among adults (Rigotti and Pashos, 1991; Wasserman et al., 1991; Stephens et al., 1997). In particular, Wasserman et al. (1991) found strong negative association between strict regulations on smoking in public places and number of cigarettes consumed by teenagers. Likewise, Chaloupka and Grossman (1996) found an important correlation between public places bans and youth smoking reduction, and more specifically, a significant effect of smoking restrictions in schools on the average number of cigarettes smoked by young smokers. Chaloupka and Wechsler (1997) also linked the smoking bans in restaurants and schools with lower smoking participation of college students. Growing evidence suggests a significant impact of smoking restrictions in the workplace and at home on the consumption decline (Brownson et al., 1997; Chapman et al., 1999; Farkas et al., 1999), on the intentions to quit or relapse prevention (Gilpin et al., 1999; 2002), and probably on increased cessation (Farkas et al., 1999; Biener and Nyman, 1999). Finally, Lantz et al. (2000) reveal that smoking restrictions in public places may influence quit rates.

Although the tax hikes are the most effective tool for reducing smoking (Clancy, 2009; Chaloupka et al., 2012), the evidence suggests that the best result is achieved with implementation of a comprehensive tobacco control policy (Joossens and Raw, 2006). Despite the rich literature dealing with tobacco control effect on consumption, only a small number of studies actually look into tobacco control interventions and policies e.g. the effects of prices and bans and/or restrictions on tobacco consumption in several European countries at the same time (Cox and Smith 1984; Laugesen and Meads 1991; Stewart 1993; Saffer and Chaloupka 2000; Escario and Molina 2001; Nelson 2003; and Gallus et al. 2006). Recently, Gravely et al. (2017) analyzed WHO data from 126 countries and found that the implementation of key demand-reduction WHO FCTC policies (MPOWER policies) at the highest level was strongly associated with reductions in smoking prevalence from 2005 to 2015, the first decade of the treaty. Similar findings were indicated by Ngo et al. (2017) who studied the relation

between MPOWER scores and smoking prevalence changes for the period 2007–2014. Feliu et al. (2019) showed that countries, in the EU-27, with higher scores in the TCS, which indicates higher tobacco control efforts, had lower prevalence of smokers, higher quit ratios and higher relative decreases in their prevalence rates of smokers over the last decade. Furthermore, bans on public places and health warnings were among the individual TCS components that showed a higher association with both lower smoking prevalence and higher quit ratios in 2014. These results are in agreement with other studies showing a reduction in smoking prevalence and an increase in quit ratios after implementing tobacco control policies (Schaap et al., 2008; IARC, 2009; Martínez-Sánchez et al. 2014; Lidón-Moyano et al., 2017).

In conclusion, health campaigns and policy actions should encompass an integrating approach driven mainly by the damaging health effects of tobacco consumption in order to change the social conceptions about the acceptability of smoking.

2.2.5.5 Smoking and unemployment

Several studies have indicated that smoking is associated with unemployment (Hammarstrom, 1994; Leino-Arjas, 1999). In particular, Hammarstrom, (1994) argue that unemployment is a risk factor for tobacco smoking in young people, especially among women.

Despite a substantial body of research, however, there is controversy over whether unemployment relates to tobacco consumption (Henkel, 2011). Indeed, previous studies have stressed conflicting assumptions indicating that unemployment could protect against tobacco or other substances consumption, on one hand, or that it might encourage smoking or other unhealthy habits, on the other (Ruhm, 1995; Ettner, 1997; Ruhm & Black, 2002; Davalos & French, 2011; Henkel, 2011; Pacula, 2011). In spite of little evidence found in the paper of Chandola et al. (2004), a majority of studies investigating the relationship between unemployment and smoking showed that job loss raised the likelihood of relapse after cessation (Falba et al., 2005). This is in accordance with other studies within

EU suggesting that former addicted people relapse back into their smoking habit or other unhealthy behaviour during economic crisis, most frequently associated with unemployment status (Gallus et al., 2011). Further, several studies found that job loss increased odds of starting smoking (Hammarström & Janlert, 1994) and tobacco consumption (Falba et al., 2005; Hammarström & Janlert, 1994), while it reduced the probability of cessation (Rose et al., 1996; Weden et al., 2006). Particularly, Arcaya et al., (2014) demonstrated that unemployment was related to nearly twice the odds of subsequent smoking, in comparison with employment, and with increased cigarette consumption among male, but not female, smokers.

In a broader context, a research by Montgomery et al. (1998) showed that both recent and accumulated unemployment are associated with deterioration of health, establishing life-long patterns of hazardous behaviour including cigarette smoking. Relevant conclusions in the EU demonstrated, also, that existing socio-economic discrepancies lead to societal inequalities, including tobacco and other substance use patterns (Tarantilis, 2015). In line with previous studies, a survey of European Commission (2015), conducted in order to monitor Europeans' attitudes to a range of tobacco-related issues, confirm established socio-demographic tendencies, suggesting that, inter alia, the unemployed were more likely to have a smoking habit than those in other social groups. Similarly, a European Commission report (2014) suggested a high association between smoking cessation and the unemployed rather than those in managerial and professional positions.

Summing up, overall literature findings upon the association between smoking and unemployment is unclear with opposite conclusions. So, more research is needed on this topic across different cohorts using more detailed information on potential mediators and confounders. Understanding these effects and further exploring mechanisms may help encourage healthy behaviours and attitudes during economic crisis.

Figure 2.7 illustrates the changes in cigarette consumption and unemployment rate across the EU over the period 1995 up to 2018.

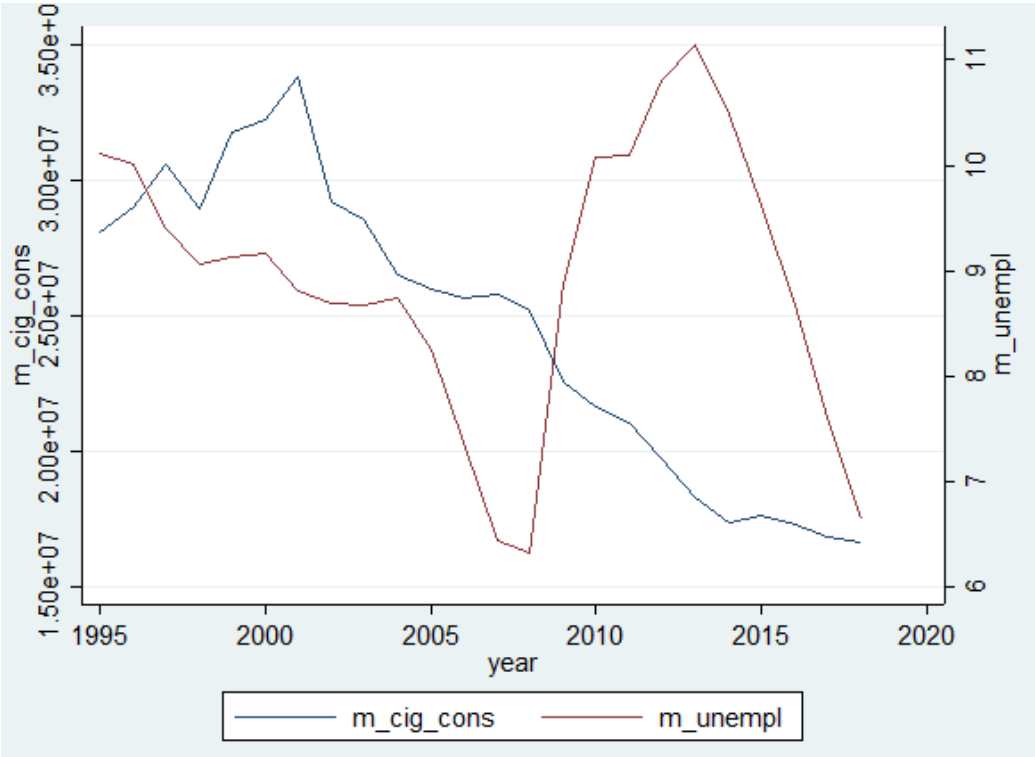

Figure 2. 7 Cigarette consumption and unemployment rate across the EU, 1995 - 2018.

Notes: *m_cig_cons* is the median value of releases for consumption of cigarettes per 1,000 cigs; *m_unempl* is the median value of unemployment rate as a percentage of total labor force. Data on consumption releases are obtained from the Excise Duties Tables series compiled by Directorate-General for Taxation and the Customs Union (DG TAXUD) and published in the European Commission data base, and unemployment rate comes from the World Data Bank Indicators (WDI) database.
Source: European Commission (DG TAXUD); World Data Bank Indicators (WDI) and author's calculations.

Figure 2.7 shows that cigarette consumption and unemployment rate have both downstream trends until almost 2008, whereas thereafter their relation is rather confounding, a finding which is in line with prevalent empirical evidence.

2.2.5.6 Smoking and education

Tobacco literature examines the effects of educational attainment on cigarette consumption. However, the overall findings remain still unclear regarding the straight impact of education on tobacco use. Firstly, Chaloupka (1991) explore differences in the price sensitivity of cigarette demand by education, among other socioeconomic characteristics and demonstrate that less educated persons reduce their tobacco consumption more in response to price increases than people who are more educated. Besides, several studies stress that less educated individuals tend to underestimate the health

consequences of smoking and the risk of becoming addicted to cigarettes (Jha et al, 2006). In line with these findings, a handful of papers suggest that the least educated are least aware of smoking harms. They are also the most addicted to nicotine and least likely to be able to quit (Siahpush et al., 2005). In another view, a survey of Eurostat (2019), conducted between 2013 and 2015 covering persons aged 15 and over, reveals that there are differences in smoking patterns by educational attainment level across EU countries. Particularly, the prevalence of daily smoking is generally lowest among people having completed tertiary[12] education and highest among those having completed upper secondary or post-secondary non-tertiary education.

Several studies have researched the existence of socioeconomic inequalities in smoking. Besides, the potential causal effect of educational attainment on lifetime patterns of cigarette smoking remains unresolved, though, it has emerged repeatedly from epidemiologic studies in the United States (Clay et al., 1988; Wagenknecht et al., 1990), Europe (Cavelaars et al., 2000; Giskes et al., 2005), Australia (Siahpush et al., 2005) and several emerging market economies (Chen et al., 2004; Pampel, 2005). Several papers studying some European countries individually (i.e. Spain, Italy Portugal), for different time periods and age groups, observed similar patterns of smoking by education and sex, a higher prevalence of smoking among men (Faggiano et al., 2001; Schiaffino et al., 2003; Santos and Barros, 2004) than women, and among women the higher educated smoked more. Additionally, educational inequalities in smoking have already been researched by Huisman et al. (2005) across EU and find that different socio-economic status measures (i.e. education and income) are more or less related to smoking depending on country, age and gender. This highlights the need to use more than one indicator of socio-economic status and furthermore to explore both gender and age interactions with socio-economic status measures.

[12] Three education levels have been formed based on the International Standard Classification of Education (ISCED)12: (1) lower secondary education or less; (2) upper secondary education; and (3) tertiary education, which is constituted by higher vocational and university education.

Figure 2.8 depicts the evolution of cigarette consumption levels and the percentage of the working age population with an advanced level of education across the EU over the period 1995-2018. The figure reveals a relation between consumption and education, but this result should be researched further with caution before any safe assumption is to be drawn.

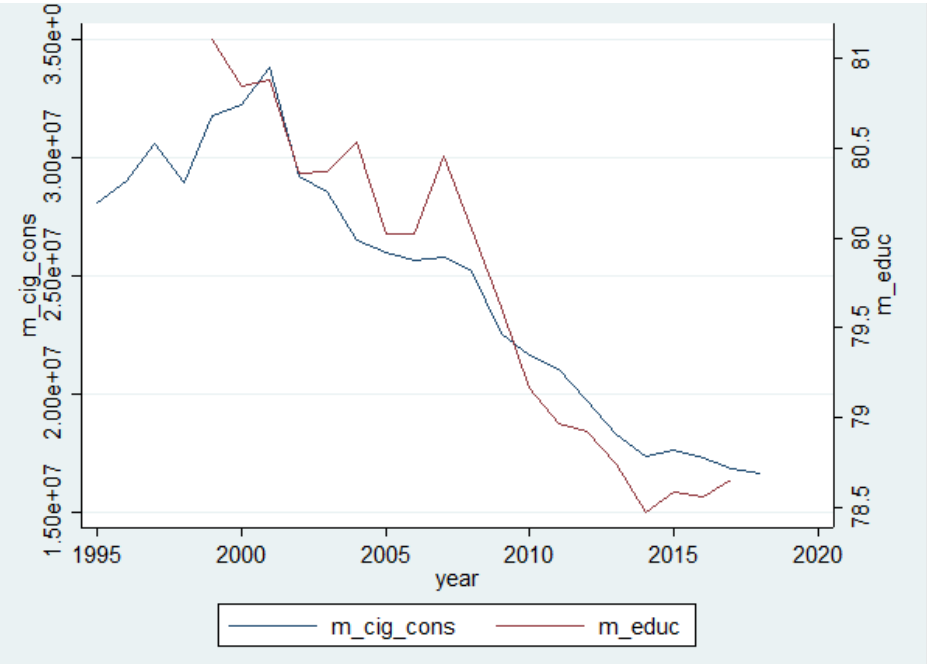

Figure 2. 8 Cigarette consumption and advanced educational level across the EU, 1995 - 2018.

Notes: *m_cig_cons* is the median value of releases for consumption of cigarettes per 1,000 cigs; *m_educ* is the median value of the percentage of the working age population with an advanced level of education. Data on consumption releases are obtained from the Excise Duties Tables series compiled by Directorate-General for Taxation and the Customs Union (DG TAXUD) and published in the European Commission data base, and educational level come from the World Data Bank Indicators (WDI) database.
Source: European Commission (DG TAXUD); World Data Bank Indicators (WDI) and author's calculations.

2.3 Empirical analysis: The association between smoking and health risk behaviours among university students in Greece.

2.3.1 Introduction

Smoking is indisputably the most preventable cause of premature death and serious related diseases (Tsalapati et al., 2014; WHO, 2017). A significant body of literature has emerged the youth smoking as an issue of utmost importance worldwide with increasing prevalence rates since the early 1990's (CDC, 2002). Investigating the most major factors affecting youth smoking may contribute to the development of more efficient tobacco control policies in order to curb the tobacco epidemic.

Prompted by this challenging issue, this study aims to answer the following questions: Is there any relationship between several health factors, such as self-perceived health status, health habits and behaviours on smoking rates in Greece? Is smoking affected by an additional estimator measuring the applied knowledge of people on health issues, known as "health literacy" (Nielsen-Bohlman, 2004; HLS-EU Consortium, 2015).

Smoking in young population is sufficiently established in tobacco literature. According to the Eurobarometer survey on smoking attitudes of Europeans, nearly 7 out of 10 of smokers and ex-smokers in the EU initiated smoking by the age of 18, while only 4% started after turning 25 (European Commission, 2012). The major risk lies on the fact that youth have been shown to underestimate the addictive nature of tobacco products, while evidence indicates that tobacco experimentation is associated with future smoking (Hodder, 2011). These findings explain why scientific evidence has concluded that tobacco prevention programs should focus on the 12-25 age group (American Lung Association, 2011; U.S. Department of Health and Human Services, 2012). Tobacco Products Directive 2014/40/EU includes provisions for reduction in smoking rates among young people through regulation of tobacco product design, manufacture and marketing, which are broadly coherent with the principles of the WHO Framework Convention on Tobacco Control.

Greece is an EU country that has not been left out of this addictive habit, presenting some of the most detrimental statistics in tobacco use and prevalence. Recent epidemiological evidence has noted that 39% of Greek men and 26% of Greek women (15+ years old) smoke daily, while 27% of young adolescents (15 – 24 years old) smoke daily or occasionally (ELSTAT, 2014). Therefore, a better understanding of what relates to the consumption of tobacco products is crucial in the policymakers' efforts in order to control it (Alpert et al., 2014; Feliu et al., 2019) and decreases the burden that smoking causes (Harvard School of Public Health, 2011). Indeed, a relevant study (Agaku et al., 2015) in EU countries indicates significant associations between cigarette design, packaging features and other marketing strategies and aspects of initial smoking among younger smokers; a finding that calls for stronger implementation of the EU Tobacco Products Directive.

As regards the effect of health indicators on smoking, tobacco evidence is rather ambiguous. A study of Prokhoorov (2003) shows an optimism bias regarding the self-perceived health status; all of the smokers tended to overestimate their self-reported health status stating that their health was either not at all or only slightly affected by smoking. Further, almost half of smokers thought that quitting would bring either no benefit or only minor benefit to their health. In the same lines, Pimenta et al. (2008) point out that ex-smokers perceive themselves as more competent to deal with their health in general than regular smokers.

Moreover, the impact of physical activity on tobacco use is widely discussed in the relative tobacco literature. Poortinga (2007) shows that physical workout is associated to smoking, underlining, though, the need for further research in order to distinguish between different types of physical activity. Further, a previous study of Blair et al. (1985) reveal an inverse relationship between smoking and leisure-time activity and a positive relation with occupational physical activity.

Considering the impact of alcohol consumption on smoking, there is sparse and poorly established evidence, especially in Greece. Findings from a recent survey of Lynch et al. (2019) suggest that moderate drinking may be associated with short-term continued smoking and heavy drinking may

be associated with relapse in the short and long term. Similarly, evidence from US indicates a strong association between heavy smoking with ever drinking among current smokers as well as a significant link between smoking cessation and drinking cessation among ever drinkers who also were ever smokers (Leon et al., 2007).

In addition, health literacy is widely considered as an important determinant of health. Although it has been defined in several ways, the proposed definition for the purposes of this study is according to the Health Literacy Score (HLS)-Eu Consortium as follows; the degree to which individuals are capable to obtain, process and conceive fundamental health information in order to make decisions about their health and life style (Sorensen et al., 2012). Despite the little evidence on the relationship between health literacy and smoking, the available literature suggests that health literacy is associated to smoking behaviour, indicating actually that improving the level of health literacy can lead to change people's behaviour in relation to tobacco consumption (Atri et al., 2018). Specifically, a study of Stewart et al. (2013) reveal that lower health literacy is related to higher nicotine dependence, more positive and less negative smoking outcome expectancies as well as with less knowledge about smoking health risks.

Recognizing the characteristics of smokers is an important tool for policymakers in designing well-targeted anti-smoking programs and consequently in assessing the effect of these prevention policies (Jha and Chaloupka, 2000; Joossens and Raw, 2011; 2014; 2017; WHO, 2017). A relevant paper of Bosdriesz et al., (2016) found that smoking cessation mostly among higher socioeconomic groups is associated to tobacco-control policies, which include smoking restrictions in public places or public information campaigns. Similarly, recent evidence in Greece showed a statistically significant impact of antismoking campaigns on cigarette consumption (Tarantilis et al., 2015). The same study showed that cigarettes in Greece are regarded as a luxury good. This can be used as a great opportunity for decision makers to empower anti-smoking efforts in order to counter smoking, given

that the implementation and effectiveness of tobacco control policies in Greece are still at low levels (Economou et al., 2017; Feliu et al., 2019).

In the present study, we analyze primary data derived from a survey, which was carried out using a random sample of 1,526 university students in Greece so as to assess the association between health behaviours and smoking incorporating a number of control variables, including demographic and socio-economic determinants, i.e. gender, family status and income. The evidence we provide is straightforward. All health estimators are related to smoking rates, whereas the effect of health literacy is not significant.

The remainder of the paper is structured as follows: section 2 introduces the estimation methodology and presents the data; section 3 presents the results; section 4 discusses the findings and section 5 concludes.

2.3.2 Methods and data

This paper is based on primary data derived from a survey which was conducted during the period 15–30 April 2013 in 33 Departments of 14 Higher Tertiary Public universities and Technological Educational Institutes in Greece, located in six major cities of the country (Vozikis et al., 2014). The sample consisted of 1,526 students, aged 18–24 years and was chosen in a random way among trained postgraduate students. This paper uses and conducts new analysis of these collected data.

The data of interest was collected through questionnaires, including questions about demographic characteristics, such as age, sex, city of residence, occupational and marital status, income, perceived health status and various health behaviours, such as physical workout and alcohol consumption as well. To assess the students' health literacy level, the short four-item comprehension test of Bostock and Steptoe was adopted through a separate questionnaire including four comprehensive questions (Bostock and Steptoe, 2012). The procedure was followed with respect to the principles of personal data protection and security in order to assure the anonymity of the participants. Analyses were performed with Stata V.13.0.

The estimated model is specified as:

$Y_i = f$ *(Health Status*$_i$*, Male*$_i$*, Income [<1,100]*$_i$*, Income [1,100-2,000]*$_I$*, Alcohol*$_i$*, Workout*$_i$*, Health Literacy*$_i$*)*

where the dependent variable Yi is smoking (*Smoking*) and takes the value 1 if the student is a regular smoker and 0 if not. The variable *Health Status* ranges from 0 to 100. Male takes the value 1 if the respondent is a male and 0 if they are a female. *Income [<1,100]* takes the value 1 if the students' monthly family income is less than 1,100 Euros and 0 otherwise. *Income [1,100-2,200]* takes the value 1 if the students' family income is between 1,100 and 2,200 Euros and 0 otherwise. There is also a third income variable *Income [>2,200]* which takes the value 1 if the students' family income is more than 2,200 Euros and 0 otherwise; this variable is excluded to avoid the dummy variable trap. *Alcohol* takes the value 1 if respondents consume alcohol daily or almost daily and 0 otherwise. *Workout* takes the value 1 if a student works out more than once a week and 0 otherwise. Finally, the variable *Health Literacy* is a discrete variable, which ranges from 0 (minimum health literacy grade) to 4 (maximum health literacy grade).

2.3.3 Results

2.3.3.1 Summary statistics and correlation

Table 2.1 presents the summary statistics of the variables which are examined in our regression analysis. According to the table, people who smoke represent on average 38% of all participants. Respondents perceive their current health status at a relatively high level (77,2 out of 100), a not surprising score given that their age varies between 15 and 24 years. As regards the demographic characteristics, our sample concentrates more on the second income group [1100-2200€], although in general there is a uniform distribution between all three categories (around 30%). Our sample is divided almost in half among men and women with a slight predominance of women (55%). As far as health habits are concerned, 63,5% of postgraduates answered that they follow a systematic workout (twice a

week), while daily consumers of alcohol represent 22% of our sample. As regards the health literacy grade, the average respodent scored 2,4, indicating a fair to high level of participants.

Table 2. 1 Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Smoking	1,526	0.3761	0.4845	0	1
Health Status	1,526	77.2097	15.0409	15	100
Male	1,526	0.4567	0.4982	0	1
FamIncome[<1100]	1,526	0.2988	0.4578	0	1
FamIncome[1100-2200]	1,526	0.3597	0.48	0	1
FamIncome[>2200]	1,526	0.3414	0.4743	0	1
Workout	1,526	0.6349	0.4815	0	1
Alcohol	1,526	0.2162	0.4118	0	1
Health Literacy	1,526	2.3591	1.2994	0	4

Smoking factors study among university students, Greece, 2013.

Table 2.2 shows the correlations across variables used in our regression analysis with their significance levels. Our results reveal that smoking is correlated strongly with all variables we examine, except for the income criterion. Among all variables, health habits seem to be more strongly related to smoking decision. More specifically, smoking is adversely correlated with working out (−0.204) at the 1% significance level, while there is a notable positive correlation with the alcohol consumption (0.240), which is statistically significant at the same level. Similarly, the health status of participants is negatively associated with the consumption of tobacco products (−0.174). Finally, the level of literacy on health issues is also proved to have a negative, albeit milder, relation to smoking. Regarding income, no statistical correlation is observed.

Table 2. 2 Correlations across variables of interest

	Smoking	**Health Status**	**Male**	**FamIncome [<1000]**	**FamIncome [1100-2200]**	**FamIncome [>2200]**	**Workout**	**Alcohol**	**Health Literacy**
Smoking	1								
Health Status	−0.174***	1							
Male	0.067***	0.005	1						
FamIncome [<1100]	−0.013	-0.081***	-0.058**	1					
FamIncome [1100-2200]	−0.027	0.023	-0.030	-0.489***	1				
FamIncome [>2200]	0.040	0.055**	0.086***	-0.470***	-0.540***	1			
Workout	−0.204***	0.225***	0.042	-0.040	-0.007	0.046*	1		
Alcohol	0.240***	-0.104***	0.154***	0.036	-0.042*	0.008	-0.098***	1	
Health Literacy	-0.046*	0.059**	-0.064**	-0.016	-0.058**	0.074***	0.098***	-0.046*	1

Smoking factors study among university students, Greece, 2013.
Note: Three stars (***) indicate statistical significance at 1% level, two stars (**) at 5% level, and one star (*) at 10% level.

From the perspective of health status, the picture is different. The sex of the respondents does not appear to be associated with the health status of participants, whereas income seems to play an important role. Students who belong to the lowest income group are related to a lower health status (-0.081). Although middle income has no significant association with health status, respondents of the highest income are correlated to the highest health status (0.055) at the 5% significance level, indicating that wealthier people are healthier. Moreover, health status has a positive association with working out (0.225) and this is significant at the 1% level. As also anticipated, respondents who consume alcohol regularly present lower levels of health status.

As regards the correlations between health literacy and the rest variables of our interest, it is worthy mentioning its strong positve relation with the high family income group (0.074) and with the

regular physical workout (0.098). Finally, respodents with high scores of health literacy perceived their health status to be better.

Finally, we tested for multicollinearity through further evaluation of associations across demographic and health habits variables. As presented in Table 2.2, the correlations among three income groups are the highest. This makes sense because these variables are mutually exclusive. Except for income, there is no other strong association among independent variables suggesting that our model does not suffer from multicollinearity.

2.3.3.2 Results of estimations

Table 2.3 presents the results of regression analysis displaying how the variables are associated with the dependent variable, smoking; marginal effects are displayed. Column 2 shows the coefficients of independent variables. Health status seems to be significantly associated with smoking at the 1% level (coef; -0.004) and more specifically, students with a highly perceived health status smoke less than students with a lower perceived health status. According to Table 2.3, all health habits are also associated at the 1% significance level. Especially, participants who work out at least once a week appear to avoid smoking more (coef; -0.168) than others who do not work out. In contrast, respondents who consume alcohol have a significantly positive correlation with smoking (coef; 0,245).

Table 2. 3 Factors associated with smoking through regression analysis.

	dy/dx	Delta-method Std. Err.	z	95% Confidence Intervals
Health Status	- 0.004***	0.009	- 4.63	(-0.006 ; -0.002)
Male	0.039	0.027	1.50	(-0.012 ; 0.092)
FamIncome[<1100]	- 0.066**	0.033	- 2.01	(-0.131 ; -0.016)
FamIncome[1100-2200]	- 0.048	0.032	- 1.52	(-0.110 ; 0.014)
Workout	- 0.168***	0.027	- 6.15	(-0.222 ; -0114)
Alcohol	0.245***	0.032	7.78	(0.183 ; 0.307)
Health Literacy	- 0.006	0.099	- 0.65	(-0.026 ; 0.013)

Smoking factors study among university students, Greece, 2013.
Note: Three stars (***) indicate statistical significance at 1% level and two stars (**) at 5% level.

As far as demographic variables are concerned, gender has insignificant relation to the consumption of tobacco products. In terms of income, though, there is a significant association between lower income groups and smoking. More specifically, a family income of less than 1,100 € is found to be, at the 5% level, significantly associated with smoking in a negative way (coef; - 0.066). On the other hand, there is no effect of middle family income on smoking. It should also be noted that the impact of health literacy on smoking is not significant as well.

2.3.4 Discussion

This paper presents an analysis of data collected from a survey using a random sample of 1,526 university students in Greece, aged 18–24 years, in order to examine the effects of health risk behaviours and socio-economic factors on smoking rates in Greece.

To sum up, regular smokers represent 38% of our sample and their perceived health status is on average at a high level, as was expected since the respondents are very young. Among the variables we examined, smoking was found to be significantly associated with health status, family income and concerning health habits, smoking is correlated to systematic physical workout and the alcohol consumption as well. On the other hand, there was no significant association between smoking and health literacy.

While the major results of the study are in line with previous work in this area, it is worth mentioning several findings. Our paper showed an inverse relationship between income and smoking rates, i.e. students of lower family income smoked less, a finding which is not clearly demonstrated in the prevailing tobacco literature (Leinsalu, 2011; Farmer and Hanratty, 2012). Indeed, a study of Hosseinpoor et al. (2012) shows that smoking was disproportionately prevalent in poorer males in the vast majority of countries. In many cases they were found to be more than 2.5 times more likely to be

smokers than the richer men. On the other hand, a conflicting finding was suggested by Nikolaou' s study (2009) advocating a positive relation between income and smoking, i.e. smoking is more frequent among higher income groups, in females but not in males in Italy, Spain, Portugal and Greece. On the contrary, our findings upon the strong association between smoking and health habits or behaviours are in line with the majority of relevant studies. Finally, despite the fact that the research on health literacy and its effect on health habits, such as smoking, are still at an initial stage, our results do not confirm the prevailing literature, as there was found no relation with the smoking decision.

To conclude, some limitations need to be acknowledged. First, the variable describing the employment status of respondents was excluded from our analysis, as it might lead to biased results because of our sample composition. Second, our sample may not completely reflect the characteristics of university students in Greece as a whole, even though it comes from many universities of different geographical areas of the country.

2.3.5 Conclusion

Given that smoking prevalence among college students has been poorly explored, the contribution of our paper lies on the research data provided. Although there is rich tobacco literature regarding the effects of socio-economic and behavioral factors on the consumption of tobacco products at macro-level, there is a need for further research of this issue in more focused age-groups throughout a country. This knowledge can lead to more effective programs and interventions, which promote healthy behaviour and self-efficacy; both playing a key role in providing the necessary confidence to an adolescent so as not to engage in unhealthy behaviours like smoking.

Chapter 3: Cigarette excise taxation, revenues and Laffer Curve

3.1 Introduction

This chapter documents the prevailing theoretical literature and empirical evidence on cigarette excise taxation and the government revenues collected from cigarette consumption across the EU, providing, finally, an empirical research of the relationship between excise tax rates and revenues in the cigarette market across the EU.

3.2. Theoretical & Empirical Review

3.2.1 Cigarette excise taxation in the EU – Law framework

Tobacco products and, particularly, cigarettes are subject to excise taxes and Value Added Tax (VAT). There are two types of excise taxes – specific and ad valorem. A specific excise tax is a monetary value per quantity (e.g. pack, weight, carton, piece) of tobacco products, while the ad valorem excise tax is levied on the value of the tobacco products.

Excise duties are indirect taxes on the sale and use of specific products. EU legislation lays down harmonized rules for excise duties on tobacco, alcohol and energy, as well as common provisions. EU legislation ensures that excise duties are coherently applied throughout the EU. Cigarettes manufactured in the EU and those imported from third countries are subject to an ad valorem excise duty calculated on the maximum retail selling price, including customs duties, and also to a specific excise duty calculated upon the unit of the product.

The differences in the preferred structure of cigarette taxation have impeded agreement on harmonization. The fiscal legislation of EU on tobacco products needs to ensure the proper functioning of the internal market and, at the same time, a high level of health protection, as required by Article 168 of the Treaty on the Functioning of the European Union. One of the objectives of the Treaty is to maintain an economic union, whose characteristics are similar to those of a domestic market, within which there is healthy competition. As regards manufactured tobacco, achievement of this aim

presupposes that the application in the member states of taxes affecting the consumption of products in this sector does not distort conditions of competition and does not impede their free movement within the Union.

Historically, the first EU directive issued in 1972 (Directive 72/464/EEC) instructed all member states to introduce a mixed tax structure. The specific tax should be not less than 5% and not higher than 75% of the total excise duty. The directive was clearly in favor of predominantly ad valorem taxation; at that time, the majority of European Community members had an entirely ad valorem tax structure. Shortly afterwards, Denmark, Ireland and the UK, countries with predominantly specific taxation, joined the Community. A second directive was approved in 1977 (Directive 77/805/EEC) according to which the specific tax should be between 5% and 55% of the total tax burden including the VAT. This second stage was extended five times until 1985, when it was extended indefinitely. After several years of disagreement, in 1992 (Directive 92/79/EEC on the approximation of taxes on cigarettes), it was agreed that the overall excise duty should be no less than 57% of the final retail price of the most popular price category (all taxes included), and the VAT should be at least 15% of the final retail price (inclusive of excises). These directives implied a minimum overall tax level on cigarettes of 70% of the retail price. The ratio of specific to total taxation should be the same as in the 1977 Directive. The Council Directive 2010/12/EU of 16 February 2010 updates Directives 92/79/EEC, 92/80/EEC and 95/59/EC on the structure and rates of excise duty applied on manufactured tobacco and Directive 2008/118/EC. The directive is intended to ensure a higher level of public health protection by raising minimum excise duties on cigarettes, whilst bringing the minimum rates for hand-rolled tobacco gradually into line with those for cigarettes. The measures also aim to narrow the differences between member states' tobacco taxation levels and so help tackle intra-EU tobacco smuggling.

Currently, the minimum rates of excise duties on cigarettes are regulated by Directive 2011/64/EU, which actually codifies the previous common fiscal legislation on manufactured tobacco

in the EU in a single act, and most notably the revisions by Council Directive 2010/12/EU13[13]. This minimum rate must consist of a specific component of between 7.5% and 76.5% of the total tax burden (TTB) - expressed as a fixed amount per 1000 cigarettes – and an ad valorem component - expressed as a percentage of the maximum retail selling price. In addition, the overall excise rate must be at least 90 euro per 1000 cigarettes as well as at least 60% of the weighted average retail selling price (W.A.P.)[14]. Member states that apply excise duty of €115 or more, however, do not need to comply with the 60% criterion above. In this context, the member states are free to apply excise duty rates above these minimum levels of taxation according to their own national needs. All revenues from excise duties go entirely to the member states.

The current Directive sets specific objectives, as follows: (i) support EU market integration (i.e. avoid partitioning of geographical market) and removal of obstacles and barriers to it; (ii) avoid tax-induced competition distortions, both cross-country (between low- and high-taxing countries) and cross-product (between products subject to different levels of taxation); (iii) ensure freely-formed prices for all groups of manufactured tobacco in all geographical markets; (iv) pre-empt fraud and smuggling (tax avoidance, circumvention and 'abuse' of tax categories); (v) deter consumption through taxation and reduce access to 'less-taxed' alternatives and (vi) ensure a proper functioning of the excise duty system.

The aforementioned objectives of the Directive can be broken down into more specific ones: 1. harmonization in the excise duty structures applied by the different member states; 2. progressive

[13] In particular, Directives 92/79/EEC, 92/80/EEC, 95/59/EC on the structure and rates of excise duty applied on manufactured tobacco and subsequent amendments of Council Directive 2010/12/EU.

[14] Weighted Average Retail Price (W.A.P.) is defined as the weighted average price for cigarettes calculated by reference to the total value of all cigarettes released for consumption, based on the retail selling price including all taxes, divided by the total quantity of cigarettes released for consumption during the previous year. Until January 2011, excise taxes were calculated on the basis of the retail selling price of highest selling category, defined by price (i.e. the most popular price category - MPPC), in each country. Directive 2010/12/EU, which entered into effect on 1 January 2011, changed the reference point for calculating taxes from the MPPC to the W.A.P.

convergence in the tax rates applied by the member states in order to deter substitution from other cheaper alternatives, and in particular between cigarettes and fine-cut tobacco; 3. the establishment of a tax 'floor' to reduce the affordability of tobacco products for; 4. sufficient flexibility in the application of rules to local conditions and - where needed - derogations, to facilitate adaptation and to prevent market disruptions and unintended side effects; 5. an overall coherent interpretation and application of EU definitions.

According to the European Commission study (2020), the contribution of the Directive to the convergence of tax (hence price) levels between member states has been mixed. In fact, the gap between 'high-tax' and 'low-tax' countries has slightly broadened as a result of some member states having adopted a strong public health agenda through tax rate increases. EU minimum rates have contributed somewhat to moderating such a larger gap with a progressive hike and a transitional period offered to a number of member states until end 2017. As regards the effectiveness of the tax structure requirements, the same study notes that member states have switched their priority highlighting their reliance on specific taxation as opposed to ad valorem taxation in the period considered. As far the tax level 'gap' between cigarettes and fine-cut tobacco is considered, the Directive has not, also, entirely contributed effectively in its reduction. The difference in the monetary EU minimum rates for the two products has not reduced in the 2011-2018 period. The price differential remains high in Belgium, Luxembourg and Germany where the FCT/cigarettes price ratio is lower than 40%. By contrast, in Bulgaria, Greece and Sweden the ratio exceeds 90%. Many member states have autonomously increased the taxation of fine-cut tobacco more than cigarettes and as a result tax-induced substitution has slowed down, but the effectiveness of the Directive regarding this aim remains insufficient.

Another issue of concern negotiated considering the tax policy differentiation across EU is the lack of convergence in price levels between countries and, as a result the incidence of cross-border flows of duty-paid cigarettes from low-tax to high-tax countries. The study estimates the EU aggregated net effects at approximately 2.5 billion euro of revenue losses. In certain member states this

situation causes significant concerns not only to revenue collection but also to health protection measures taken at national level. The European Commission study (2020) points out that five member states (Ireland, the United Kingdom, Germany, France and Finland) experience a significant revenue loss while seven member states (Luxemburg, the Czech Republic, Estonia, Poland, Lithuania, Spain and Romania) register considerable extra revenue.

Similarly, the current law framework is inefficient as regards the tax treatment of new generation of modern products coming into the market (containing nicotine or cannabis) or 'heated tobacco products' and e-cigarettes. This legal uncertainty regarding the rates and tax structures of these products creates inefficiencies in the internal tobacco market. The feedback from member states during the European Commission study (2020) indicates a strong preference for EU level harmonization for the tax regime of e-cigarettes as different regimes prevent monitoring and control of cross border trade.

Despite the moderate effectiveness of the tobacco law framework on minimum excise rates in raising tax rates and prices in member states, there is undeniably need for convergence of tax levels. This lack of convergence is responsible for significant loss of tax revenues for some member states while others register considerable extra revenue compared with local consumptions because of high levels of unintended cross-border flows.

3.2.2 Considering the appropriate type of excise duties levied on cigarettes

This section reviews existing theoretical and empirical evidence on alternative approaches to the choice of specific and ad valorem excise duties levied on cigarettes as well as their different impact on retail prices, cigarette consumption and government revenues (Sunley et al., 2000; WHO, 2010 and Chaloupka et al., 2010). As mentioned before, the member states are free to choose the excise structure according to their own national needs and complying with the minimum levels of tax rates, as provided by the current Directive.

The different excise tax structures throughout EU reflect the different fiscal policy followed by each country with some countries focused more on economic goals and others motivated by public health and other objectives. Evidence shows that for the first decade of 2000, southern European countries predominantly favor ad valorem taxation, whereas northern European countries prefer a more specific tax structure (Delipalla and O'Donnell, 2001; Antonanzas and Rodriguez, 2007). Given the strong presence of the multinationals' and health lobbies in the north[15] and the theoretical evidence that specific taxes leads to higher prices, the north of Europe would be expected to lobby for this type of excise. On the flip side, the existence of state monopolies for manufacturing and distribution in the south make these countries prefer ad valorem taxation since, through the multiplier effect (as explained below), it increases the price advantage to the local brands, often made from domestically grown tobacco.

As regards the impact of excise types on cigarette prices, empirical and theoretical evidence show that specific excises tend to increase consumer prices relatively more than ad valorem excises, and hence lead to relatively higher reductions in consumption (e.g. Delipalla and keen, 1992; Delipalla and O'Donnell, 1999; 2001). In other words, specific taxation provides producers with incentive to raise prices of their products as any increase in producer's price will go to the producer as revenue. On the contrary, ad valorem taxation favors production expansion and lower prices (WHO, 2010).

Along the same lines, specific taxation benefits "tax-over shifting", meaning that when tax increases, the consumer price rises by more than the tax increase itself, even though the degree of over-shifting depends on industry characteristics. The empirical study of Harris (1987) using data for the USA where cigarette taxes are specific, finds that increases in cigarette taxes lead to significant price increases, more than double the size of the tax increase, without being explained by increases in manufacturing costs.

[15] The 'northern' camp consists of Denmark, Germany, Ireland, the Netherlands and UK. The 'southern' group is Belgium, France, Greece, Italy, Luxembourg, Portugal and Spain.

Taking into consideration the growing evidence supporting the significantly greater impact of specific tax on price in relation to the ad valorem tax and given the inelastic demand for tobacco, it is reasonably inferred that increases in cigarettes produce sustainable and higher revenues for the governments (Yeh et al., 2017). Estimates from different specifications suggest that increasing the specific tax would raise government revenues, while increasing the ad valorem tax might reduce state revenues as more smokers prefer less expensive cigarettes that lead to less tax revenues (Keen, 1998 and Chaloupka, et al., 2010). Evidence from Spain supports this suggestion. In 2006, Spain which relies heavily on ad valorem taxes, raised its tobacco tax and witnessed a fall in tobacco revenues. The unexpected fall in revenue gains was due to the tobacco producers reducing the price of their products (Antonanzas and Rodriguez, 2007). Chaloupka, et al. (2010), also, suggests that greater reliance on the ad valorem tax is associated to greater instability of government tax revenues from cigarette excise taxes and such instability rises with the growth of manufacturers' market power. This suggestion stands on the general concept that specific excises generally produce a more stable stream of government revenue as they are independent of changes in price. Indeed, in the case of price uncertainty, price elasticity determines significantly the type of excise levied on cigarettes in order to ensure expected tax revenue or to eliminate the variation in revenue (Kay and Keen, 1983; Keen, 1998). More specifically, under uncertainty, Kay and Keen (1983) propose a ratio of ad valorem to total taxation to be below the expected value of elasticity in order to reassure the stability of expected tax revenue.

Further, Chaloupka et al. (2012) discuss that greater reliance on specific excise taxes reduces the price gap between premium and low-priced alternatives, thereby limiting opportunities for users to switch down in response to tax increases. To make it clear, given that specific duties are the same for all cigarettes independent of prices, this type of excise tax can reduce the relative price differentials between high and low taxed cigarettes. This may, in turn, provide smokers with an incentive to switch to higher priced cigarettes, assuming that more expensive tobacco products are considered to be of

higher quality[16] and thus more appealing (Barzel, 1976; Kay and Keen, 1983; 1987; 1991; Keen, 1998; Cremer and Thisse, 1994). This hypothesis that an upwards substitutability might occur when the price gap between cheaper and more expensive brands narrows is supported by Sobel and Garrett (1997) showing that increases in specific taxes reduced the market share of generic (lower-priced) brands in the U.S.A. significantly.

At another point of view, WHO (2010) advocates that ad valorem taxation has a multiplier effect that favors low "quality". To explain this finding, the same source provides an example; to cover the costs of a €1 "quality" improvement (i.e. improving packaging to make the brand more appealing) requires €1 more pre-tax revenue under specific taxation, but €1.25 more if the tax is ad valorem, because at a tax-inclusive rate of 20%, the price will have to increase by 1/(1-0.20) to cover the cost of a €1 improvement. So, the multiplier effect of the ad valorem causes price rise more than the cost of package improvement: a €1 improvement per unit leads to a price increase of €1.25, as the government taxes the cost of improvement and earns €0.25 extra revenue.

Tobacco literature evaluates additional attributes of two excise types, which are useful to be mentioned for a thorough consideration of an optimal tax structure. As regards the tax administration, specific taxes are much easier to administer. As the fixed tax is levied on the 'unit' of the product, the tax base is easily defined and only once, thus facilitating the government revenue collection at any stage (e.g. manufacturer, wholesaler or importation). On the contrary, the ad valorem taxation entails the risk of administration for undervaluation, which is faced only with technically sound tax administration and awareness of the manufacturers' pricing policies. Valuation problem is another danger lurking under ad valorem taxation. In particular, manufacturers have the potential to sell their products to a related marketing company at an artificially low price, in order to reduce the excise tax liability (transfer pricing). Consequently, tax revenues accrued from government are declined due to

[16] Quality here does not refer in any way to the health impact of the product. It may be evaluated based on the packaging or the blend used for the cigarette, or anything that makes the product more appealing to consumers. In that sense, cigarettes might be of "higher or lower quality" but they are equally harmful.

the reduction in tax base. Indeed, this was the reason why Philippines and Russian Federation preferred specific excises instead of ad valorem taxes on cigarettes in 1996 (WHO, 2010). Finally, it should be noted that specific taxes need to be adjusted with the Consumer Price Index (CPI) to keep pace with inflation, while on the contrary, there is not the same need for ad valorem tax because the amount of the tax increases as prices increase.

To sum up, there is no single rule for choosing the optimal excise tax structure. Even though a growing evidence shows that the specific excise tax on cigarettes, compared to the ad valorem tax, is a more efficient policy device to achieve fiscal goals, as well as public health objectives, governments may prefer one instrument over the other depending on industry characteristics, public choice issues and the level of health awareness at the time. At any case, literature shows that most developing countries still have great potential to raise tobacco excises. A study of Ross et al. (2012) shows that if an excise tax represents at least 70% of the retail price is a determinant factor with respect to lives saved. A 70% benchmark does seem to be a feasible target considering that it has already been reached by a few countries worldwide and across EU.

Figure 3.1 depicts the average change in excise structure of cigarettes in the EU over the period 2008-2018 as well as the corresponding fluctuations of excise revenues accrued from cigarette consumption.

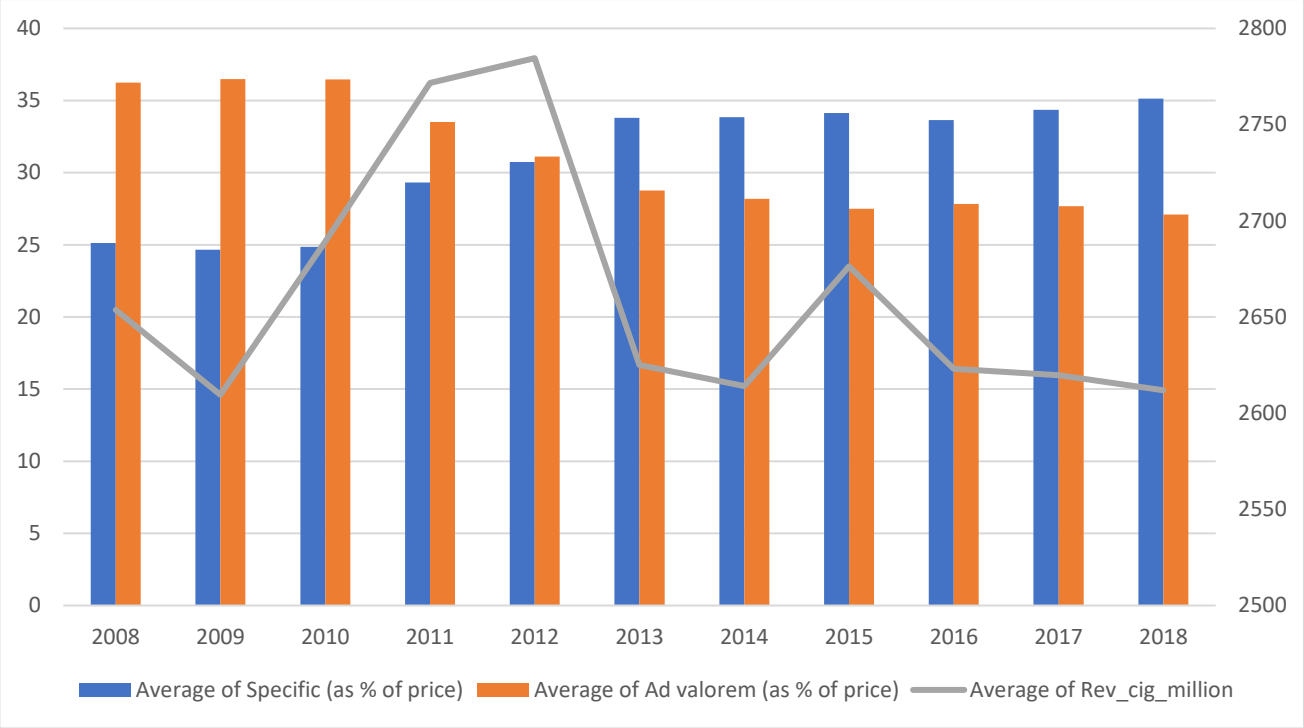

Figure 3. 1 Evolution of EU-28 average specific tax (as % of price), ad valorem tax (as % of price) and excise revenues from cigarette consumption, 2008 – 2018.

Source: European Commission (DG TAXUD) and author's calculations.

As evident from Figure 3.1, EU member states preferred on average the specific taxation over the ad valorem one until 2012 and afterwards the EU average specific excise exceeded the ad valorem tax, indicating a clear tax policy switch for the majority of EU countries favoring the specific taxation.

Yet, it should be noted the rather wide 8%-61% of the cigarette price threshold for the specific component and the significant difference in excise duty structure (i.e. the specific component varies from 8.1% in Italy to 61.4% in Ireland, in 2018). At the same time, revenues collected from excise taxation levied on cigarettes decreased sharply following this shift of taxation structure. Figure 3.2 illustrates the proportion of specific and ad valorem tax (as % of price) and prices of cigarettes (€ per 1,000 cigarettes) across the EU-28 in 2018.

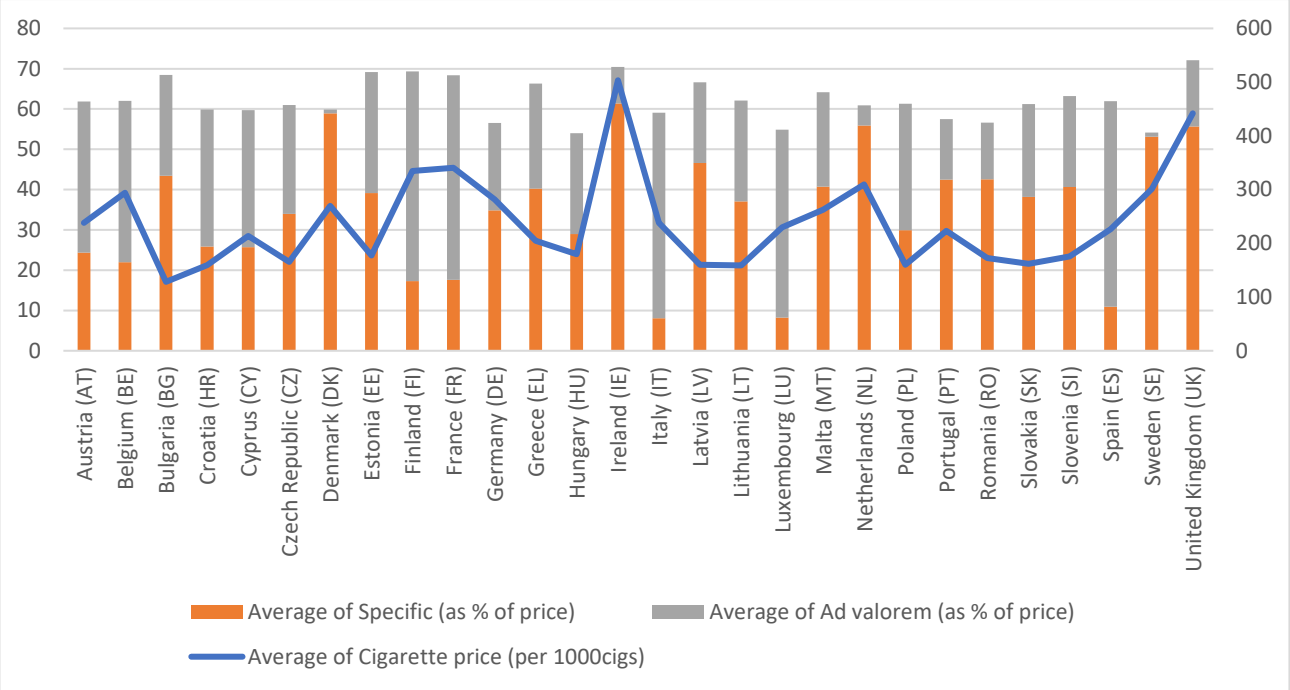

Figure 3. 2 Cigarette excise structure and prices of EU-28, 2018.

Source: European Commission (DG TAXUD) and author's calculations.

As presented in Figure 3.2, in 2018, Ireland and United Kingdom record the highest prices per one pack of cigarettes (containing 20 cigarettes) at €10.07 and €8.83, respectively, while Bulgaria notes the lowest price per pack at €2.57, followed by Lithuania at €3.18. Concurrently, taxation system of Ireland and United Kingdom favors obviously the specific tax against ad valorem one.

3.2.3 Price of cigarettes – Price elasticity of demand

One of the most fundamental laws of economics is that of the downward – sloping curve, which states that increases in the price of a given product will lead to reductions in the quantity of that product, while reductions in price will lead to increases in quantity demanded. The extensive empirical research on the demand for tobacco products confirms that the law of the downward – sloping demand curve applies to tobacco products.

Estimating elasticity is crucial to policymakers in order to anticipate an intervention's impact on tobacco consumption as well as on tobacco tax revenue. If the proportionate fall in tobacco

consumption exceeds the proportionate increase of tax, revenue will fall. Otherwise, revenue will rise. In other words, tax increases on cigarettes have a significant effect on reducing cigarette consumption and raising the government revenues from cigarette taxes.

The effect of the law of demand for tobacco products is likely to be threefold: (1) some smokers will smoke less; (2) others will stop smoking altogether; and (3) smoking take-up may also decline, increasing the number of non-smokers. The magnitude of the reduction in overall consumption of tobacco (e.g. the number of packets of cigarettes bought) depends on the price elasticity of demand for tobacco products that is how sensitive smoking behaviour is to tobacco prices. Considering that cigarette, in particular, is an addictive product and smokers are not price sensitive in general, cigarette demand is inelastic. There is a considerable body of literature estimating price elasticity of demand for tobacco products, suggesting that an increase in the price of tobacco products would be expected to reduce the proportion of smokers in the population and increase tobacco revenues. Smith (1776) lays the groundwork for taxing consumable goods like tobacco, rum, or sugar, with an excise tax on such goods seen as the most market-neutral tax — guaranteeing government revenues, while at the same time their consumption may still increase. Nguyen et al. (2012) claim that cigarette elasticity of demand for 11 EU countries varies between −0.3 and −0.4. In the same lines, the narrative review of Chaloupka and Warner (2000) and the meta-analysis by Gallet and List (2003) both suggest a synthesis estimate of the total price-elasticity of around−0.4, while in studies that included smuggling, demand is less sensitive (−0.36). These findings confirm the general suggestion that a 10% increase in price would lead to a 4% reduction in consumption in high-income countries (Joossens and Raw (2011). The seminal World Bank publication (1999) concluded at the same estimation of the cigarette price elasticity at -0.4 for developed countries and between -0.4 and -0.8 for developing countries.

The price elasticity of demand reflects a combination of conditional demand – i.e. the amount or intensity of smoking – and smoking prevalence (Ranson et al., 2000). Global evidence suggests that, for cigarettes, half of the impact of higher prices comes from a reduction in smoking prevalence (CDC,

1999; and IARC, 2011). Consequently, the prevalence elasticity is assumed to half of the price elasticity, i.e. −0.15, −0.2 and −0.25 in high-, middle- and low-income countries, respectively (Goodchild et al., 2016).

Stavrinos (1987) is one of the Greek researchers who examined cigarette demand in Greece using data from 1960 to 1982. His empirical results indicate a short-run price elasticity of -0.01 and a long-run elasticity of -0.015. Hondroyiannis and Papapetrou (1997) estimated higher price elasticities for the period 1960-1990 at the level of -0.33 in the short run and -0.6 in the long-run, employing an Error Correction Model. Other Greek studies found the short run price elasticity at -0.24 and the long run elasticity at -0.48 (Nikolaou and Velentzas, 2001), while Koutsoyiannis (1963) and Cameron (1997) found price to be insignificant.

Modeling tobacco consumption opens up a methodological debate in response to expanding knowledge into addictive behaviour. From a basic economics standpoint, it can be claimed that addiction is an important factor when analyzing tobacco consumption econometrically. Literature suggests two basic models of tobacco product demand; the conventional demand models, which are static (i.e., they examine the model only within a single time period) and the addictive demand models, which are dynamic and are further subdivided into two types: myopic addictive and rational addictive (Baltagi & Griffin, 2001). Rational addiction model developed by Becker et al. (1994) considers that current buying decisions are formulated by accounting for both past and future costs of choices. On the flip side, myopic addictive model recognizes only the dependence of past consumption on current tobacco purchases, ignoring the future consumption effect. The supportive researchers of myopic model advocate that higher past consumption raises the marginal utility of current consumption and leads to higher current consumption (Houthakker and Taylor, 1970; Pollak, 1970; 1976). On the other hand, other empirical studies reject the myopic model of addictive behaviour and support the rational-addiction model based on the statistical significance of future period's consumption as a determinant of current consumption (Becker et al.,1994; Chaloupka, 1991; Chaloupka et al., 2000).

Recent empirical evidence reports confounding findings upon demand models for cigarettes. An econometric approach of Nguyen et al. (2012) shows negative association between lagged consumption and current cigarette consumption in four out of eleven EU countries; Italy (1970-2009), Netherlands (1980-2009), Spain (1960-2009) and Sweden (1955-2009). Similarly, the econometric analysis of Tarantilis et al. (2015) measuring the price and income elasticity in Greece finds no significant effect of the lag cigarette consumption on the current one, indicating that addiction models fail to offer additional information, whereas there is significant relationship with the following year's consumption.

Becker and Murphy (1988) point out some notable interactions between time preference and addiction. First, it is more possible that people who discount more heavily are more vulnerable to addiction. Second, addicts with higher discount rates respond more easily to the price changes than those with lower discount rates. These two findings may explain why young and poor people are more likely to initiate smoking than older and richer people and, as a result the price elasticities of demand for the first group of people are higher.

The elasticity estimates may vary from one country to another, though, the vast majority of studies upon the demand for tobacco in developing countries finds a relatively inelastic demand for cigarettes. So, a significant increase in tobacco product taxes and prices has been demonstrated to be the single most effective and cost-efficient intervention for reducing tobacco use and to create the fiscal space needed to generate revenues.

3.2.4 Cigarette Excise Revenues in the EU

Historically, revenue generation has been the primary aim of tobacco taxation. At the same time, governments intend to increase as much as possible the excise duties on tobacco in order to achieve goals of public health by reducing tobacco consumption and the external cost of smoking. The objective of ensuring revenue from excise duties applied to manufactured tobacco may seem to be contradictory to the objective of protecting the health of citizens. This is partly true. However, it does seem possible

to reach both objectives; increasing tax revenues or remaining stable and decreasing tobacco consumption. Some countries apply more complex tax structures in their effort to combine budgetary, health and competition objectives.

Figure 3.3 illustrates the average evolution of cigarette consumption and tax revenues throughout the EU during the 11-year period from 2008-2018.

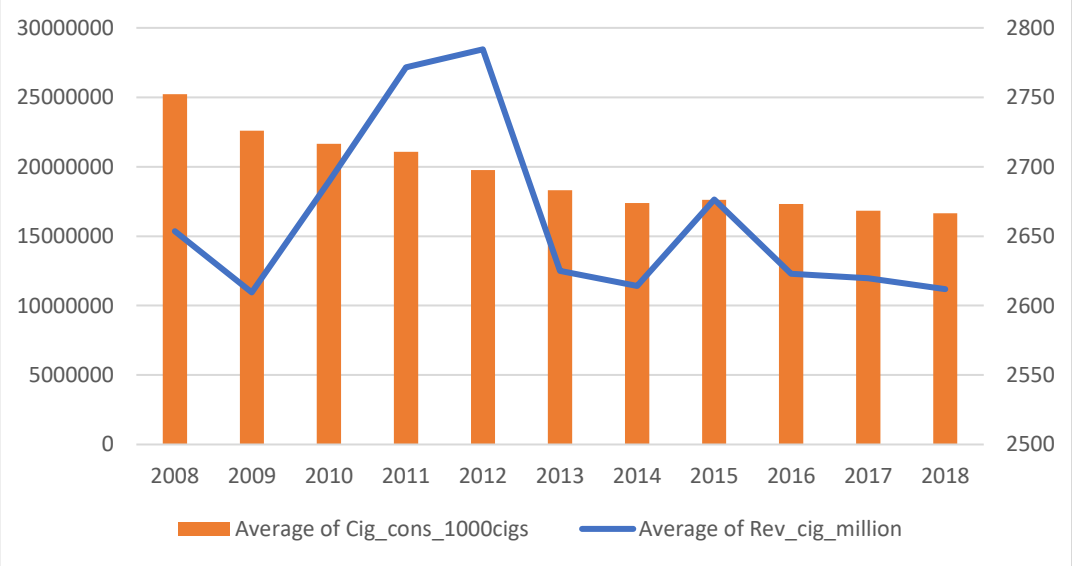

Figure 3. 3 Average volume of EU cigarette consumption in 1,0000 sticks and excise revenues from cigarette consumption in million €, 2008-2018.

Note: *Cig_cons:* average of releases for consumption of cigarettes per 1,000 cigs ; *Rev_cig_million:* average of government revenues accrued from cigarette consumption in € million.
Source: European Commission (DG TAXUD) and author's calculations.

Figure 3.3 shows that the cigarette consumption throughout EU in 2018 is on average 16.7 billion sticks. This represents a decline of volume sales of 34.1% in comparison to 2008, when 25.2 billion sticks were sold on average in the EU. The graph also shows that the average excise revenue accrued from cigarette consumption across the EU, is €2.6 billion in 2018. This represents a decrease of just 1.5% from the €2.7 billion excise revenue collected in 2008. It should be noted that since 2009 revenues increase at a significant rate until 2012, where the revenue streams reach their highest point (€2.8

billion) for the entire period 2008-2018. The following period is characterized by some mild fluctuations with a slight decline until the revenues reach almost the initial levels of 2008.

The marginally stable revenues for the 11-year period in combination with declining consumption can only be explained by the inelastic demand of tobacco products; an increase in rates must have taken place, in order to maintain the same level of revenue. In other words, the lower consumption and the decrease in revenue that this would otherwise generate, have been compensated by increased rates, according to the fundamental law of price elasticity of demand, which was discussed in detail in the previous section.

Existing literature (Matrix Report, 2013; European Commission, 2020) note that three main factors may lie behind the reduction in cigarette sales: a) Substitution to cheaper alternative tobacco products (rise in sales) with fine-cut tobacco to be the most popular. b) Substitution towards purchasing cheaper illegal cigarettes (rise in illegal sales). c) Falls in smoking prevalence due to different smoking patterns and health habits. Nevertheless, while the decrease in the market size of cigarettes has coincided with rising fine-cut tobacco sales, rising illegal sales and falls in smoking prevalence, it is not possible to prove a causal link to any one of them.

3.2.5 Fine-Cut Tobacco (FCT) – Empirical data

Fine-cut Tobacco (FCT) is a category of smoking tobacco that includes two subcategories: i. Roll-Your-Own (RYO) tobacco, which is intended for the hand-rolling of cigarettes and is rolled by consumers in a cigarette paper and, possibly, adding a filter and ii. Make-Your-Own (MYO) tobacco, which is intended for the machine-rolling of cigarettes. MYO is filled through a handheld device into an empty cigarette tube.

The FCT market in the EU has experienced an essential growth over the period 2006-2012, albeit then followed by stability (See Figure 3.4). Given that excise duties levied on FCT tobacco are lower than duties on factory made cigarettes, FCT cigarettes are becoming increasingly popular across EU.

This provides a price incentive for smokers to switch to FCT in response to increasing prices of cigarettes and economic crisis (Chaloupka et al., 2011; Raisamo, 2011; Lopez-Nicolas, 2012 and Young, 2012)

In 2006, the quantities of FCT released for consumption in the EU reached at about 65 million tones and in 2012 they amounted to 87.5 million tonnes (+35%, or +5.2% year-on year). The cigarette market growth might be triggered by the economic crisis and the decline of the available income as happened in Ireland and Italy, and, to a lower extent, in Germany but this is not easy to prove in isolation (Hanewinkel et al., 2008), because the crisis was usually accompanied by tax increases. Since 2012, cigarette growth rate declined in absolute terms and until 2016 FCT market volume has been fluctuating at about 87-88 million tones.

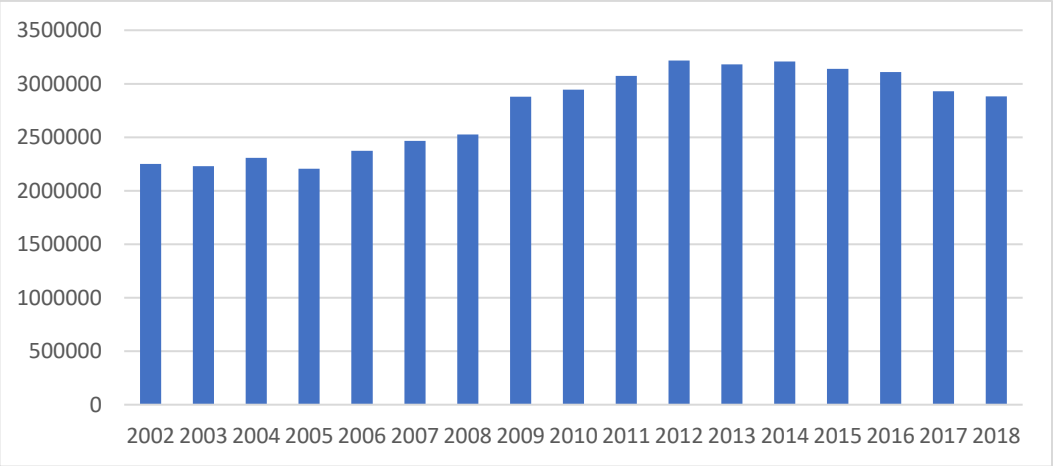

Figure 3. 4 Evolution of fine-cut tobacco market (1kg) on average, EU-28, 2002-2018.
Source: European Commission (DG TAXUD) and author's calculations.

According to the database of European Commission's Directorate for Taxation and Customs Union (DG TAXUD) regarding total volumes of cigarettes and fine-cut tobacco in 2018 and using a

comparison standard of 1kg equating to 1,000 cigarettes[17], for comparison purposes, fine-cut tobacco consumption accounts for 17,3% of total tobacco consumption.

As can been seen in Figure 3.5, FCT consumption varies considerably across member states of EU from almost nil (Romania) up to about 50% of total tobacco consumption (Luxembourg (55.2%), Belgium (39.2%), Hungary (37.4%) and the Netherlands (37.2%)).

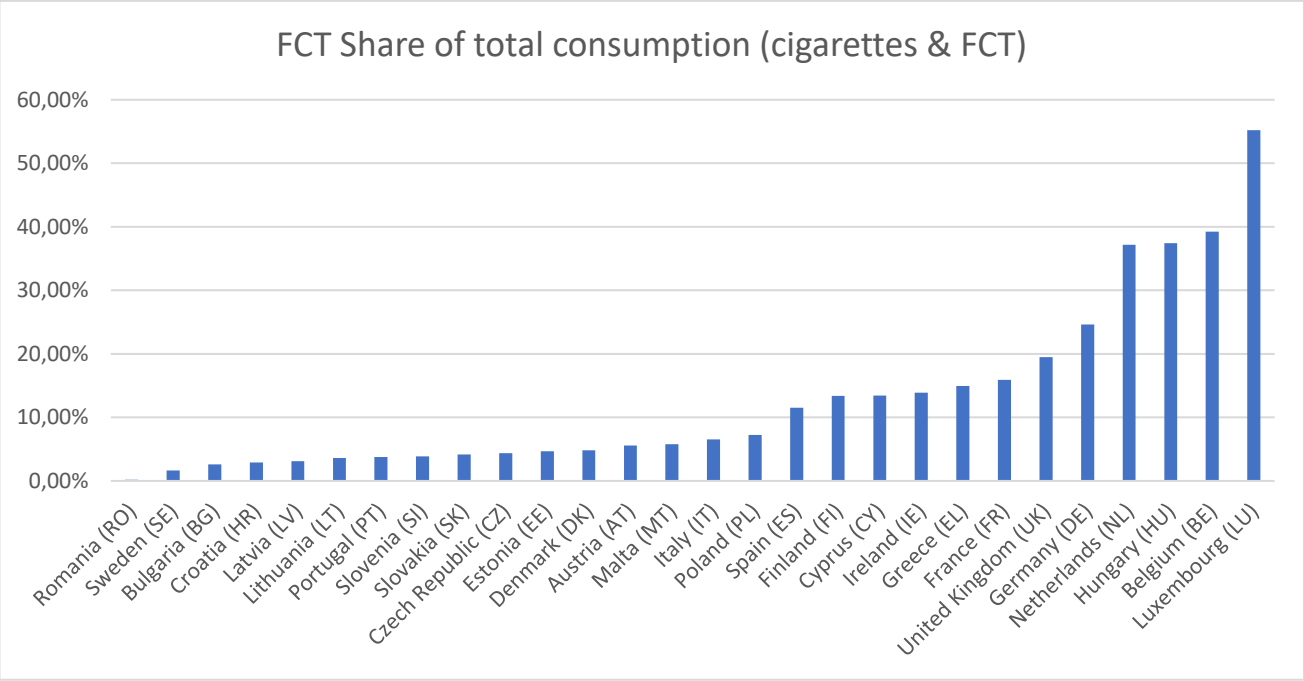

Figure 3. 5 Fine-cut tobacco share as percentage of total consumption (cigarettes & fine-cut tobacco), EU-28, 2018.

Source: European Commission (DG TAXUD) and author's calculations.

[17] As regards the conversion rate between FCT and FMC, sources of European Union8 accept that 1 kg of smoking tobacco corresponds to 1,000 industrial cigarettes. Although it is a controversial issue among academic8, industry players and national tax authorities, this paper takes into account the 1 g of FCT = 1 FMC conversion rate.

3.2.6 Substitution between cigarettes and fine-cut tobacco

Tobacco literature (European Commission, 2017; Rothwell et al., 2015) supports the substitution of cigarettes from FCT, namely downtrading from cigarettes to FCT. According to the study of European Commission on Council Directive 2011/64/EU regarding the structure and rates of excise duty applied to manufactured tobacco, FCT was proved to be largely a substitute of cigarettes.

Based on the study on fine-cut tobacco excise structure in the European Union (2018) conducted by London Economics, fine-cut tobacco provides a buffer function between cigarettes and cross border and/or illicit trade. In economic terms, the buffer function associated with fine-cut tobacco reflects the fact that FCT acts as a potential alternative proposition for illicit tobacco products. Domestic duty-paid cigarettes, cross-border purchased cigarettes and illicit cigarettes are to some extent substitutes for each other. Therefore, one would expect an increase in the excise duty imposed on duty-paid cigarettes to increase demand for both cross border cigarettes and/or illicit cigarettes. However, FCT provides an alternative domestic-duty paid tobacco product to consumers who are priced out of the market for domestic duty-paid cigarettes. The maintenance of some excise duty and price differential between domestic cigarettes and FCT encourages consumers to switch to legal FCT rather than purchasing cross-border cigarettes or illicit tobacco products. The result is to reduce the negative fiscal impact associated with raising duties on cigarettes, and hence to consolidate the tobacco tax receipts that are accrued by the government.

Empirical evidence (Antic, 2015) shows that the policy of differentiated taxation of cigarettes and fine-cut tobacco is the main reason for the migration of consumers from the market for higher-taxed cigarettes, towards the market for fine-cut tobacco, a less taxed and thus, cheaper product. Townsend (1998) cited the examples of Norway in order to highlight the tax-induced substitution between FCT and cigarettes. From another point of view, fine-cut tobacco may play a crucial role in the industry's strategy to attract or retain price-sensitive smokers (Leatherdale et al., 2009 and Young et al., 2012). In line with this suggestion, there is supportive evidence pointing out that there is negative

cross-price elasticity between cigarettes and FCT, which means that an increase in the price of cigarettes triggers an increase of FCT consumption (Laffer, 2014; Nguyen et al., 2012).

At present, all countries tax fine-cut tobacco for hand-rolled cigarettes at a lower rate than manufactured cigarettes. As a result, in many European Union countries, smokers have been switching from manufactured cigarettes to hand-rolled cigarettes. An estimate of the cross-price elasticity of demand for hand-rolling tobacco with respect to cigarette price, based on an econometric analysis of over 40 years of aggregate time-series data from Finland suggests that hand-rolling tobacco use is a substitute for cigarettes in Finland, with a cross-price elasticity estimate of 1.7 (Nguyen, 2011). This finding implies that a 10% increase in cigarette price increases consumption of hand-rolling tobacco by 17%. Cross-sectional, self-reported data from 19 European Union member states, however, show no correlation between the price of a pack of cigarettes, standardized by purchasing power standards, and the proportion of hand-rolled cigarettes on total cigarette consumption (Gallus et al., 2011). While the former analysis is more robust, it is limited to one country. The latter analysis suggests that, at least in some European countries, price differences between brands of manufactured cigarettes do not explain the high prevalence of hand-rolling tobacco use.

In terms of consumer behaviour, the study on fine-cut tobacco excise structure in the European Union (London Economics, 2018) advocates that rolled cigarettes are mostly preferred by men and particularly by people living in rural areas. With respect to economic status, the same study proved that FCT consumers have probably a lower income and are more price-sensitive as a larger proportion of unemployed and those self-describing as ‘in financial difficulties’ prefer the use of FCT. As far as the educational level is concerned, the survey of Gallus et al. (2014) in European countries document that fine-cut tobacco use is most frequent among less educated people. This finding is in broad agreement with surveys from Canada (Leatherdale et al., 2009; Leatherdale and Burkhalter, 2012), Malaysia and Thailand (Young et al., 2008) and New Zealand (Li et al., 2010; Young et al., 2010) as well as with the International Tobacco Control Four Country Survey conducted in Australia, Canada, the USA

(Young et al., 2006) and with other data from the UK (Tavakoly et al., 2013). This evidence is in line with studies supporting the strong association between FCT use and socio-economic aspects, as individuals with lower socioeconomic levels are more sensitive to changes in tobacco price (Gallus and La Vecchia, 2012; IARC, 2011).

3.2.7 Illicit market in the EU

In terms of illicit trade, it is estimated that the EU and its member states lose up to €10 billion in unpaid taxes every year from counterfeit and smuggled tobacco products[18]. Measuring illicit trade is a difficult task due to the lack of validated and comprehensive data. By its nature, every illicit activity is hard to measure and quantify since it is not officially recorded. Up today, one of the most comprehensive panel data source available is the KPMG's Project report series, which contains detailed estimates of the overall amount of non-domestic consumption of cigarettes for all member states, further broken down by legal and illegal consumption (contraband and counterfeit, including 'illicit whites')[19] and the origin of flows. KPMG, the global accountancy firm, created the EU Flows Model, a dynamic, iterative model that is principally based on legal domestic sales, Empty Pack Survey results and consumer research data collected at member states level by different independent market research agencies. It should be highlighted, though, that Project SUN is sponsored by the industry[20]. Therefore, the validity of its results has been questioned (Joossens and Raw, 2012; Gilmore et al., 2013) and needs to be taken with due caution.

[18] Communiqués de press RAPID; "Contraband and counterfeit cigarettes: frequently asked questions." MEMO/10/448, Brussels, 27 September 2010.

[19] According to the European Commission's official definitions: a. Contraband refers to genuine product that has been bought in a low-tax country, exceeds legal border limits or acquired without taxes for export purposes to be illegally re-sold (for financial profit) in a higher priced market, b. Counterfeit cigarettes are illegally manufactured and sold by a party other than the original trademark owner, c. Illicit whites are cigarettes that are usually produced legally in one country/market, are exported legally and are smuggled across borders in their final destination market.

[20] Initially (Project STAR) the exercise was sponsored by PMI (Philip Morris International) then, until 2015, by the four Big Tobacco companies. In 2016, JTI (Japan Tobacco International) did not support the exercise.

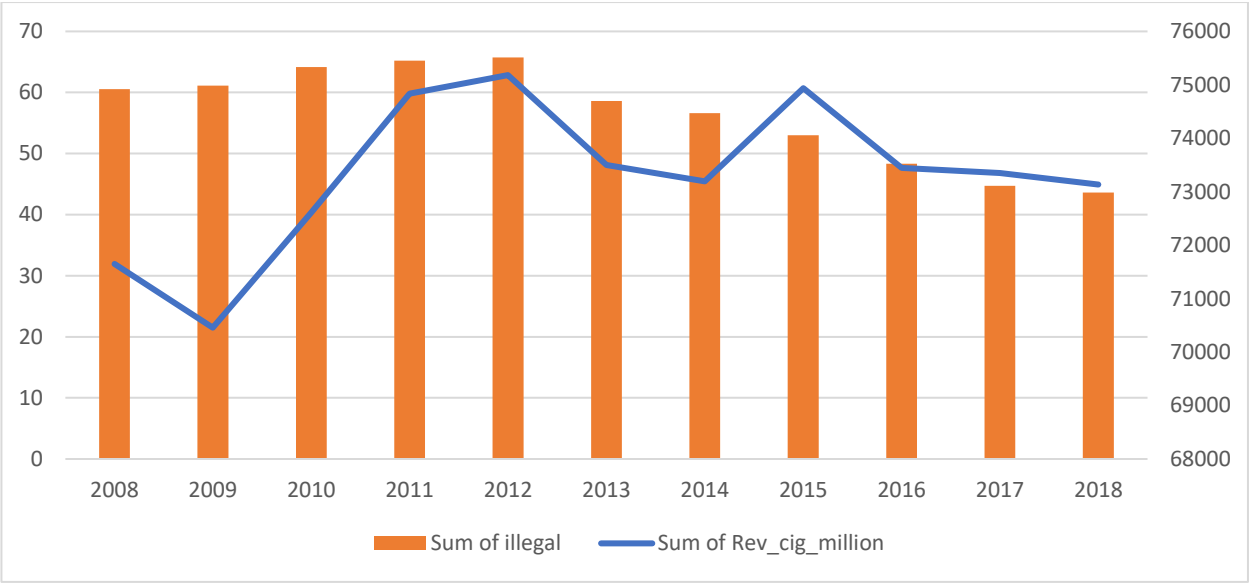

Figure 3. 6 Volume of illicit trade in EU28 (in billion sticks) and excise revenue evolution on average over the period 2008-2018.

Source: KPMG Project report (2019), European Commission (DG TAXUD) and author's calculations.

As depicted in Figure 3.6, between 2008 and 2018, the trade of non-duty paid cigarettes decreased by 27.9% across the EU. The overall size of non-duty paid cigarettes fell from 60.5 billion sticks in 2008 to 43.6 billion sticks in 2018. In 2012, illicit trade reached its highest point with 65.7 billion illegal sticks. The illicit market volume decreased in most EU member states and increased in six EU countries (Romania, Croatia, Malta, Italy, Latvia, Cyprus and Greece) over the last decade.

As derived from the Figure 3.7, Greece experienced the highest percentage change in illicit trade following by Cyprus and Latvia. The 446% rise in Greek market between 2008 and 2018 is attributable to a number of factors, including the increase of excise duties. Whilst the overall volume of illicit sales steadily decreased between 2000 and 2008, the largest jump coincided the period between 2008 to 2010 with the large excise duty rise, as the change in illicitly-traded cigarettes was over 3 billion. This can be seen as an example for a strong correlation between price rises, lack of effective enforcement and increases in illegal sales.

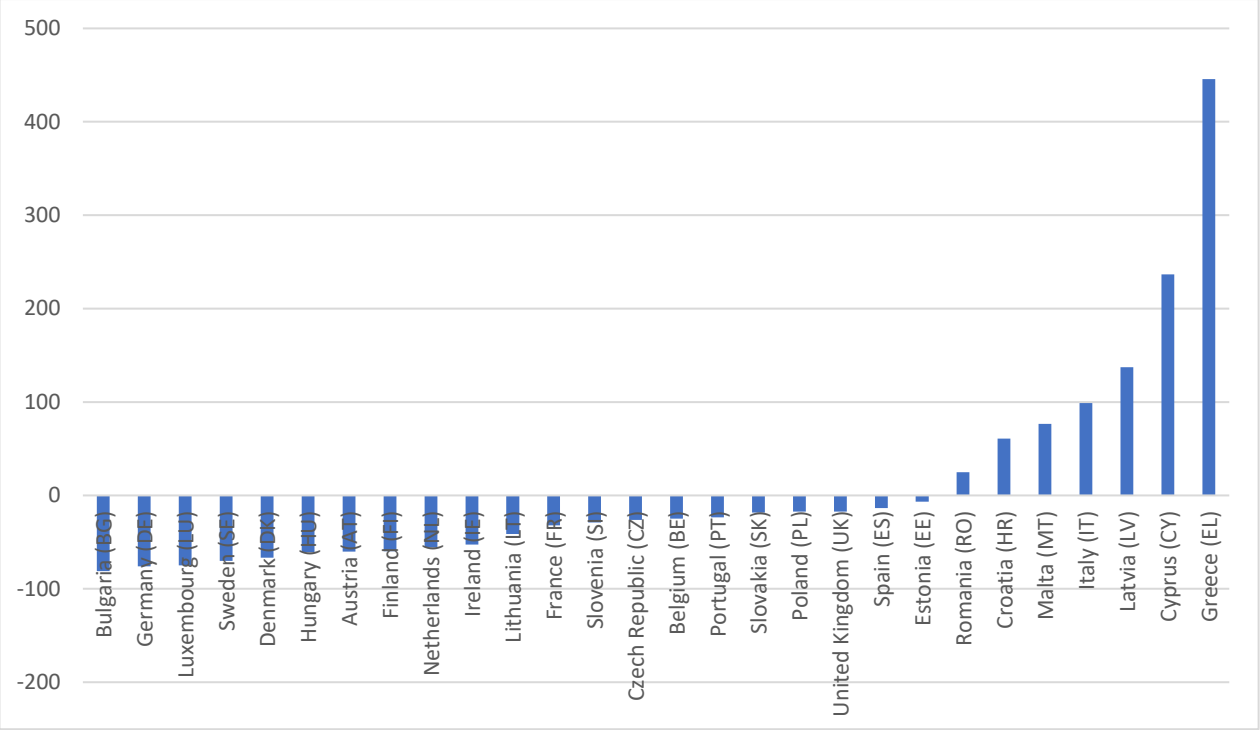

Figure 3. 7 Percentage change in illicit trade of cigarettes (in billion sticks), 2008-2018.

Source: KPMG Project report (2019) and author's calculations.

3.2.8 Revenue loss from illicit trade – Empirical data in the EU

According to literature review, the illicit trade in tobacco accounts for a significant percentage of lost government revenues due to evaded taxes and customs duties (Joossens and Raw, 1995; 1998; West et al., 2008; Joossens et al., 2010; FATF, 2012; Allen, 2010; Joossens and Raw, 2012). In particular, Joossens et al. (2009) find that governments are currently losing approximately $40.5 billion annually worldwide because of illegal trade, based on 2007 data. They also estimate that if the illicit cigarette trade were eliminated, the revenue gained would be globally $31.3 billion, $13 billion in high income countries and $18.3 billion in middle- and low-income countries. In terms of EU, an estimate of the European Anti-Fraud Office (OLAF) (2012) suggests that annual losses to national and EU revenues in 2010 amount to about 10 billion Euros a year. This is in accordance with KPMG Project

report series[21], which estimates the illicit cigarette consumption (contraband and counterfeit, including 'illicit whites') to 43.6 bn sticks across the EU for 2018, indicating a tax revenue loss of €10 billion. The same Project provides data for the tax revenue loss for each EU country over the period 2017-2018, as depicted in Figure 3.8. In the UK, Her Majesty's Revenue and Customs (HMRC[22], 2019) estimates the size of illicit market in cigarettes and fine-cut tobacco at £1.8 billion in 2017-18. In Spain, the resources invested in combating cigarette smuggling rose from €4 million to almost €40 million from 1993–1996 to 1996–2000 (Joossens, 2003). Over this period the market share of smuggled cigarettes decreased from 16% to 2% and cigarette tax revenue rose from €2,300 million to €5,200 million.

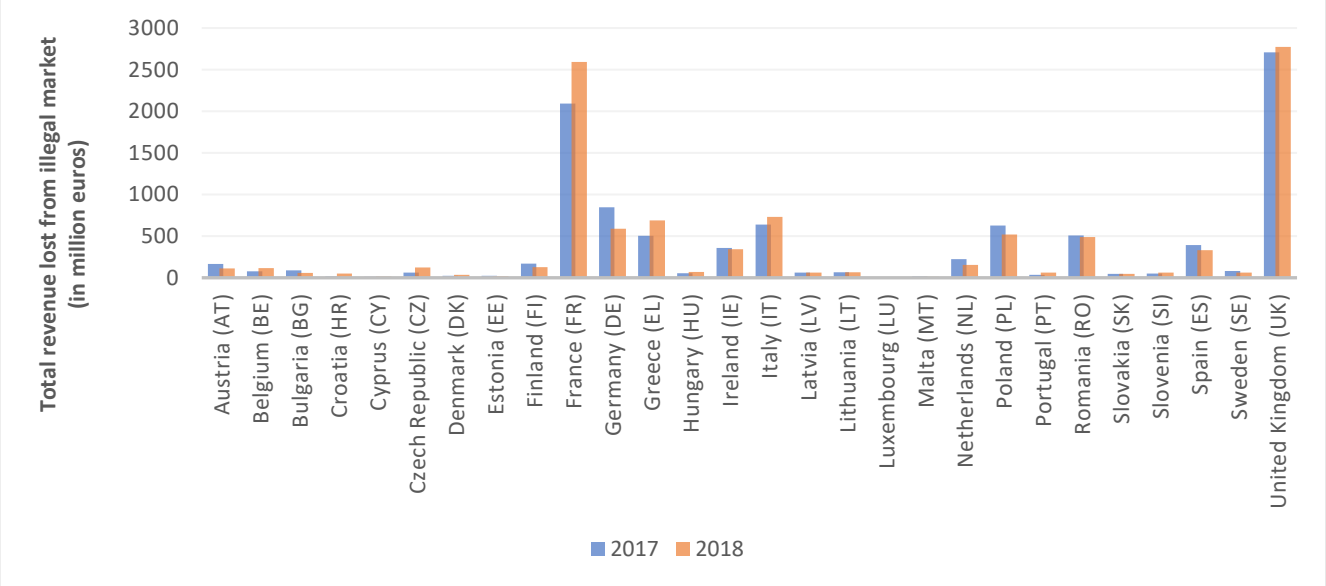

Figure 3. 8 Total revenue loss from illegal market (C&C) in € million, 2017-2018.

Source: KPMG Project report (2019) and author's calculations.

[21] This project, called "Project Stella" is an annual study estimating the scale and development of the illicit cigarette market in the EU. It contains detailed estimates of the overall amount of non-domestic consumption of cigarettes for all member states, further broken down by legal and illegal consumption and the origin of flows.

[22] Her Majesty's Revenue and Customs (HM Revenue and Customs or HMRC) is a non-ministerial department of the UK Government responsible for the collection of taxes, the payment of some forms of state support and the administration of other regulatory regimes including the national minimum wage.

Figure 3.8 shows that the United Kingdom loses annually an outstanding amount of revenues due to the illegal market, amounting to €2,8 billion in 2018. Despite the decrease in total cigarette consumption in 2018, the share of illegal market continued to increase. Similarly, this trend is followed also by France, whose total revenue loss from illegal cigarettes consumed amounted to €2,6 billion. KPMG's Project states that overall cigarette consumption continued to decline as consumers switched from legal domestic sales to non-domestic (legal) consumption from low-priced countries. Undeniably, eliminating the illicit market benefits not only public health but also contributes to a significant government revenue streams.

3.2.9 The Laffer Curve theory

The Laffer Curve illustrates the relationship between tax rates and government revenues. The basic idea behind Laffer Curve (Laffer, 2004) is that changes in tax rates have two effects on revenues: the arithmetic effect and the economic effect. The arithmetic means that if tax rates are lowered, tax revenues (per euro of tax base) will be decreased by the amount of the tax rate decrease. The reverse happens for an increase in tax rates. The economic effect, though, acknowledges the positive effect of lower tax rates on work, output, and employment - and thereby the tax base - by providing incentives to increase these activities. Increasing tax rates has the opposite economic effect by penalizing participation in the taxed activities as a result the economic effect always works in the opposite direction from the arithmetic impact. The combination of these opposite effects makes the consequences of the tax rates changes to be no longer ambiguous.

Figure 3. 9 depicts the Laffer Curve and how it works. When tax rate is 0 per cent, regardless of tax base, there is no revenue collection. Similarly, when the tax rate is 100 per cent, no revenue is also generated as no one will have the incentive to work for an after-tax wage of zero. So, policymakers should set the tax rate between these two extreme cases. Another issue of interest derived from Laffer Curve is the optimal tax rate that maximizes tax revenue. According to the Laffer curve theory, when

the tax rate increases, the tax revenues reach a maximum point and eventually decline as the tax rates become more excessive.

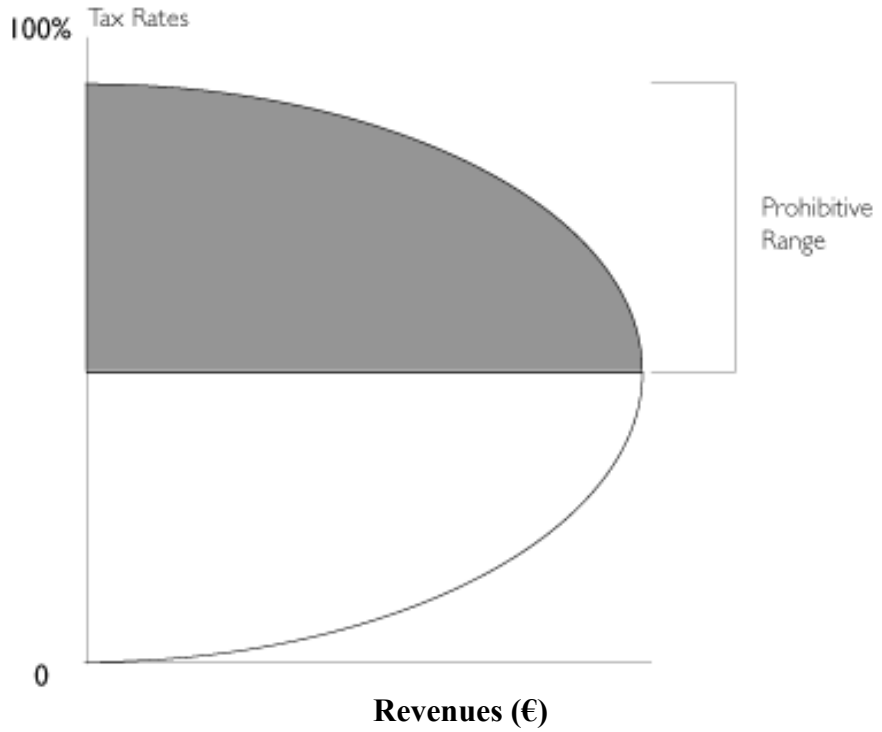

Figure 3. 10 The Laffer Curve.

Source: Laffer (2004)

The optimal tax rate varies among economies. Several determinant factors are likely to contribute to revenue responses as a result of a tax rate change, such as the existing tax system, the time period being considered, the ease of movement into illegal activities, the prevalence of legal and accounting-driven tax loopholes or institutional factors, i.e. corruption level of a state. If the existing tax rate is too high and it is in the "prohibitive range" shown above, then a tax-rate drop would result in raised tax revenues.

Empirical evidence, though in a limited extend, advocates the Laffer Curve theory for describing the relationship between tax rates and revenues for a number of economies (Reidy and Walsh, 2011). While the theoretical construct of the Laffer curve is generally accepted, a handful of studies show that a wide range of economies, regardless of their development level, experience revenue increases despite

the cigarette tax increases, thereby rejecting the general concept of Laffer Curve (Kaiser et al., 2016; Scollo and Winstanley, 2016; Rodriguez-Iglesias et al., 2017).

The next section studies empirically the association between excise taxes and excise tax revenues in the EU cigarette market, based on a dataset including 26 European Union member states over the period 2008-2018. A graphic illustration of relationship between excise rates and excise revenues accrued from cigarette consumption for each member state separately is provided in Appendix II, Figure II.1.

3.3 Empirical analysis: A Laffer curve in the EU cigarette market.

3.3.1 Introduction

The basic idea behind the theoretical concept of the Laffer curve is a turning point beyond which any tax increase reduces government revenues (Laffer, 2004). In the same context, Laffer (2016) discusses the relationship between taxes and revenues on the tobacco products. However, this relationship is found to be ambiguous in a number of empirical papers that use macro data across the world (Blecher, 2018).

Historically, revenue generation and elimination of smoking prevalence have been the primary objectives of tobacco taxation. In this respect, the European Commission report (2020) shows that the EU tax revenues from tobacco products amounted to € 82.3 billion in 2016, including only excise revenues. These revenues accounted for almost 2% of the total tax revenues, whereas, at the same time, cigarette taxes remain the main source of these receipts. The same evaluation report points out that excise duty receipts have slightly increased, specifically by 0.7% year-on-year for the 2010-2017 period, despite the reduced consumption levels.

Prompted by all these findings and in light of the discussion about the fiscal integration of the European Union (EU), this study investigates empirically the relationship between excise tax revenues and rates on cigarettes across EU member states. Considering that the greatest bulk of the retail price of cigarettes are excise taxes, we focus on tax revenues from cigarette consumption accrued from excise duties - a specific excise duty levied on the product unit and an ad valorem excise duty calculated on the basis of the retail selling price[23] – and thus exclude the VAT that indicates a mild change over the sample period.

The global evidence on Laffer curve has shown that an unclear relationship exists between cigarette tax revenues and tax rates. Regarding EU, there are few studies that discuss this empirical

[23] Council Directive 2008/118/EC of 16 December 2008 determines the general arrangements for excise duty and repeals the Directive 92/12/EEC.

specification for individual member states. In particular, Reidy and Walsh (2011), by using a model in the Irish cigarette market, find an inverse U-shaped curve between excise rate and cigarette revenues, in which the maximum revenues in 2008 correspond to a specific rate at 43.11% and an ad valorem rate at 17.92%. However, their results are not statistically significant. Further, Krasovsky (2012) focuses on the tobacco markets in Estonia, Latvia and Lithuania, and finds that even though the proportion of taxes in retail prices was in its highest value in 2011, all three countries experienced revenue increase over that year. In line with Krasovsky (2012), a handful of studies discuss that in emerging economies, *inter alia* Philippines, South Africa, Brazil and Argentina, higher cigarette taxes are followed by higher revenues, even though cheaper, less-taxed and illicit cigarettes are still consumed in these markets (Kaiser et al., 2016; Rodriguez-Iglesias et al., 2017); similarly, very high-taxed countries (e.g., Australia) keep sufficiently high tax rates on cigarettes and continue to increase their tax revenues (Parliament of Australia, 2010).

An important issue in the relevant literature is that different excise structure may have different impact on retail prices, cigarette consumption and government revenues (WHO, 2010; Chaloupka et al., 2010). According to the WHO report (2015), the specific tax rate has a significantly greater impact on price in relation to the ad valorem tax rate. Estimates from different specifications suggest that increasing the specific tax rate would raise government revenues, while increasing the ad valorem tax rate might reduce state revenues, as more smokers prefer less expensive cigarettes that lead to less tax revenues (Keen, 1998; Chaloupka, et al., 2010). For instance, Spain experienced a sharp decrease in tobacco revenues by raising ad valorem tobacco taxes (Antonanzas and Rodriguez, 2007). Furthermore, Chaloupka et al. (2012) discuss that greater reliance on specific excise taxes reduces the price gap between premium and low-priced alternatives, thereby limiting opportunities for users to switch down in response to tax increases.

The most influential factor of tax revenues is cigarette consumption, widely discussed in the relevant economic literature. Creedy and Gemmell (2004), studying the revenue responsiveness

properties of UK income and consumption taxes between the late 1980s and 2000, observe that the rising revenue elasticity is essentially due to changing consumption patterns. Further, Smith (1776), considering that smokers are not price sensitive in general (the demand is price-inelastic), strongly relates the rise in tobacco consumption with the respective tax revenues. In that context, a large body of the empirical literature on the demand for tobacco products states that although a tax increase leads to higher cigarette prices and in turn to lower consumption levels, tax revenues increase due to inelastic demand for cigarettes, since the relative increase in cigarette prices exceeds the related decrease of consumption (IARC, 2011; Joossens and Raw, 2011).

Further, a number of studies agree that the illicit trade in tobacco products accounts for a sharp decline in government revenues (Allen, 2010; Joossens et al., 2010; Joossens and Raw, 2012). Joossens et al. (2009), based on 2007 global data, find that due to illegal trade governments are currently losing approximately $40.5 billion annually. Over the last decade, estimates in the EU show that illicit cigarette consumption (contraband and counterfeit, including 'illicit whites') causes an annual tax revenue loss of €10 billion (European Anti-Fraud Office, 2010; KPMG, 2019). For instance, HMRC[24] (2019) estimates the size of illicit cigarette and hand-rolling tobacco market in the UK at £1.8 billion between 2017 and 2018. Finally, Spain spent almost €40 million over the period 1996–2000 to combat cigarette smuggling and thus, the market share of smuggled cigarettes decreased from 16% to 2% and cigarette tax revenues rose from €2.3 billion to €5.2 billion (Joossens and Raw, 2008).

Through this framework, our paper aims to answer the following questions: Is there any relationship between the excise duties levied on cigarettes and the government tax revenues? To what extent, each component of the excise duties builds a separate relationship with tax revenues? In this regard, we use an empirical model that incorporates two crucial factors that affect tax revenues, i.e. legal and illegal cigarette consumption, and analyzes the relationship between tax excise duties and

[24] Her Majesty's Revenue and Customs (HM Revenue and Customs or HMRC) is a non-ministerial department of the UK Government responsible for the collection of taxes, the payment of some forms of state support and the administration of other regulatory regimes, including the national minimum wage.

government revenues from cigarette market. Our evidence clearly demonstrates a significant inverse U-shaped effect from the specific cigarette taxes on state excise revenues. However, an insignificant U-shaped form between ad valorem taxes and government revenues is also drawn.

The remainder of the paper is structured as follows: section 3.3.2 introduces the empirical setup and analyzes the estimation methodology; section 3.3.3 presents the data; section 3.3.4 discusses the results and section 3.3.5 concludes.

3.3.2 Analytical framework

This section presents the empirical specification and the econometric method of our empirical analysis.

3.3.2.1Empirical Specification

Following the baseline forms in the empirical literature (Malcomson, 1986; Agell and Persson, 2001), we construct an empirical model that investigates the non-linear effect of cigarette excise duties on government revenues and also includes a number of control variables, as below:

$$lnRev_{i,t} = a_i + a_t + a_1 tax_{i,t} + a_2 tax_{i,t}^2 + a_3 lnCons_{i,t} + a_4 lnIlleg_{i,t} + u_{i,t} \quad (1)$$

where the dependent variable *lnRev* is the government revenues in logarithms accrued from excise duties on cigarettes, *tax* is the specific component of excise duty levied on cigarettes as a percentage of price or alternatively the ad valorem component of excise duty levied on cigarettes as a percentage of price, *lnCons* is the cigarette consumption and *lnIlleg* is the illicit cigarette consumption, both in a logarithmic scale. In turn, a_i , a_t denote country- and year- fixed effects, respectively, while *u* refers to the remainder disturbance. Finally, the coefficients of our interest are a_1 and a_2, while a_3 refers to the elasticity of tax revenues with respect to cigarette consumption.

3.3.2.2. Model Estimation

We estimate the eq. (1) by using a variety of econometric methods and tests. We account for country- and time-specific fixed effects and country-specific time trends with country-clustered standard errors to deal with the heteroskedasticity and within-country serial correlation. Therefore, in all specifications, we get rid of fixed effects of the error term and correct our model from omitted-variable bias associated with time-invariant characteristics. To further address concerns regarding endogeneity and improve the efficiency of our estimators, we apply a two-step efficient generalized method of moments (GMM) estimator by using a set of appropriate instruments.

For our assumed endogenous variables, i.e. the specific excise tax duties ($tax_{i,t}$, $tax_{i,t}^2$), we use the lagged values of the endogenous variables to ensure that there is no feedback effect. We also employ the lagged values of three institutional variables, i.e. "control of corruption", "regulatory quality" and "democracy" indices as argued in the respective literature (La Porta et al., 1999 who show that corruption influences the effectiveness of government policy tools, regarding the tax law enforcement; Kottaridi et al., 2019 who suggest a moderating role of regulations on taxation; Asatryan et al., 2017 who find a direct effect of democracy on local taxes). We further use the mean of the lagged value of the average excise tax duties of the neighboring EU countries (Caselli and Reynaud (2020) who argue that reforms in neighboring countries may affect the adoption of domestic reforms through peer pressure and imitational effects). As for the third endogenous variable, i.e. the cigarette consumption ($lnCons_{i,t}$), we use the lagged value of cigarette affordability measure, a variable widely

discussed in the relevant literature[25], as well as the lagged value of the specific excise taxes (WHO, 2010; Chaloupka et al., 2012; Jha et al., 2014)[26].

We further report many tests to assess the instruments' validity and the model's fitness. We examine the instruments exogeneity by applying a Hansen J-test under the null hypothesis that instruments are exogenous. To test for weak instruments, we report Kleibergen-Paap rank Wald F-statistics compared to their respective critical values. We also employ a Durbin-Wu- Hausman test, in which a rejection of the null hypothesis demonstrates that instrumental variable estimation techniques are required. In addition, to test the fitness of our specification, we perform a Kleibergen-Paap rank Lagrange Multiplier test under the null hypothesis that the model is under-identified. We further use Arellano-Bond AR(1) to AR(4) tests for first and higher order autocorrelation in the residuals under the null hypothesis of no autocorrelation. We also test for cross-sectional dependence across countries -caused by the presence of common factors (De Hoyos and Sarafidis, 2006)- by using the CD-test of Pesaran (2004) under the null hypothesis of no correlation. Finally, we evaluate the significance of the quadratic term of the excise tax duties ($tax_{i,t}^2$) by using a U-test under the null hypothesis of a monotone or U-shape relationship between taxes and revenues.

3.3.3 Data Description

Our empirical analysis is based on annual data for 26 member states of EU[27] over the period 2008-2018[28]. The list of all countries is reported in Table II.1 in the Appendix II.

[25] Blecher & Walbeek (2004) estimate the affordability elasticity of demand for 70 countries worldwide between 1990 and 2001 at -0.53 and He et al. (2018) estimate the same elasticity for 78 countries worldwide over the period 2001-2014 at -0.20. Blecher & Walbeek (2009) find that in high-income countries cigarettes are significantly more affordable than in low and middle-income countries. Further, Krasovsky (2012) also displays the decrease of tobacco affordability due to tax hikes and economic recessions that lead to tobacco consumption decline.

[26] Empirical evidence points out that simple tax structures emphasizing on specific taxes are more effective in reducing cigarette smoking.

[27] Croatia and Malta have been excluded for data availability reasons.

[28] Even though the availability of our data starts in 1996, we deal with missing data in the "tax revenues" variable between 2003 and 2007. In addition, cigarette consumption data begin in 2002.

Our data come from a range of different sources. Data on our dependent variable "excise tax revenues", excise tax rates (specific and ad valorem) and cigarette consumption are obtained from the Excise Duties Table series compiled by Directorate-General for Taxation and the Customs Union (DG TAXUD) and published in the European Commission database[29]. Illegal cigarette consumption is derived from KPMG[30,31]. As for our instrumental variables, we construct the average performance of the surrounding EU countries. Information on the quality of economic institutions is derived from the World Bank, Worldwide Governance Indicators (WGI) database. Among the six institutional indices, we rely on "Control of Corruption" and "Regulatory Quality" indices, as the most relevant to illegal tax activities (Johnson et al., 1998; Hindriks et al., 1999; Cebula and Foley, 2012; Baum et al., 2017).[32] Further, the quality of political institutions is proxied by the "Democracy" index that comes from the Polity5 Project (2020). Finally, to measure "cigarette affordability", we employ the relative income price ratio (RIP), developed by Blecher and Van Walbeek (2004). This ratio is calculated by dividing the price of 100 packs of cigarettes with GDP per capita. The higher the ratio is, the less affordable cigarettes become and *vice versa*. For the purposes of the present paper, RIP is preferred over other measures, such as the minutes of labor, since it allows for comparison over time and across countries, and thus, it has advantages in capturing and comparing the real cost of cigarettes (Guindon et al., 2002; Blecher and Van Walbeek, 2009).

[29] See https://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/excise-duties-tobacco_en

[30] Till now, the most comprehensive panel data source available is the KPMG's Project report series which contains detailed estimates of the overall amount of the non-domestic cigarette consumption for all Member States of the Union, broken down by legal and illegal consumption and by origin of flows. Since this project is totally financed by tobacco firms, the validity of the results has been questioned and needs to be taken with due caution (Joossens and Raw, 2012; Gilmore et al., 2014).

[31] Measuring illicit trade is a difficult task due to the lack of validated and comprehensive data. By its nature, every illicit activity is hard to be measured and quantified as it is not officially recorded.

[32] This variable selection may highlight differences among EU countries in several dimensions i.e. the size of illegal market, establishment and implementation of tobacco control policies, regulatory penalties for illegal activities and legislation violation in general, the level of corruption in the political system, the public administration and the business sector (Torgler and Schneider, 2009; Profeta et al., 2013).

To get a better feel of our data, we present below the Figure 1 that shows a Laffer curve relationship between the excise tax revenues and the specific tax rate on cigarettes. We also observe that the mean of EU countries' tax revenues increases till 2012 and thereafter decreases (European Commission, 2017).

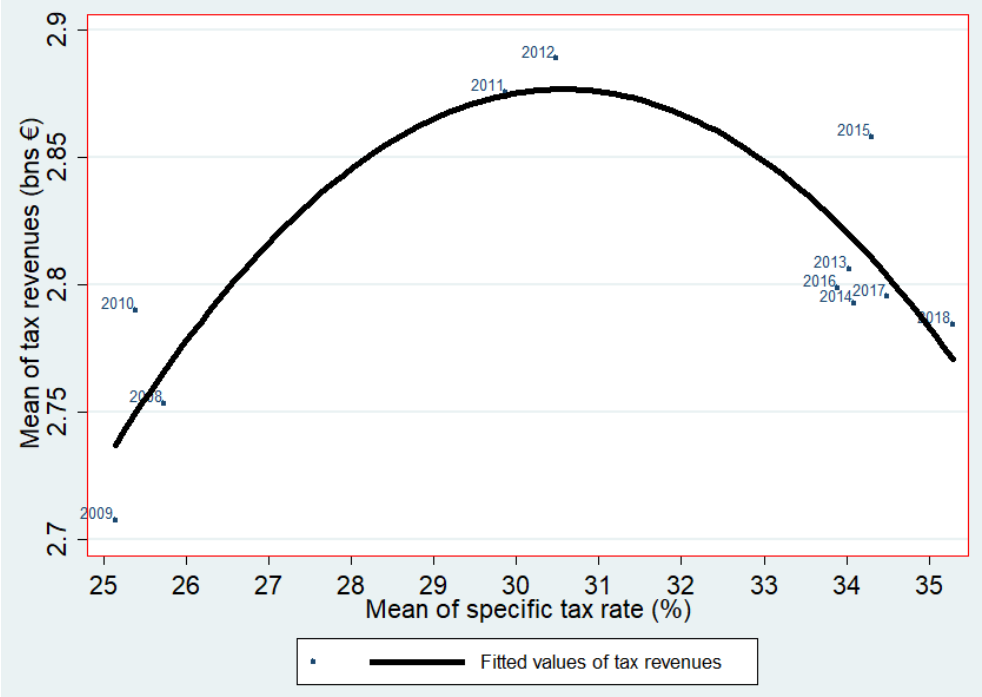

Figure 3. 11 Cigarette excise tax revenues vs specific tax rate (Mean values).

We continue with Table 3.1 that provides summary statistics of our variables.

Table 3. 1 Summary Statistics 2008-2018.

Variables	**Observations**	**Mean**	**St. Dev.**	**Min**	**Max**
Excise tax revenues (bn)	286	2.81	3.59	0.10	12.87
Specific excise tax (%)	286	31.16	16.10	3.67	64.19
Ad valorem excise tax (%)	286	30.70	15.44	0.83	58.43
Cigarette consumption per 1,000 cigarettes (m)	286	20.71	23.94	1.15	100.30

Illegal cigarette consumption per 1,000 cigarettes (m)	286	2.17	2.86	0.01	13.96
Instruments					
Specific excise $\text{tax}_{\text{Neighbor}}$	286	30.54	12.31	3.67	61.38
Control of Corruption index	286	79.46	15.43	48.82	100
Regulatory quality index	286	84.97	9.47	59.13	100
Democracy index	286	9.63	0.64	8	10
Cigarette affordability	286	1.84	0.72	0.41	4.13

Notes: *Tax revenues*, *Cigarette consumption* and *Illegal cigarette consumption* are numerical variables that are used in logs in eq. (1); *Excise taxes* (specific and ad valorem) are ratios of cigarette price; $Tax_{Neighbor}$ is the average value of the specific excise duties on cigarettes of the neighboring countries; *Control of Corruption index* captures perceptions of the extent to which public power is exercised for private gain and ranges from 0 to 100; *Regulatory quality index* captures perceptions of the ability of the government to formulate and implement sound policies and regulations and ranges from 0 to 100; *Democracy index* is an indicator where 10 indicates a maximum level of institutional democracy; *Cigarette affordability* is a ratio that is calculated by dividing the price of 100 packs of cigarettes by GDP per capita.

On average, countries in our sample period collect €2.81 billion and impose 31.16% and 30.7% specific and ad valorem excise duties on cigarettes, respectively. Illegal cigarette consumption seems to be the 10% of the total cigarette consumption, on average; a finding which is in accordance with relevant European studies (European Anti-Fraud Office, 2010; KPMG, 2019). Bulgaria shows the highest total excise tax rates[33] (67.97%), while Sweden the lowest (55.44%). However, the Netherlands has the highest specific tax rate (52.39%), while Italy the lowest (5.51%) and Spain sets the highest ad valorem tax rate (53.55%), while Denmark the lowest (6.97%). Finally, approximately 3/4 of the whole sample alter excise tax rates at least twice (countries with changing tax scheme). More specifically, we define a change in tax scheme from year to year when its value is higher than the mean value of all changes in our dataset, i.e. values 2.60% and 3.69% in the specific and the ad valorem tax, respectively.

[33] The total excise tax rates are calculated by adding the specific and the ad valorem component.

3.3.4 Empirical results

This section discusses the empirical results. We examine the impact of excise taxes on the excise tax revenues from cigarettes and complete with presenting robustness analysis.

Table 3.2 below presents estimation results of eq. (1). Columns (1) and (2) discuss OLS estimates, while columns (3) and (4) report GMM estimates to address endogeneity concerns; column (4) shows estimates for a sub-group, i.e. countries that change their taxes regarding the cigarette taxation. All specifications include country- and year- fixed effects, country-specific-time trends and clustered robust standard errors with countries for heteroskedasticity reasons; t-values are also reported in parentheses. At the bottom part of Table 3.2, a number of diagnostic tests as well as the global maximum per column are also reported.

Table 3. 2 Excise taxes and Excise Tax Revenues on cigarettes.

Dependent variable	(1)	(2)	(3)	(4)
Excise Tax Revenues (logs)	OLS(1)	OLS(2)	GMM	Changing tax scheme
Consumption (logs)	0.3337***	0.3217***	0.6025***	0.7299***
	[4.159]	[3.972]	[4.916]	[5.510]
Specific tax	0.0087***		0.0191*	0.0198*
	[3.325]		[1.883]	[1.772]
Specific tax^2	-0.0001**		-0.0003*	-0.0003*
	[-2.443]		[-1.884]	[-1.706]
Ad-valorem tax		-0.0042		
		[-1.630]		
Ad-valorem tax^2		0.0001		
		[0.983]		
Illegal consumption (logs)	-0.0203	-0.0192	-0.0045	-0.0010
	[-1.264]	[-1.092]	[-0.305]	[-0.045]
Observations	286	286	260	180
Number of countries	26	26	26	18
Within R-squared	0.405	0.381	0.085	0.176
Year effects	Y	Y	Y	Y
Country effects	Y	Y	Y	Y
Country-specific-time-trends	Y	Y	Y	Y
Clustered standard errors	Country	Country	Country	Country
Pesaran (CD) test (p-value)	0.339			
U-test (p-value)	0.204		0.050	0.074
Hansen J-test (p-value)			0.834	0.745
K-P rk Wald (F-statistic)			6.128	2.476
Durbin-Wu-Hausman (p-value)			0.003	0.026

K-P rk LM (p-value)			0.017	0.074
Arellano-Bond AR-1 (p-value)	0.733	0.980	0.385	0.994
Arellano-Bond AR-2 (p-value)	0.044	0.082	0.306	0.285
Arellano-Bond AR-3 (p-value)	0.086	0.074	0.192	0.182
Arellano-Bond AR-4 (p-value)	0.024	0.015	0.100	0.052
Specific Tax (Maximum)	***52.05***	***-***	***37.13***	***37.46***

Notes: See text for the variables' definition. {*}, {**}, {***} are significance level at 10%, 5% and 1%, respectively; t-values are reported in parentheses. In all specifications, year- and country- fixed effects, country-specific-time-trends and clustered robust standard errors with countries are also reported.
The following diagnostics are also reported: Pesaran test for cross sectional independence (null); U-test for an inverse U-shape non-linear relationship (rejection of null); Hansen J-test for instrument validity (null); Kleibergen-Paap (K-P) rank Wald (F-statistic) test for weak instruments (null), with critical values varying between 4.44 and 13.95; Durbin-Wu-Hausman test for IV estimation appropriateness (null); Kleibergen-Paap (K-P) rank Lagrange Multiplier statistic test for the model under-identification (null); Arellano-Bond for AR(1) to AR(4) tests for no autocorrelation (null).
Instruments used in columns (3) and (4) are: Affordability(t-1), Specific tax(t-1), Specific tax^2(t-1), Democracy(t-1), Control of Corruption(t-1), Regulatory Quality(t-1) and Average of specific tax(t-1) of neighboring countries.

We start with OLS estimates reported in columns (1) and (2). In column (1), we observe that specific tax on cigarettes show an inverse U-shaped relationship, as *tax* and tax^2 show positive and negative significant signs, respectively. However, the diagnostic U-test does not confirm this relationship since it fails to reject the null hypothesis of a linear or a U-shaped form between taxes and revenues (Lind and Mehlum, 2010). Even if the p-value of the U-test is high (0.204), we present the maximum value of the specific tax which equals 52.05%, confirm the absence of cross-sectional dependence by applying a CD-test and observe a higher order autocorrelation in the residuals by setting a 10% significance level. After the global maximum, tax revenues start to decrease. Further, the coefficients of cigarette consumption - in other words, the elasticity of tax revenues regarding cigarette consumption- and that of illegal consumption carry the expected sign; the former associates positively (0.3337) with a high significance and the latter negatively relates (-0.0203) with no significance with excise tax revenues, respectively. Turning to estimation results of column (2), we find that the ad

valorem excise tax component exhibits an insignificant U-shaped impact on excise tax revenues.[34] The remaining variables show almost equal impact and significance, as in column (1).

We further deal with a common concern regarding endogeneity. In column (3), we address endogeneity by using lagged values of affordability, specific tax and its squared term, democracy, control of corruption, regulatory quality, as well as the average specific tax rate of the neighboring countries. To test the instruments validity and the fitness of our model, we apply many diagnostics. For instance, our instruments are exogenous (Hansen J-test) and are not weak identified (Kleibergen-Paap rank Wald F-statistic). The instrumental variable estimation technique is essential (Durbin-Wu-Hausman test). Our model is not under-identified (Kleibergen-Paap rank Lagrange Multiplier test) and does not suffer at least from 1st to 4th order autocorrelation problem of the residuals (Arellano-Bond tests). The U-test confirms the inverse U-shaped relationship between specific tax rate and excise tax revenues (a Laffer curve) and thus, the maximum, after which the relationship between the two variables becomes negative, is 37.13%. This value is quite lower than that of column (1), which indicates a significant improvement of our model by using GMM approach.[35] Further, the elasticity of tax revenues regarding changes in cigarette consumption is now 0.6025. Finally, illicit cigarette consumption again does not significantly affect tax revenues.

Finally, in column (4), by using the same instruments with those in column (3), we obtain the estimation results for a sub-group of countries, i.e. countries with changes in cigarette taxation.[36] Our results do not significantly differ compared to those reported in column (3) for the whole sample and the turning point is now 37.46%. Perhaps, these countries drive the results of the whole sample since they alter more frequently and intensely their tax scheme regarding the cigarette taxation. We additionally test our model by using revenues, consumption and illegal consumption of cigarettes per

[34] We also tested the impact of total excise duties, i.e. the sum of specific and ad valorem components, and found non-significant results.
[35] Besides, in column (1), our model suffers from higher order autocorrelation of the residuals and the U-test does not confirm the existence of an inverse U-shaped relationship.
[36] See Table A.1 in the Appendix for more details.

capita (it includes age group 15 and over), in which we find similar results with those reported in Table 3.2.[37]

Thus far, the relevant literature documents unclear findings on the relationship between excise taxes and tax revenues from cigarette consumption (Antonanzas and Rodriguez, 2007; Delipalla, S., 2009; Chaloupka et al., 2010)[38]. Our results have shown that tax revenues are strongly associated with specific excise duties on cigarettes and form a Laffer curve relationship. However, an insignificant U-shaped relationship between tax revenues and ad valorem tax rate exists. In a broader context, our results are in line with Baldwin and Sbergami (2000) and Rivera-Batiz and Romer (1991) who observe a bell-shaped relationship between growth rate and specific rate, and a U-shaped association between growth rate and ad valorem rate, respectively. A direct impact on growth rate due to a tariff-revenue change can be implied given that the revenues are returned lump sum to consumers.

3.3.5 Conclusion

The relationship between excise taxation and revenues accrued from cigarette consumption is an issue of foremost concern for the government's fiscal objectives. Laffer curve could be used to describe this relationship suggesting a turning point beyond which tax revenues eventually decline as the tax rates become more excessive. However, this evidence is rather disputed by many empirical studies.

Motivated by this controversy, our paper aimed to empirically investigate how and to what extent each component of the excise duties, specific and ad valorem tax, build a significant relationship with cigarette tax revenues, given that excise taxes account for the major tax burden of cigarettes. Based on a dataset that included 26 EU member states over the period 2008-2018, we used an empirical

[37] Results are not reported for brevity and are available upon request.

[38] Estimates from different specifications suggest that increases in the specific tax raise government revenues, while increases in the ad valorem tax might reduce them, though some of these estimates are not statistically significant. Delipalla (2009) demonstrates that a tax increase leads to a higher fraction of lost revenues due to smuggling under pure ad valorem taxation, but the effect is ambiguous under a purely specific tax.

model incorporating legal and illegal cigarette consumption as control variables. Our results showed a significant inverse U-shaped relationship between the specific cigarette taxes and the government revenues, whereas an insignificant U-shaped effect was found between ad valorem taxes and state revenues.

Summing up, our study contributes to the tobacco literature with empirical application for the EU area which, thus far, has been poorly explored. Our findings shed some light on the separate impact of each excise element on the state revenues, thereby providing policy-makers with valuable evidence to implement effective tax and price strategies.

Chapter 4 Tobacco Industry Analysis and Revenues of Stakeholders

4.1 Introduction

The fourth chapter conducts a theoretical analysis of the major categories of tobacco industry stakeholders involved in supply and value chain of tobacco products. The last section devotes to an empirical analysis of tobacco industry in Greece, investigating if and to what extend the revenue shares of three main supply chain stakeholders are affected by the changes of cigarette excise taxation.

4.2 Tobacco supply chain - Theoretical and Empirical Review

In this section we clarify the sectors of the tobacco industry and the value of trade in each of these sectors. There is a variety of activities that may be deemed necessary to supply tobacco products to the market; however, the literature generally identifies the following groups of activities as analytically important for economic policy analysis: production, distribution and retailing of tobacco leaf and tobacco products (Buck et al., 1995; World Bank, 1999). Specifically, the three main groups contain the following activities: 1) production sector: farming, leaf marketing and processing; 2) manufacturing sector: production of unmanufactured tobacco and manufacturing tobacco products; and 3) sales sector: wholesale and retail. Each of these groups contains numerous direct activities to transform tobacco crops into final products. The types of activities include preparing the land for farming, adding chemicals or additives to tobacco, storing cigarettes in warehouses and selling cigarette packets in retail shops.

In order to describe the sectors of tobacco industry across countries over time, there needs to be a common understanding of what constitutes a particular industrial activity and what does not (i.e. manufacturing in tobacco). Brief description of tobacco supply chain activities and their respective

NACE (Rev. 1.1) codes[39] as well as graphical illustration of the cigarette supply and value chain in a simplified form are available in Appendix III, Table III.1. and Figure III.1, respectively.

4.2.1 Tobacco growing - Worldwide data

Tobacco is a differentiated product with certain characteristics that influence its production, consumption and trade patterns worldwide. Tobacco products are prepared by curing the leaves of tobacco plant which is a part of the genus *Nicotiana* of the Solanaceae family. There are more than seventy species of tobacco known till now, however, *N. tabacum* remains the chief commercial crop (Kishore, 2014). Tobacco contains a colorless volatile alkaloid, nicotine, which is responsible for stimulating brain functions, increasing blood pressure, constricting peripheral blood vessels and raising heart rate (Jiloha, 2010). Dried tobacco leaves are majorly used for smoking in cigarettes, cigars, pipes and shisha; and as chewing tobacco, snuff, snus and dipping tobacco.

Tobacco production takes place in more than 100 countries in a variety of climatic conditions and soils (Food and Agriculture Organization of the United Nations (FAO, 2003). The major producers are located in China, the United States, India, Brazil, Turkey, Zimbabwe, Malawi and the EU, accounting for more than 80% of world production. World tobacco leaf production in dry weight experienced an increase ranging from 4.3 million tonnes in 1970 to 8.1 million tonnes in 1997 (which was an all-time high), indicating a rise of almost 90% over this period. Tobacco production in developing countries is higher, whereas in developed countries tobacco production decreased. This trend continued, thus reducing the share of developed countries in world production and, as a result, their position in the world tobacco economy. These growth rates in production worldwide is owing mainly to yield increases, while

[39] NACE is the "statistical classification of economic activities in the European Community" and is the subject of legislation at the European Union level2 , which imposes the use of the classification uniformly within all the Member States. The NACE codes are useful because they provide a mechanism for providing harmonized statistics by sector.

the area of land used for tobacco has, overall, remained rather stable. Similarly, the area used for tobacco growth extended substantially in developing countries, while decreasing in developed countries (See Appendix III, Figure III.2).

4.2.2 EU tobacco production and employment data

The European Union contributes to the tobacco cultivation with approximately 140,000 tonnes in 2018, accounting for less than 2% of global yearly raw tobacco production[40]. Tobacco growing has steadily decreased since 1991 – when approximately 400,000 tonnes were grown in eight EU countries, while in 2018 tobacco is growing in 12 EU countries. In 2018, EU tobacco represented some 66,000 hectares, whereas according to 2009 estimates, the EU provided approximately 118,190 for tobacco growing, which represents a decrease of 44%. The main producers are Italy, Spain, Poland, Greece, Croatia, France, Hungary and Bulgaria, accounting for 99% of the EU tobacco production. In general, the tobacco production is limited to small regions carried out by family businesses, while the average area (1.6 ha per farmer) differs considerably according to the varieties grown. In 2018, the EU imported 420,000 tonnes, indicating an increasing trend, and exported 120,000 tonnes, indicating a decreasing trend, of raw tobacco. The Figure below illustrates the downward trend of tobacco production in the EU.

[40] According to European Commission, https://ec.europa.eu/info/food-farming-fisheries/plants-and-plant-products/plant-products/tobacco_en?cookies=disabled

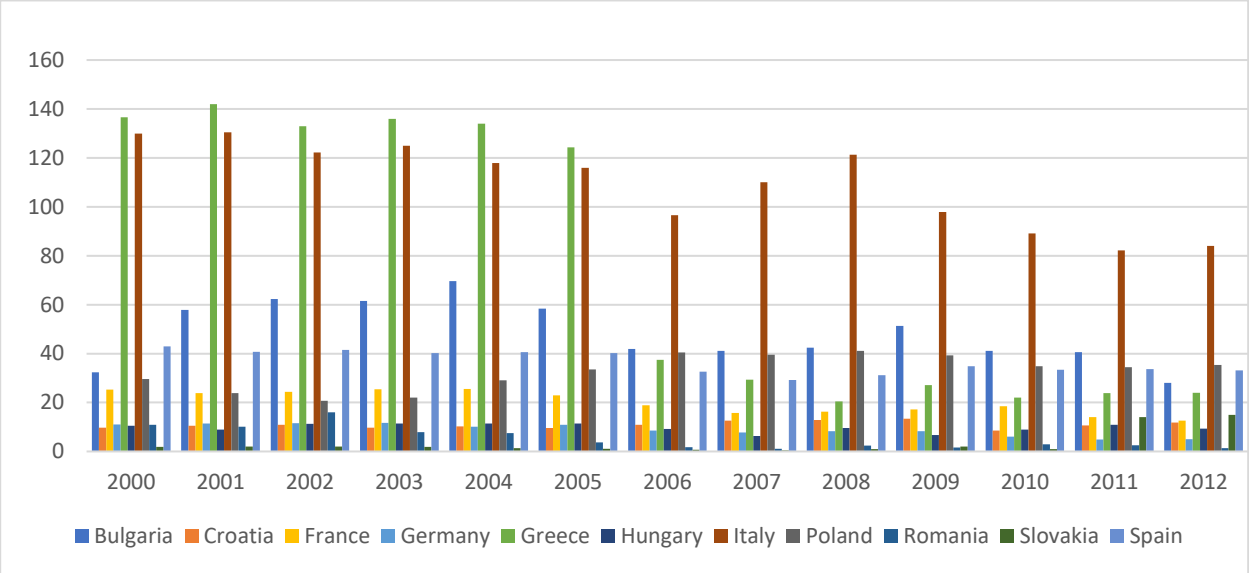

Figure 4. 1 Production of unmanufactured tobacco leaves, in thousand tonnes, 2000-2012.

Source: FAOSTAT, International Labour Organization (ILO), 2014[41].

As Figure 4.1 shows, there was significant cross-country variation in how the production of unmanufactured tobacco leaves changed. Production decreased in most member states but the most notable trend was that of the large reduction of Greek tobacco production, from 137 thousand tonnes in 2000 to just 24 thousand tonnes in 2012. Within this general downward trend in tobacco production, there were various different developments by tobacco variety.

The EU employ about 86,000 tobacco farmers[42]. Farmers in Bulgaria account for 50% of total tobacco farmers, followed by Poland and Greece (both representing 17%). Except for farmers, the EU employs also around 100 first processors. The first processors collect the raw tobacco cured by the

[41] Note that there is conflicting data from different sources on this. According to Eurostat, Cyprus no longer produces tobacco (and only did briefly, in very small amounts, in 2003, 2004 and 2005. According to the FAO, Cyprus has been producing small amounts of tobacco across all eleven years between 2000 and 2010. By both accounts, Austria and Slovakia lost all their tobacco production by 2010. Based on ILO, the production in Cyprus is significant during the period 200-2007. According to the sources, there are thus either twelve or thirteen tobacco-producing countries.

[42] According to European Commission, DG AGRI. In addition to the farmers, a number of people (including seasonal workers) are employed on the farms. Copa-Cogeca (European farmers and agri-cooperatives) has estimated this figure to 400,000.

farmers and make a first process before selling it to the industry in order to produce cigarettes, cigars or manufactured tobacco. Bulgarian first processors account for 44% of the EU total first processors, while 22% are located in in Italy. The second processors subsequently purchase, process, blend pack, store and ship tobacco to meet each specifications of manufacturers of cigarettes and other consumer tobacco products. According to European Commission (2012), most of the EU market is controlled by two U.S. based leaf tobacco merchants - Alliance One Int. and Universal Corporation - with substantially similar global market shares. For instance, Alliance One delivered in 2017 39% of its tobacco sales to customers in Europe, which worth approximately €669 million[43].

The Nomisma report (2010) shows that the overall number of farmers involved in tobacco remained relatively stable between 2007 and 2009. The highest percentage of tobacco growers are Bulgarian, where in 2009 they represented more than 50% of total EU growers (see Appendix III, Table III.2).

4.2.3 Manufacture of tobacco products in the EU and employment data

According to Matrix Report (2013), the European cigarette market is largely dominated by four large multinational companies: British American Tobacco (BAT), Imperial Tobacco (IT), Japan Tobacco (JT) and Philip Morris International (PMI)[44], with the EU market share (in terms of volume) of these tobacco companies, known as 'Big Four' to increase from around 60% in 2001 to around 90% in 2010. Rest players providing cigarettes for the European market are as follows: companies with an EU-28 market share between 0.5% and 2% (Bulgartabac Holding Group, Karelia Tobacco Co Inc), and companies with an EU28 market share below 0.5% (Ari Grupa dd, China National Tobacco Corp, Continental Tobacco Group, Dubek ltd, Heintz van Landewyck Sarl, King's Tobacco AD, Pöschl Tabak

[43] AOI 2017 Annual Report, https://last10k.com/sec-filings/aoi/0000939930-17-000036.htm#last10k-feature-modal-downloads, accessed on April 2020.
[44] These are known as the Big Four.

Gmbh & Co KG, SEKAP SA,Sinoroma Industry SRL, Slance Stara Zagora Tabak AD, Zaklady Tytoniowe w Lublinie SA, Continental Tobacco Group, European Tobacco, Randelco Tobacco Company, Raquel Ltd.)

The predominance of the 'Big Four' tobacco companies is a result of organic sales expansion and acquisitions, which took place since 2007. Particularly, BAT, IT, JTI and PMI increased their market share from around 60% to around 90% in just ten years through the following acquisitions: (1) JTI acquisition of the Gallaher Group in 2007[45], (2) IT takeover of Reemtsma Cigarettenfabriken GmbH in 2002[46], (3) IT acquisition of Altadis in 2007[47] and (4) BAT takeover of the cigarette and snus operations of the Scandinavian Tobacco Company in 2008[48]. These break events clearly caused sudden jumps in market shares.

Considering the fine-cut tobacco market, it is more fragmented than the cigarettes market and more producers have significant market shares in individual countries, or in more than one country. Consequently, the role of largest four companies is less dominant than in the cigarettes market. (see Appendix III, Table III.3).

Regarding the total employment in tobacco manufacturing sector throughout the EU, in 2013 there were 32,200 persons employed, a total amount declined by 65% in relation to 92,000 persons employed in 2000 (FAO, 2003; International Labour Organization 2014) (See Appendix III, Table III.4)[49].

[45] http://www.nytimes.com/2007/04/18/business/worldbusiness/18iht-tobacco.1.5332040.html.
[46] http://www.guardian.co.uk/business/2002/mar/08/smoking.
[47] http://www.telegraph.co.uk/finance/markets/2812343/Imperial-secures-Altadis-with-11bn-bid.html.
[48] http://www.forbes.com/2008/02/28/british-american-update-markets-equity-ll_0228markets30.html.
[49] The data is available at aggregated level, thus no granular data for employment in distinct product categories (cigarettes, RYO, cigars, etc.) is available.

4.2.4 Other key indicators of tobacco manufacturing in the EU

According to Eurostat[50], the tobacco manufacturing sector was consisted of 261 enterprises as their main activity in the EU-27[51] in 2010 (see Appendix III, Table III.5). This was the second lowest number of enterprises for any of the NACE indicating that the manufacturing sector is controlled by a small number of players with international operation. The total employment is 41,4 thousand persons, representing the 0.2% of all persons employed in the manufacturing workforce. The value added[52] generated amount to €6.9 billion, which account for 0.4% of the manufacturing total. Tobacco manufacturing is a sector of high concentration as the UK, Germany, the Netherlands and France accounting for nearly 71% of value added in the manufacture of tobacco products in the EU. The United Kingdom had the largest tobacco products manufacturing sector among the EU member states in 2010, accounting for close to one third (31.2 %) of the EU-27's value added; this was the third highest share for the United Kingdom in any of the non-financial business economy NACE divisions (with data available) in 2010.

Another important issue, according to Eurostat[53], is that apparent labor productivity of the EU-27's tobacco products manufacturing sector in 2010 was €153.7 thousand per person employed, equivalent to three and a half times as high as the non-financial business economy average of € 44.8 thousand per person employed and three times as high as the manufacturing average of €52.8 thousand

[50] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Manufacture_of_tobacco_products_statistics_-_NACE_Rev._2&oldid=90710

[52] Value added at factor costs is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. Value adjustments (such as depreciation) are not subtracted.

[53] Archive: Manufacture of tobacco products statistics - NACE Rev. 2 This article presents an overview of statistics for tobacco products manufacturing in the European Union (EU), as covered by NACE Rev. 2 Division 12.
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Manufacture_of_tobacco_products_statistics_-_NACE_Rev._2#Country_analysis

per person employed. It is worth noting that this was the third highest level of apparent labour productivity recorded by any of the manufacturing NACE divisions in the EU-27 in 2010.

Italy, Greece and Denmark recorded particularly high wage-adjusted labor productivity ratios for the tobacco products manufacturing sector in 2010; for Italy this was the second highest wage-adjusted labour productivity ratio in any of the NACE divisions within the non-financial business economy in 2010. In general, most of the EU member states recorded wage-adjusted labor productivity ratios for the tobacco products manufacturing sector above their national non-financial business economy averages in 2010, except for Bulgaria and Germany. On the contrary, as regards the gross operating rate for tobacco products manufacturing, Bulgaria, Germany, Hungary, the Netherlands and Poland scored below their national non-financial business economy averages.

4.2.5 Retail of tobacco products in the EU

According to Matrix Report (2013), the sales through tobacco retail channels have changed only slightly for the decade 2000-2010 despite the general declining trend of tobacco sales. It should be noted that declining sales in cigarettes have affected all retail channels, but to different degrees (see Appendix III, Figure III.3 which displays these trends for nine categories). So, they all declined steadily over the same time period, except for bar discounters, which in 2010 sold more tobacco in comparison with 2000. Supermarkets and hypermarkets have also experienced a smaller decline in tobacco sales than other channels, for example vending or bar-tobacconists. An explanatory factor for this trend is the change of overall consumer behaviour (e.g. longer working hours and extended shopping hours for supermarkets and major shopping centers) urging people to avoid the very small businesses. Thus, regardless of public policies on tobacco, the continuing decline in profitability of small corner stores in EU is likely to lead to concentration of cigarette and tobacco sales by larger retailers.

Euromonitor data on eleven member states (Austria, Czech Republic, Denmark, Finland, Germany, Ireland, Italy, Netherlands, Portugal, Spain and Sweden) demonstrate that hotels, bars and restaurants have seen the highest declines in sales (-60%). This sharp drop is attributed probably to the introduction of smoking bans in public places and deterring people from purchasing cigarettes in those premises. In contrast, the specialized stores have experienced the least drop of cigarette sales (-17.34%), while sales through the internet and non-grocery retailing have dropped by 38.6%. These findings indicate that the effect of smoking bans and sales restrictions is less than for those traditional outlets of cigarettes retail (see Appendix III, Figure III.3).

4.2.6 Revenue analysis of the tobacco stakeholders – Empirical review

The following section explains how a decline in consumption would impact the different stakeholders along the tobacco supply chain; i.e. the tobacco industry, upstream suppliers and downstream distributors. Table 4.1 presents the expected impacts of reduced consumption on these stakeholders, according to the estimate of European Commission report (2012).

Table 4. 1 Reduction in revenues and profits for tobacco industry in € million.

	Reduction in tobacco consumption				
Sector of tobacco industry (in € million)	**1%**	**2%**	**3%**	**4%**	**5%**
Tobacco manufacture					
Revenue loss in sector	188	376	564	753	941
Profit loss in sector[54]	27.1	54.2	81.3	108.4	135.5
Tobacco growers					
Revenue loss in sector	6.8	13.6	20.4	27.2	34
Profit loss in sector	0.54	1.09	1.63	2.18	2.72
Tobacco processors					
Revenue loss in sector	25.6	51.2	76.8	102.4	128
Profit loss in sector	2.05	4.10	6.14	8.19	10.24
Wholesale					
Revenue loss in sector	232.5	465	697.5	930	1,162.5
Profit loss in sector	3.49	6.98	10.46	13.95	17.44
Retail					
Revenue loss in sector	313.6	627.2	940.8	1,254.4	1,568
Profit loss in sector	4.70	9.41	14.11	18.82	23.52

Source: Euromonitor, European Commission (2012).

4.2.6.1 Impact on tobacco companies

The cigarette and fine-cut tobacco market across the EU are worth €130.6bn[55]. According to the estimates of Matrix report (2013), taxes on tobacco products account for 76% of the €130.6bn market value. In addition, another approximately 40% of the remaining value represent retail and wholesale

[54] The profit margins are based on industry averages.
[55] Matrix Report, 2013. Euromonitor figure - consist of overall EU market value of FMC (€121,3 billion) and fine-cut tobacco (€9.3 billion).

margins. Therefore, the tobacco industry gains revenue of about €18.8bn. As a result, a 0.5% to 2% reduction in tobacco consumption would cause a revenue loss for the tobacco industry between €94m and €377m. The previous findings are also confirmed by the European Commission report (2012) with respect to the impact of different stakeholders along the tobacco supply chain; i.e. the tobacco industry, upstream suppliers and downstream distributors, as a result of 2% consumption decrease.

4.2.6.2 Impact on tobacco farmers (growers and processors)

A tobacco consumption decrease is also expected to impact the upstream suppliers to the tobacco industry, given that the tobacco industry will buy less from upstream suppliers as a result of declining sales. The analysis is based on the assumption that a 2% reduction in consumption will lead to a linear reduction in purchases of the tobacco industry (cigarettes and fine-cut tobacco) from upstream suppliers. As the Table 4.1 shows, the projected decrease of 2% consumption would trigger total revenue losses for tobacco farmers in the EU of approximately €13.6 million, leading to an overall sector net profit loss of approximately €1.1 million. The decrease of 2% consumption also would cause total revenue losses for tobacco processors in the EU of approximately €51 million, leading to overall sector net profit loss of €4 million. This assessment is based on the assumption that all growers generate revenues only from cigarettes and fine-cut tobacco, whilst they reasonably and actually do, generate at least some additional revenues with other products. Given that the overall reduction in profits is distributed over all 86,133 farmers[56] in the EU, the turnover of every individual farmer decreases annually €158 per year. This amount sounds reasonable, although certain types of farmers (Burley or Oriental growers) is likely to be affected in particular manner.

[56] European Commission, DG AGRI data.

A limitation of this impact assessment on shares of farmers should be noted. Considering that the market for growers has decreased faster than the market for cigarettes, while the sales of fine cut tobacco has grown, the correlation between the reduction in smoking consumption and EU farming output is no-linear.

In 2010, the raw tobacco production of EU growers amounted to 294,000 tonnes generating revenues of €682 million[57] in sales to the tobacco industry. It should be stressed that this estimation considers sales for all tobacco products except for cigarettes and fine-cut tobacco. But, this assessment is limited to, thus leading, probably, to an overestimation of the overall reduction.

Comparing the European market for growers and processors with the world market the findings are interesting. While the world market has increased by 7%, the EU market has experienced a decline of 31% from 2000 to 2009 in volume terms. In detail, the volume of the EU cigarettes market in 2010 amounting to 608.8 billion sticks, decreased by 23.3% in comparison to 2000. The market size of fine cut tobacco in 2010 reaching 75.500 tonnes grew in comparison to 2000 by 42.2 %. Thus, both markets declined by 19.2%, with the assumption that 1g of fine-cut tobacco corresponds to one cigarette. A remarkable reason for this negative trend for European growers is probably the reform which grew the raw tobacco's prices and brought significant competitive disadvantage of EU tobacco growers in the global market.

4.2.6.3 Impact on wholesalers and retailers

The reduction in consumption is estimated to influence also the downstream distributors of the tobacco industry, i.e. wholesalers and retailers (which range from specialist retailers to hypermarkets). The generated revenues of wholesalers in the EU amount to €23.25 billion in 2010, as accrued from

[57] European Commission, DG AGRI data

sales of cigarettes and fine-cut tobacco (European Commission, 2012). As can been seen from Table 4.1, a designed decrease of 2% in consumption would decrease the total revenue of the sector by approximately €465 million, representing an overall sector net profit loss of €7 million.

In several member states wholesale activities are operated by large tobacco manufacturers, which are often national tobacco monopolies. In other MS the wholesalers, e.g. cash and carry warehouses, European Tobacco Wholesalers Association, are often engaged in the distribution of additional product categories, and therefore their total revenue would be only partly affected.

In retail sector, European Commission (2012) evaluated the generated turnover (cigarettes and fine cut tobacco) at almost €31.36 billion in 2010. According to the results of impact assessment, if the tobacco consumption decreased by 2%, the retail sector would experience a revenue loss of approximately €627 million (corresponding to the sector added value of €162 million) which would lead to an overall sector net profit loss of €9.4 million.

There is a variety of retail channels throughout the EU, as discussed in previous section. Obviously, all of them sell a wide range of additional products other than tobacco products. Subsequently, the dependence of retailers on revenue generated from tobacco determines their profitability and the impact that they experience from a decline of tobacco consumption. On the one hand, there are specialist tobacco retailers, which generate a significant part of their turnover from tobacco. On the other hand, big super markets sell a great variety of products so that tobacco products only account for a minor proportion of their revenues. Analytical data as regards the impact of a 2% consumption decrease on shares of retail sales of tobacco products in the EU across the different retail channels are provided in Appendix III, Table III.6.

The retailers most dependent on selling tobacco products, i.e. tobacco specialists and newsagent-tobacconists/kiosks generate aggregated revenue from selling tobacco products of representing almost 50% of the total retail revenues from the sales of tobacco products. Given that, the projected decrease of

2% in cigarettes consumption would reduce their revenues by 0.9-1.2% of their total revenues, which amount to revenue losses of €304.2 million. Consequently, the overall profit reduction for these retail channels, most dependent on tobacco, would account for €4.57 million. Nevertheless, it is noteworthy that money not spent on tobacco products is likely to be spent on other products or services and this argument favors retailers such as bars, newsagents, snacks. The retailers which are less dependent on tobacco products, i.e. forecourt retail/ gas stations and others with a share of retail sales approximately of 11.3%, lose an insignificant amount of revenue in the case of a 2% consumption drop.

4.3 Empirical analysis: Assessing the impact of cigarette taxation on the supply chain stakeholders' revenue shares in Greece.

4.3.1 Introduction

Every year in Greece, more than 22,700 of its people are killed by tobacco-caused disease (Drope and Schluger, 2018). Still, more than 12,000 children, aged 10-14 years and 256,000 adults (15+ years old) continue to use tobacco each day. Besides, the economic cost of smoking in Greece amounts to 4,663 million euro, including direct costs related to healthcare expenditures and indirect costs related to lost productivity due to early mortality and morbidity. Tobacco taxation is an efficient tobacco control tool for reducing the smoking prevalence and its harmful consequences. On the flip side, though, it is an important source of revenue, making it an interesting topic for branches of economics concerned with this issue (Goodchild et al., 2016). Tobacco supply chain involves many types of activities employing a substantial number of employees.

Our paper aims to analyze the impact of cigarette taxation and price evolution over the period 1992-2017 on the revenue shares of the main tobacco supply chain stakeholders in Greece; Tobacco Companies, including producers and importers, Wholesalers – Distributors and Retailers. In particular, we indent to show whether and how the changes in cigarette prices, and every type of tax levied on cigarettes are related to the changes in the revenue shares of each stakeholder.

The tobacco market in Greece is highly competitive and dominated by four large multinational companies: Philip Morris International (PMI) (including Papastratos), British American Tobacco (BAT), Japan Tobacco International (JTI), Imperial Tobacco (IT) and three Greek tobacco companies; Karelia Tobacco Company, SEKAP SA and Georgiades Th. D. Cigarettes Industry S.A (Matrix Report, 2013). The four multinational companies control almost the 79% of the cigarette market. Despite the strong presence of multinationals, the domestic manufacturer Karelia Tobacco Company manages to rank second in 2015 with an 18% retail volume share (Euromonitor International, 2016). This

increasingly competitive tobacco environment is characterized by continuous mergers and acquisitions, causing a significant loss of volume share for Greek manufacturers during the crisis period of 2009 and afterwards (Harvard School of Public Health, 2011).

The distribution of tobacco products remained fairly stable in Greece in 2018, as the dominant channel of newsagent-tobacconists/kiosks continued to gradually lose retail volume share to convenience stores and the number of kiosks continued to decline due to the recession (Harvard School of Public Health, 2011). Regarding the retail of tobacco products, legislative changes mid-review period contributed to the growth in the sales of tobacco through convenience stores, as it allowed the sale of tobacco on the same premises as fresh groceries, which means that all convenience stores can sell tobacco products, whereas previously only a limited number of chains were qualified to do so.

Smoking prevalence throughout EU of varies greatly between the 28 member states, while the highest shares of current smokers for 2014 were recorded in Bulgaria (34.7%) and Greece (32.6%) (Eurostat, 2016). The heterogeneity of smoking prevalence between EU member states reflects, at least in part, a failure by governments to prioritize public health over the tobacco industry (Bogdanovica et al., 2011). Although globally, states intervene through taxes or other tobacco control policies in order to reduce tobacco consumption (Chow, 2017), a growing evidence highlights tobacco industry's active role in opposing tobacco control legislation by biasing both scientific and public opinion (Dearlove et al., 2002; Muggli et al., 2004; Diethelm et al., 2005; Gruning et al., 2006). Studies also reveal that Transactional Tobacco Companies lobby governments for keeping cigarettes affordable in Finland (Hiilamo, 2003), Hungary (Szilágyi and Chapman, 2004), and other countries (Gilmore et al., 2007; Krasovsky, 2010).

The taxation policy has long been supported by the World Health Organization (WHO). The EU is party to the WHO Framework Convention on Tobacco Control (FCTC). The *article 6 of the WHO* FCTC, "Price and Tax Measures to Reduce the Demand for Tobacco" recognizes the importance of this

policy and calls on governments to implement tax and price policies to contribute to their national health objectives. As analyzed in detail in previous chapter, Directive 2011/64/EU, which is broadly coherent with the principles of WHO, regulates the minimum rates of excise duties levied on cigarettes. In this context, the member states are free to apply excise rates above the minimum levels of taxation according to their own national needs.

Considering that previous chapter has focused on the detailed analysis of the specific and ad valorem taxes and their effects on cigarette prices, consumption, quality and variety of tobacco products, government revenues and tax administration, there is no need to make any additional reference to them.

This paper aims to present the evolution of cigarettes tax rates in Greece over the period 1992-2017 and examine how these tax fluctuations have influenced the revenue shares of three main stakeholders of tobacco supply chain. To succeed this, our analysis is based on econometrics offering an estimate of the price and taxation impact on revenue shares.

The reminder of the paper is structured as follows: section 4.3.2 describes the theoretical background and data; section 4.3.3 introduces the methodology; section 4.3.4 presents the empirical results; and section 4.3.5 discusses the findings and concludes.

4.3.2 Theoretical background – Data analysis

Tobacco taxation in Greece is firstly determined by the EU legislation requiring member states to levy a minimum rate of excise duties on cigarettes. According to Directive 2011/64/EU, the specific component should be of between 7.5% and 76.5% of the total tax burden. Second, the overall excise duty on cigarettes should represent at least 60% of the weighted average retail selling price of cigarettes released for consumption. Finally, the excise duty should not be less than 90 euros per 1,000 cigarettes

irrespective of the weighted average retail selling price. Member states that apply excise duty of 115 euro or more, however, do not need to comply with the 60% criterion above.

Greece is classified at the highest position regarding the cigarette tax burden across the EU for 2017, followed by Finland and United Kingdom. Yet, the level of cigarette prices remains among the lowest in EU. The preferred excise tax structure levied on cigarettes in Greece is set by the National Customs Code of Greece (L.2960/2001), requiring the total amount of excise duty not to be lower than 117.50 euros per 1,000. Additional analysis upon the cigarette tax structure is provided in Appendix III, Table III.7.

Data on excise tax rates (specific excise and ad valorem excise) applicable to cigarettes, the weighted average price (W.A.P.) and tax revenues accrued from cigarette consumption are derived from the Excise Duties Tables series compiled by Directorate-General for Taxation and the Customs Union (DG TAXUD) and are published in the European Commission data base, the official site of European Union.

Note that prices are referred to one pack which consists of twenty cigarettes and they are expressed in euro. Until 2001, prices were expressed in drachma, the ex-national currency. Yet, all price data were converted into euro in favor of comparison and statistical analysis. Data on revenue shares of three elements of tobacco industry were obtained from the Trade Attica Union of Retail Business, Kiosk owners & Tobacco Sellers.

The following Table presents the changes in the cigarette tax structure, the prices and the revenue shares over the period 1992-2017.

Table 4. 2 Prices, Taxes and Revenue Shares of three main stakeholders in Greece over the period 1992-2017.

YEAR	PRICE*	RESIDUAL REVENUE VALUE	TAX AS % OF PRICE			REVENUE SHARES OF STAKEHOLDERS					
						Tobacco companies (producers and importers)		Wholesalers - Distributors		Retailers	
			SPECIFIC TAX	AD VALOREM TAX	VAT	As % of price	As % of Total Revenue	As % of price	As % of Total Revenue	As % of price	As % of Total Revenue
1992	0.59	0.17	3.58%	41.45%	26.47%	16.76%	60.40%	2.58%	9.30%	8.41%	30.31%
1993	0.99	0.46	3.23%	53.39%	15.25%	12.48%	60.40%	1.92%	9.30%	6.26%	30.30%
1994	1.64	0.69	3.23%	53.39%	15.25%	11.80%	60.40%	1.86%	9.49%	5.88%	30.11%
1995	1.54	0.58	3.88%	53.39%	15.25%	15.10%	60.40%	2.37%	9.50%	7.53%	30.11%
1996	1.47	0.50	4.04%	53.86%	15.25%	16.42%	60.40%	2.58%	9.50%	8.18%	30.10%
1997	1.81	0.64	3.64%	53.86%	15.25%	14.64%	60.40%	2.30%	9.49%	7.30%	30.11%
1998	1.93	0.65	3.64%	53.86%	15.25%	15.01%	60.40%	2.36%	9.49%	7.48%	30.11%
1999	1.77	0.49	3.64%	53.86%	15.25%	17.70%	60.40%	2.78%	9.50%	8.82%	30.11%
2000	1.98	0.59	3.64%	53.86%	15.25%	15.87%	60.40%	2.50%	9.50%	7.91%	30.11%
2001	2.06	0.57	3.64%	53.86%	15.25%	16.39%	60.40%	2.58%	9.49%	8.17%	30.11%
2002	2.34	0.64	3.64%	53.86%	15.25%	16.67%	60.94%	2.56%	9.38%	8.12%	29.69%
2003	2.50	0.68	3.64%	53.86%	15.25%	17.60%	60.27%	2.80%	9.59%	8.80%	30.14%
2004	2.50	0.68	3.64%	53.86%	15.25%	17.60%	60.27%	2.80%	9.59%	8.80%	30.14%
2005 (a)	2.70	0.74	3.67%	53.83%	15.25%	16.30%	60.27%	2.59%	9.59%	8.15%	30.14%
2005 (b)	2.70	0.72	3.67%	53.83%	15.97%	15.93%	60.56%	2.59%	9.86%	7.78%	29.58%
2006	2.80	0.74	3.67%	53.83%	15.97%	15.36%	60.56%	2.50%	9.86%	7.50%	29.58%
2007	2.80	0.74	3.67%	53.83%	15.97%	15.36%	60.56%	2.50%	9.86%	7.50%	29.58%
2008	3.00	0.80	3.67%	53.83%	15.97%	16%	60%	2.67%	10%	8.00%	30%
2009	3.00	0.80	3.67%	53.83%	15.97%	17%	61.45%	2.67%	9.64%	8.00%	28.92%
Jan-10	3.20	0.46	8.57%	58.43%	18.70%	12.81%	60.29%	2.81%	13.24%	5.63%	26.47%

Mar-10	3.20	0.46	8.57%	58.43%	18.70%	10.63%	59.65%	2.81%	15.79%	4.38%	24.56%
May-10	3.20	0.46	8.57%	58.43%	18.70%	8.75%	60.87%	2.81%	19.57%	2.81%	19.57%
2011	3.13	0.51	12.55%	52.45%	18.70%	10.22%	60.38%	2.88%	16.98%	3.83%	22.64%
2012	3.25	0.53	12.56%	52.45%	18.70%	10.48%	59.65%	2.77%	15.79%	4.31%	24.56%
2013	3.28	0.41	48.75%	20%	18.70%	8.53%	63.64%	1.83%	13.64%	3.05%	22.73%
2014	3.50	0.50	47.10%	20%	18.70%	9.42%	62.26%	1.14%	7.55%	4.57%	30.19%
2015	3.64	0.58	45.38%	20%	18.70%	10.31%	62.50%	1.38%	8.33%	4.81%	29.17%
2016	3.71	0.59	44.50%	20%	18.70%	11.33%	61.76%	1.08%	5.88%	5.93%	32.35%
2017	3.80	0.43	44.05%	26%	19.35%	7.11%	61.78%	0.26%	2.29%	4.13%	35.93%

***** Until January 2011, excise taxes were calculated on the basis of the retail selling price of highest selling category, defined by price (i.e. the most popular price category - MPPC), in each country (European Commission, 2008). Directive 2010/12/EU, which entered into effect on 1 January 2011, changed the reference point for calculating taxes from the MPPC to the Weighted Average Price (W.A.P).

Source: European Commission, Trade Attica Union of Retail Business, Kiosk owners & Tobacco Sellers & author's calculations.

It should be noted that there are two data points for 2005, as there had been a V.A.T increase during this year leading to differential revenue shares among three components of tobacco industry. Moreover, three different data points are noticed for 2010, albeit the price and tax incidence remained at the same levels. The reason is that tobacco industries and retailers changed their tax policy three times during 2010, causing correspondingly a gradual revenue share reduction of these two stakeholders.

As might be anticipated, the tax burden on cigarettes increases gradually during the period 1992-2017, while the mixture of tax incidence changes. The two types of excise experience a smooth increase, with the exception of the last seven years. The reason is that the government initiated a major shift away from ad valorem taxation towards specific taxation. The ad valorem component of excise on cigarettes decreased by more than 50% in 2013 and has been compensated for with an abrupt increase of the specific excise duty component. On the contrary, the increase rate of VAT remained unchanged over the whole period. The price and taxation evolution occurred in Greece over the period 1992-2017 is illustrated in the Figure below.

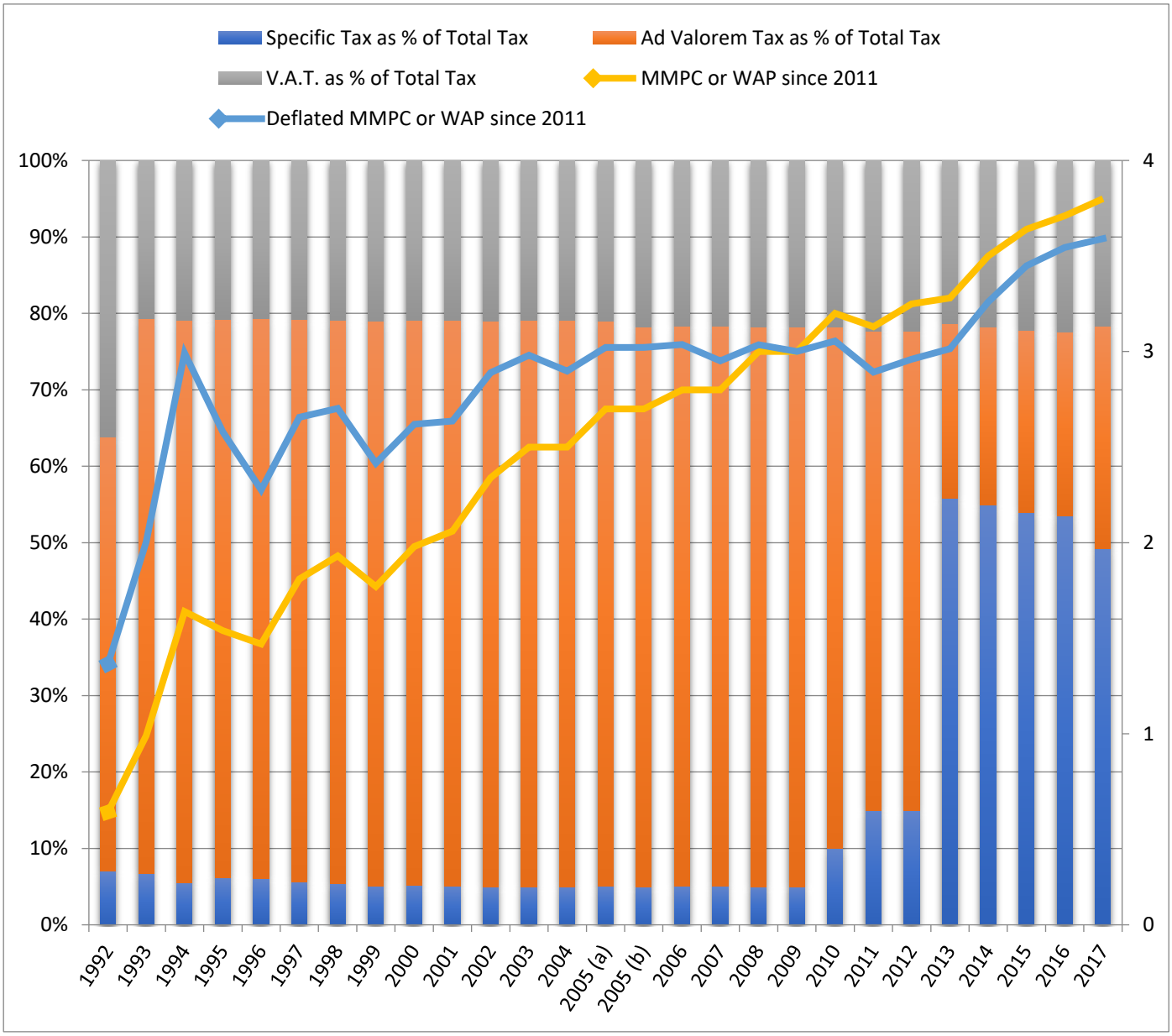

Figure 4. 2 Prices, deflated prices and tax structure of cigarettes in Greece over the period 1992-2017.

Source: ELSTAT, *(http://www.statistics.gr/el/statistics/-/publication/DKT87/2015-M10)* and author's calculations.

According to the Table 4.2, the revenue shares of the stakeholders follow a stable course until 2009-2010, where their earnings almost reach their highest point. It is obvious that all stakeholders' shares declined by half during the last four years. Moreover, the proportion of the revenue shares

changed essentially and specifically for wholesalers and distributors, whose shares seem to have been absorbed mostly by the retailers. After all, tobacco companies remain the prominent profitable category.

4.3.3 Methodology

Following the empirical literature, we construct an empirical model that investigates the non-linear effect of the changes of excise taxes and prices on revenue share of each stakeholder involved in the cigarette supply chain, i.e., as below:

$$R_i = \alpha_i + \alpha_1 \, price_i + \alpha_2 \, tax1_i + \alpha_3 \, tax2_i + \alpha_4 \, tax3_i$$

Where *i* denotes the different type of stakeholder; tobacco companies – either manufacturers or importers – distributers and retailers, R_i is the revenue share of each stakeholder, $price_i$ is the retail selling price of one pack containing 20 cigarettes, $tax1_i$ is the specific component of excise duty levied on cigarettes as a percentage of price, $tax2_i$ is the ad-valorem component of excise duty levied on cigarettes and $tax3_i$ is the Value Added Tax (VAT).

The first analysis of stakeholders' revenue shares uses a pooled time series from 1992 through 2017 and includes a data set of retail prices, three tax groups levied on cigarettes (specific tax, ad valorem tax and VAT) and revenue shares of the stakeholders.

Before running our model, we applied the Kolmogorov–Smirnov test in order to test that our data follow the normality of the distribution. The table presents the results confirming the normal distribution of our sample (sig>0.1), as P-value exaggerate the confidence interval of 10%. As a result, we can apply regression analyses so as to evaluate the effect of prices' and taxes' changes on the evolution of revenue shares.

Table 4. 3 Tests of Normality.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Price	.119	29	.200*	.955	29	.245
Total tax	.112	29	.200*	.956	29	.268
Specific tax	.343	29	.000	.584	29	.000
Ad valorem tax	.125	29	.200*	.942	29	.114
VAT	.128	29	.200*	.950	29	.179
Revenue share of Tobacco companies (RTCs)	.107	29	.200*	.958	29	.289
Revenue share of Wholesalers/Distributors (RWDs)	.149	29	.099	.944	29	.130
Revenue share of Retailers (RRs)	.141	29	.144	.959	29	.309
Total Revenue	.103	29	.200*	.962	29	.361

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

4.3.4 Results

First, we apply linear regression to all categories of variables (all types of revenue shares and all types of taxation) and we extract the below table of variation analysis.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.702	2	.351	122.823	.000[b]
	Residual	.074	26	.003		
	Total	,776	28			

a. Dependent Variable: Total revenue

b. Predictors: (Constant), total tax, price

According to the P-value (column Sig.), the results show that the association between these variables is statistically significant. Additionally, the estimators show a high fitting that reaches 90.4% (R2 = 0.904), as presented below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.951[a]	.904	.897	.0534408501

a. Predictors: (Constant), total tax, price

Based on the above regression, we obtain the following equation;

Total revenue = 0.029 + 0.895 * price – 0.875 * total tax.

After estimating the above relationship between all the categories of estimators, we can apply three separate equations which evaluate the effect of the price and each tax (specific tax, ad valorem tax, VAT) on each stakeholder's revenue share. The results are presented in the Table below.

Table 4. 4 Predictors associated to the revenue shares of each stakeholder.

Coefficients - Dependent Variable: Revenue share of Tobacco companies						
Dependent Variable: Revenue share of Tobacco companies		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.013	.020		.659	.516
	Price	.476	.042	4.481	11.391	.000
	Specific tax	-.390	.099	-2.482	-3.957	.001
	Ad valorem tax	-.359	.102	-1.670	-3.527	.002
	VAT	-.719	.266	-1.354	-2.699	.013
	R Square	.932				
	Adjusted R Square	.921				
	Std. Error of the Estimate	.0283789993				
	ANOVA	Sum of Squares	df	Mean Square	F	Sig.
	Regression	.265	4	.066	82.127	.000[b]
	Residual	.019	24	.001		

	Total	.284	28			

Coefficients - Dependent Variable: Revenue share of Wholesalers - Distributors

Dependent Variable: Revenue share of Wholesalers/Distributors		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
2	(Constant)	.004	.004		.922	.366
	Price	-.008	.009	-.355	-.957	.348
	Specific tax	.024	.021	.678	1.146	.263
	Ad valorem tax	.069	.021	1.434	3.212	.004
	VAT	-.031	.056	-.264	-.558	.582
	R Square	.939				
	Adjusted R Square	.929				
	Std. Error of the Estimate	.0059521383				

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.013	4	.003	93.062	.000[b]
	Residual	.001	24	.000		
	Total	.014	28			

Coefficients - Dependent Variable: Revenue share of Retailers

Dependent Variable: Revenue share of Retailers		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
3	(Constant)	.004	.014		.297	.769
	Price	.312	.029	5.546	10.723	.000
	Specific tax	-.304	.069	-3.654	-4.429	.000
	Ad valorem tax	-.308	.071	-2.710	-4.353	.000
	VAT	-.364	.185	-1.296	-1.965	.061
	R Square	. 882				
	Adjusted R Square	.863				
	Std. Error of the Estimate	.019750975 0				

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.070	4	.018	44.975	.000[b]
	Residual	.009	24	.000		
	Total	.080	28			

Note: Three stars (***) indicate statistical significance at 1% level, two stars (**) at 5% level, and one star (*) at 10% level.

According to the above Table, we obtain the following equations with the estimated coefficients and p-values (in parenthesis) as below:

(1) RTCs = 0.013 + 0.476 * price – 0.39 * specific tax – 0.359 * ad valorem tax – 0.719 * VAT

(0.000) (0.001) (0.002) (0.013)

(2) RWDs = 0.004 - 0.008 * price + 0.024 * specific tax + 0.069 * ad valorem tax – 0.031 * VAT

(0.348) (0.263) (0.004) (0.582)

(3) RRs = 0.004 + 0.312 * price - 0.304 * specific tax - 0.308 * ad valorem tax – 0.364 * VAT

(0.000) (0.000) (0.000) (0.061)

The above-mentioned equations provide a better view of the dynamics of the relations between revenues, taxes and prices. They explain how any change in the price, the excise tax or the VAT may affect the revenues of each category of stakeholder. As expected, prices and taxes seem to affect statistically significantly the revenue share of TCs and Rs. Specifically, the revenues of TCs are most affected by both elements of excise tax in a negative way at the 1% significance level. This means that PTCs are expected to decrease by almost €0.4 corresponding to each 1€ increase in each excise element (specific or ad valorem). The effect of VAT changes is also significant but at the 5% significance level.

Regarding retailers, their revenue share is expected to reduce by almost 0.3 for each €1 increase in every excise component and to increase by the same amount after a €1 increase in retail selling price of cigarettes. Both price and the excises affect significantly the revenue share of retailers at the 1% level of confidence and the association with VAT is also significant, but at the significance level of 10%. On the contrary, the revenue share of wholesalers and distributors is related significantly only with the ad valorem tax but in an unexpectedly positive way. A probable reason for this is the fact that distributors sell a great variety of products so that tobacco products only account for a minor proportion of their revenues. Therefore, changes of cigarette taxation may not affect significantly their total revenues.

Given the afore-mentioned regressions, we create four ratios, according to the Table 4.5. The first ratio calculates the total tax as a percentage of the cigarette price (total tax/price). The second ratio estimates the total tax as a percentage of the revenue share of tobacco companies (total tax/ RTCs). The third one calculates the total tax as a percentage of the revenue share of wholesalers and distributors (total tax/ RWDs). The fourth ratio estimates the total tax as a percentage of the revenue share of retailers (total tax/ RRs). After controlling for any linearity among these four ratios, we estimate the correlations among these ratios, as presented in Table 4.5.

Table 4. 5 Correlations across the four ratios.

		total tax/price	total tax/ RTCs	total tax/ RWDs	total tax/ RRs
total tax/price	Pearson Correlation	1	.471*	.504**	-.280
	Sig. (2-tailed)		.010	.005	.142
	N	29	29	29	29
total tax/ RTCs	Pearson Correlation	.471*	1	.570***	.559**
	Sig. (2-tailed)	.010		.001	.002
	N	29	29	29	29
total tax/ RWDs	Pearson Correlation	.504**	.570***	1	-.185
	Sig. (2-tailed)	.005	.001		.338
	N	29	29	29	29
total tax/ RRs	Pearson Correlation	-.280	.559**	-.185	1
	Sig. (2-tailed)	.142	.002	.338	
	N	29	29	29	29

Based on the Table above and using the Spearman test, we find four statistically significant combinations of associations. As we can notice, the strongest correlation is between the total tax as a percentage of the revenue share of tobacco companies (total tax/ RTCs) versus the total tax as a percentage of the revenue share of wholesalers and distributors (total tax/ RWDs). Specifically, this relationship is positive and equal to 0.570. Similarly, the rest correlations among the ratios have positive signs, albeit less related (0.471, 0.504, 0.559).

4.3.5 Discussion & Conclusion

Literature review suggests that tobacco taxation is unarguably the most effective tool for reducing the tobacco consumption and, therefore, the health care costs associated with treating smoking-caused diseases (Knuchel-Takano et al., 2017). Except for the reduction of smoking prevalence, tobacco taxes contribute to government revenue accruable from tobacco manufacturers, wholesalers and retailers. Our research examined firstly the changes occurred at the revenue shares of the main stakeholders of tobacco supply chain in Greece resulting from the cigarette tax increases and prices over the period 1992-2017.

Based on a pooled time series from 1992 through 2017, the findings of this research model the effects of the price, the excise tax (specific and ad valorem) and the VAT changes on the revenues of each category of stakeholder. In the tobacco taxation literature, there is a gap regarding such revenue share data. Our evidence shows that prices and taxes do matter for revenues of tobacco industries and retailers, whereas distributors' revenues seem unaffected, probably because selling cigarettes is not the unique or the main revenue source for this supply chain stakeholder.

As pointed out in the paper, the level of cigarette prices in Greece remains among the lowest in EU, despite its highest cigarette tax burden recorded across the EU. Specifically, Greece is among the EU-28 countries with the highest specific excise and with the lowest ad valorem excises. Delipalla and Keen (1998) claim that the specific tax has a significantly greater effect on price than the ad valorem one. This is consistent with other studies' findings demonstrating that the specific excise tax on cigarettes, compared to the ad valorem tax, is a more efficient policy device to achieve fiscal policy, as well as public health objectives (Chaloupka, et al., 2010). Specific duties reduce relative price differences and minimize the variability of prices. Consequently, specific duties have an advantage from a health point of view. Specific duties also have a number of other benefits. A scenario that sets all duties to specific duties would entail a narrowing of price differences at EU level by 50%. Therefore, greater

reliance on specific duties can lead to further approximation of retail selling prices within the EU (Commission of the European Communities, 2008).

It should be highlighted that an important change in the structure of excise taxes came to effect in Greece in 2012. The specific excise tax per 1000 cigarettes increased by 300%, the W.A.P. per 1000 cigarettes increased by 8.5% while the ad valorem excise decreased by 61.9%. This change resulted in a significant increase in the price of low-price cigarettes and a decrease of the gap between the low and high-priced cigarettes (Georgikopoulos and Pinedo, 2016).

One limitation of our research is worth noting. The regression models are expressed in a more simplified way excluding other control variables in order to highlight how the revenues of three main stakeholders' categories have been fluctuated in average as a result of price and tax policies. Therefore, this constraint is likely to create a bias in our findings.

Though, the novelty of this paper lies in the fact that for the first time in literature, the impact of cigarette tax structure and price fluctuation on the cigarette supply chain revenue shares in Greece is being researched. The evidence provided through this paper is straightforward and may be useful for policy-makers in development of effective tobacco control policies, while at the same time considering the effects on tobacco industry.

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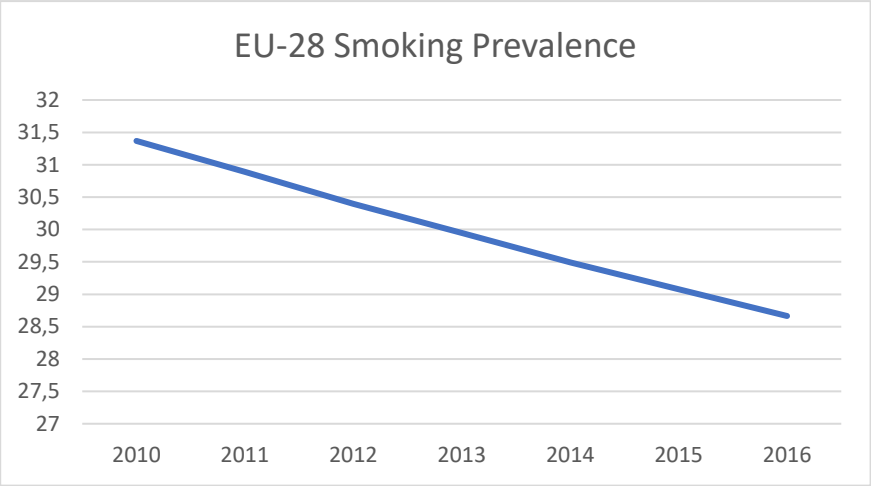
Appendix I

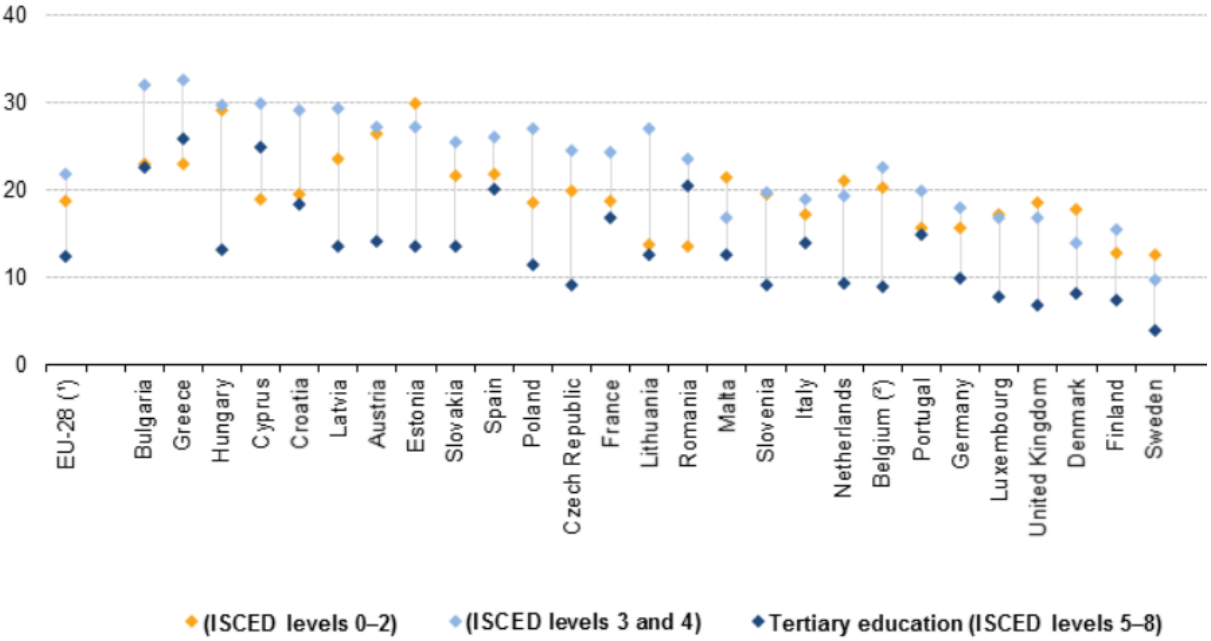
(Chapter 2)

Figure I. 1 The average EU-28 smoking prevalence, 2010-2016.



Source: The World Data Bank Indicator (WDB).

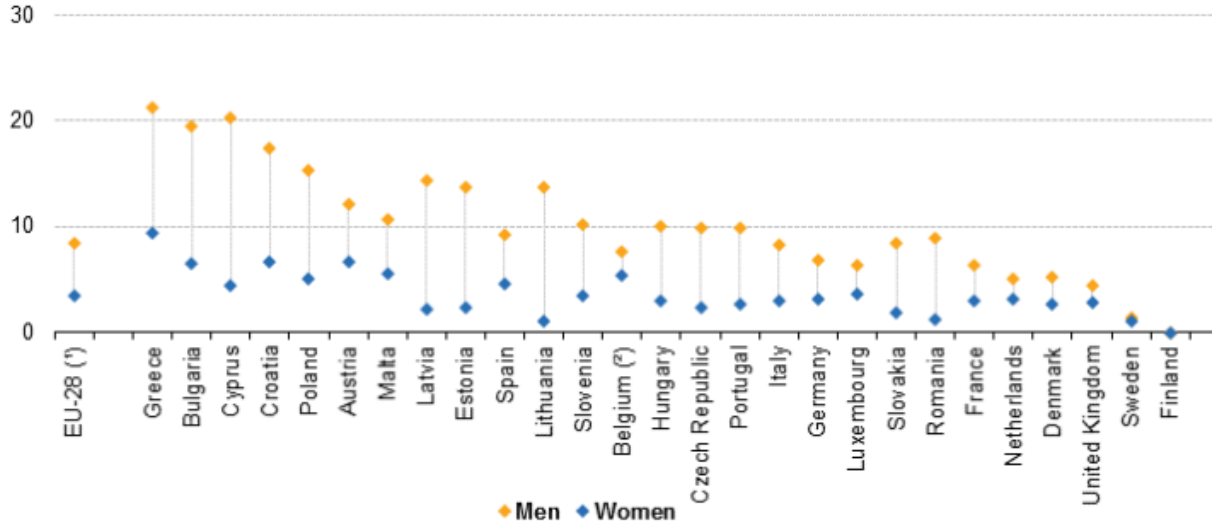
Figure I. 2 Proportion of daily smokers of cigarettes, by educational attainment level, 2014.



Note: ranked on the overall proportion of daily smokers. 2014 data for Ireland not available.
ISCED levels 0-2 (Pre-primary, primary and lower secondary education)
ISCED levels 3 & 4 (Upper secondary and post-secondary non-tertiary education)
ISCED levels 5-8 (Tertiary education)
(1) Estimates
(2) Data with low reliability

Source: Eurostat

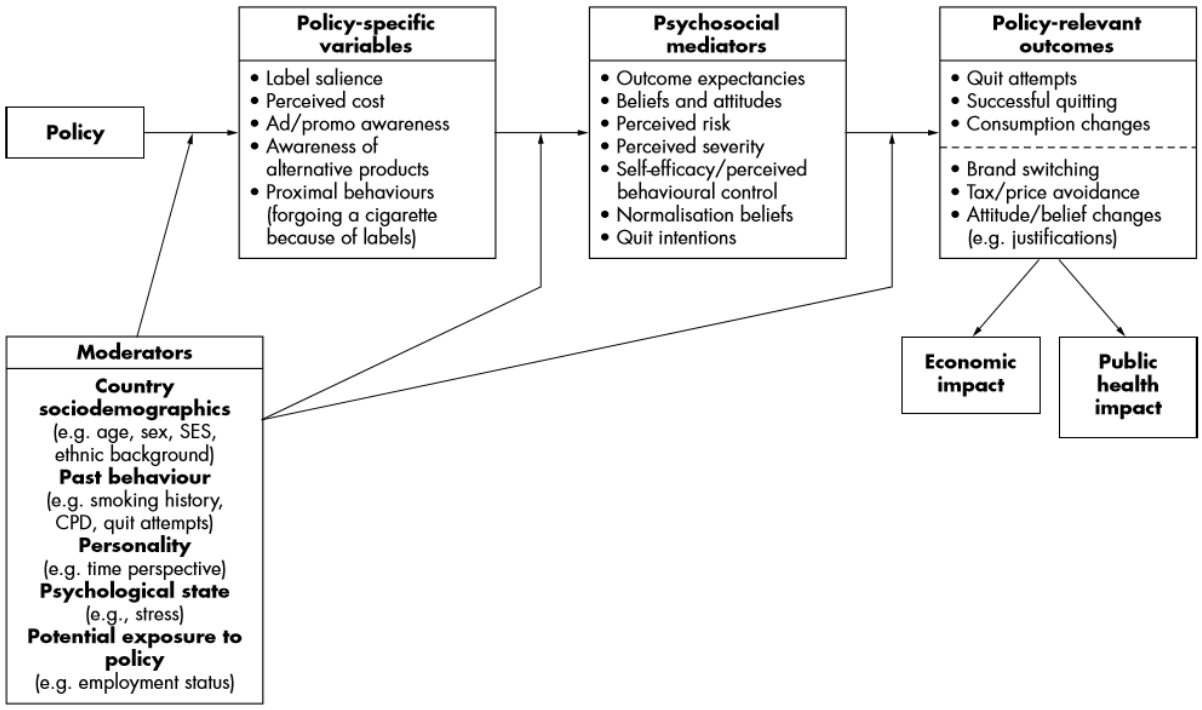
Figure I. 3 Proportion of persons consuming 20 or more cigarettes per day by sex, 2014 (% persons aged 15 and over).



Note: ranked on the overall proportion of persons consuming 20 or more cigarettes per day. 2014 data for Ireland not available.
(1) Estimates
(2) Data with low reliability

Source: Eurostat

Figure I. 4 Conceptual model illustrating the hypothesized causal chain of how tobacco control policies exert their influence on tobacco use behaviors.



Note: CDP is cigarettes per day; SES is socioeconomic status.
Source: Fong et al., (2006).

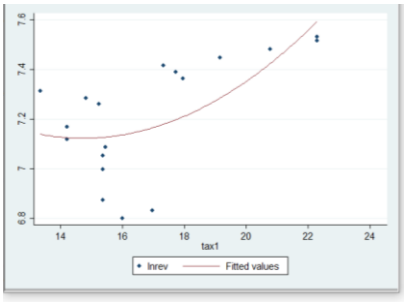
Appendix II

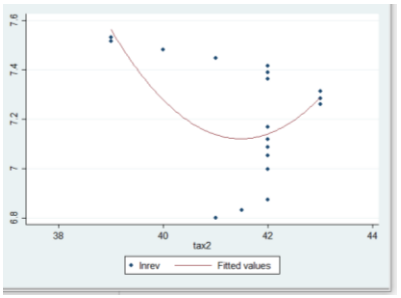
(CHAPTER 3)

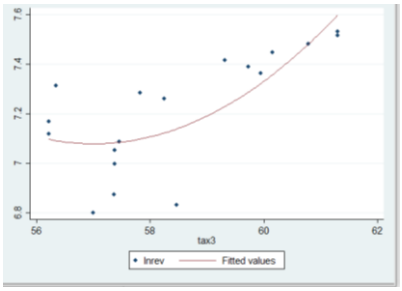
Figure II. 1 Relationship between excise rates and revenues for each EU member state, 2008-2018.

Specific Tax | Ad valorem Tax | Total Excise

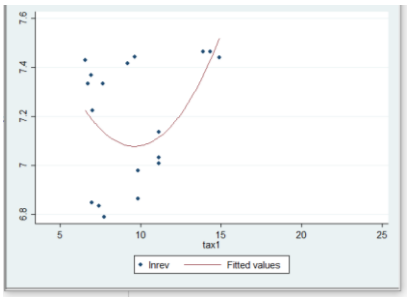
1. Austria

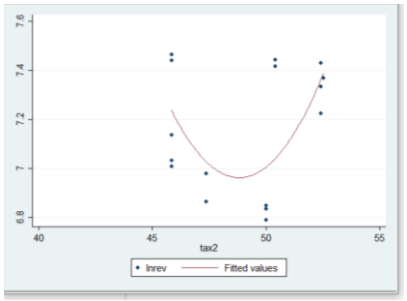


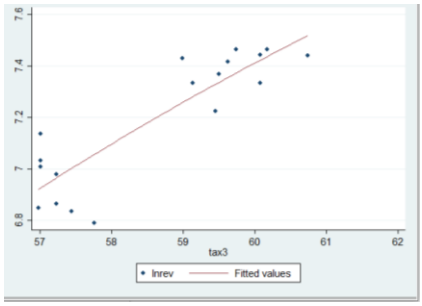




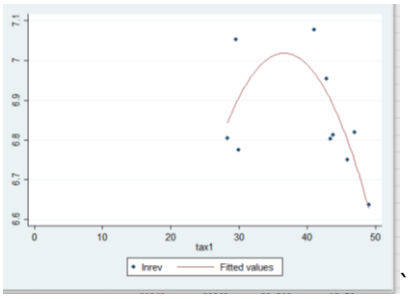
2. Belgium

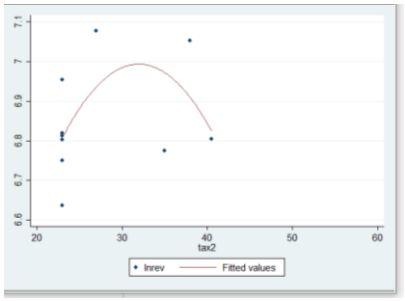


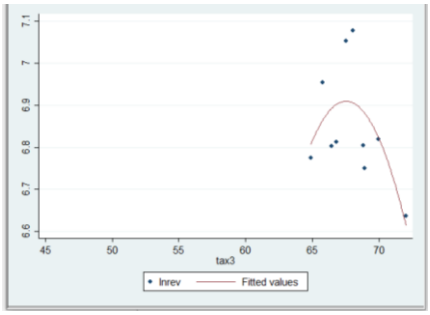




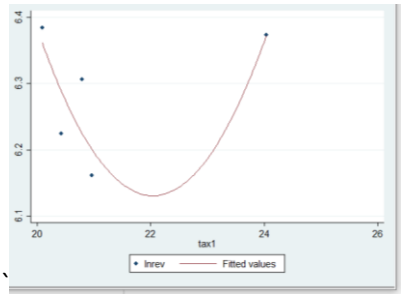
3. Bulgaria

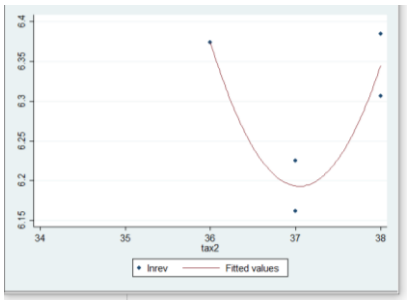


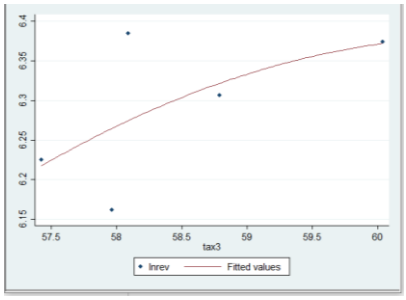




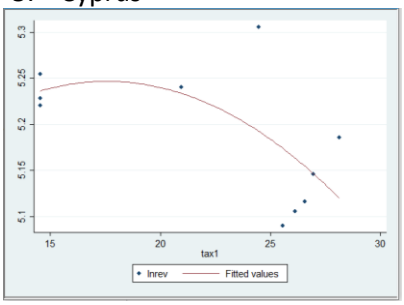
4. Croatia

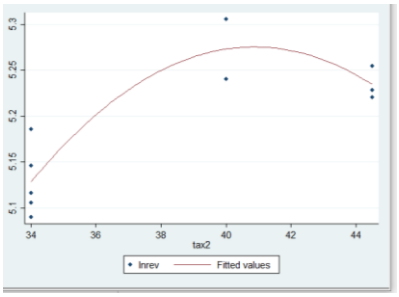


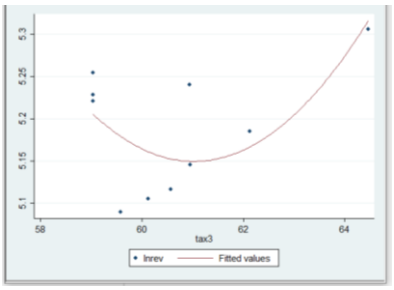




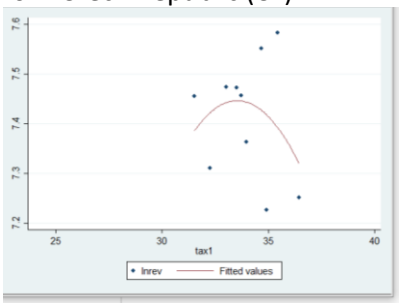
5. Cyprus

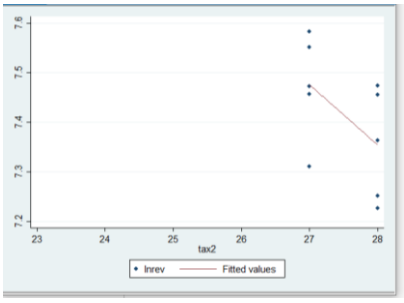


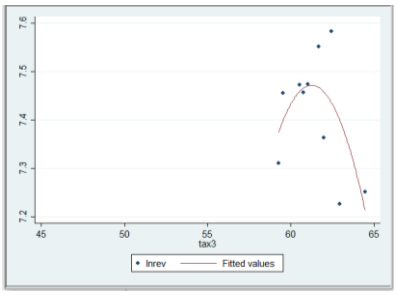




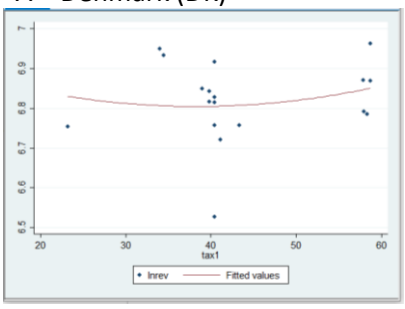
6. Czech Republic (CZ)

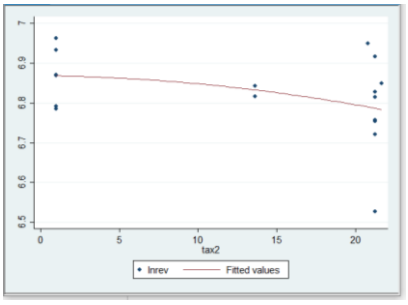


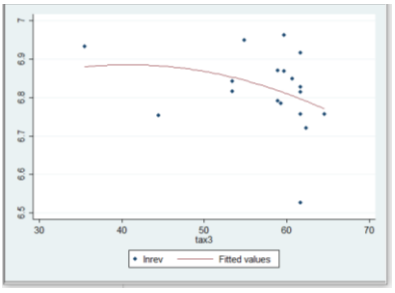




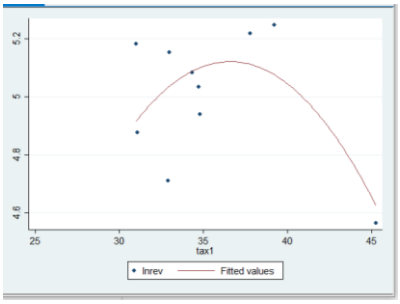
7. Denmark (DK)

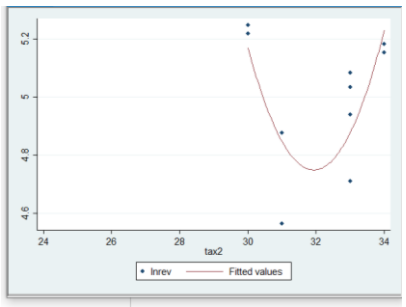


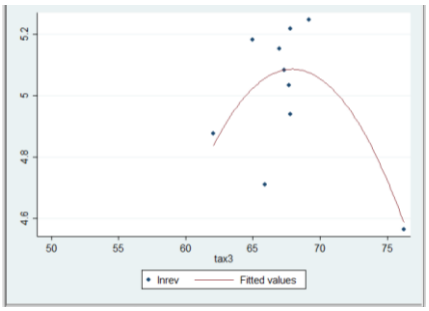




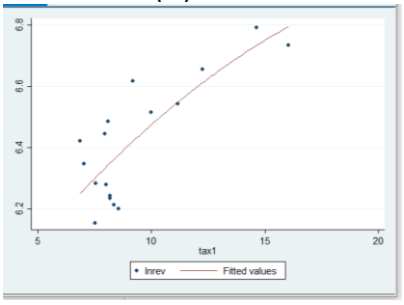
8. Estonia (EE)

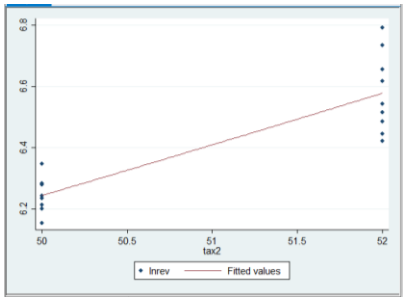


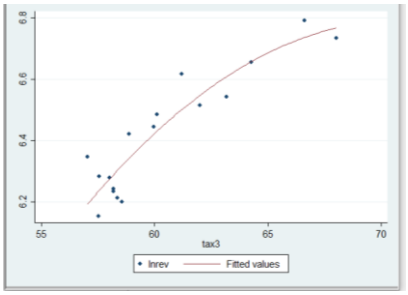




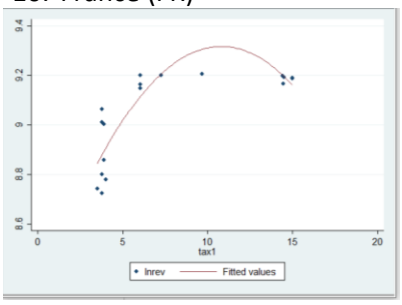
9. Finland (FI)

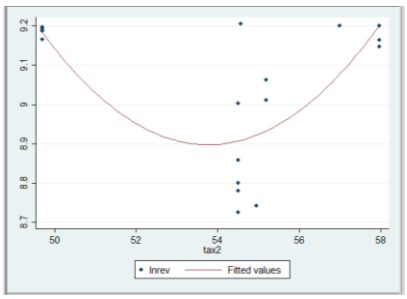


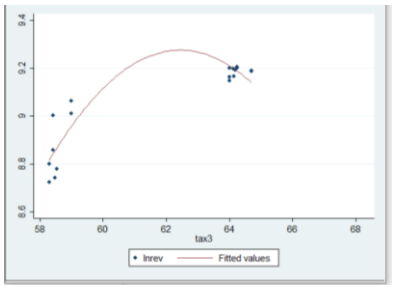




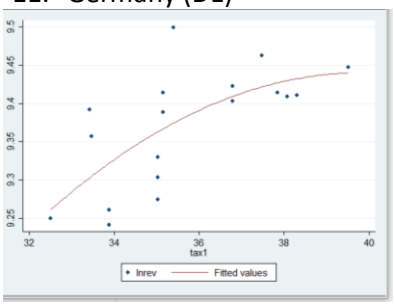
10. France (FR)

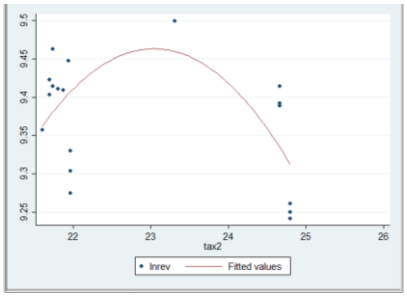


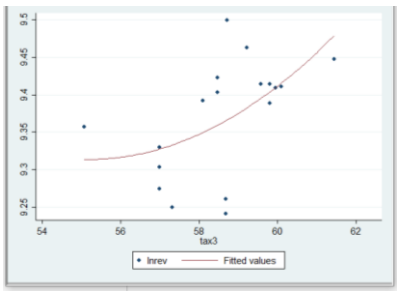




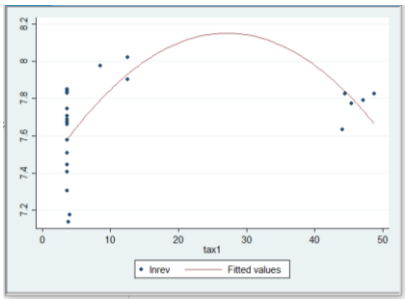
11. Germany (DE)

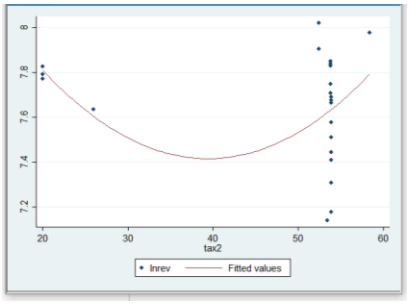


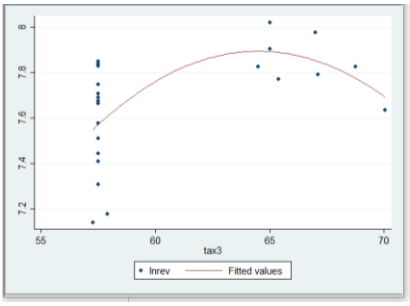




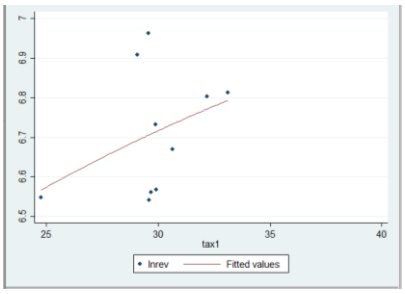
12. Greece (EL)

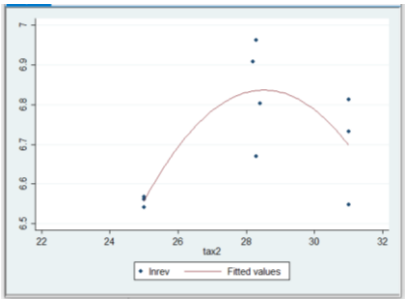


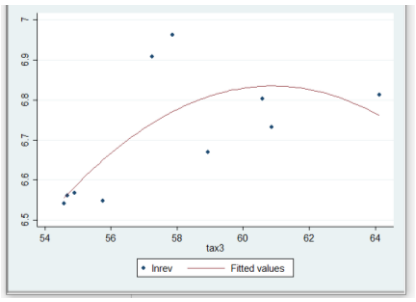




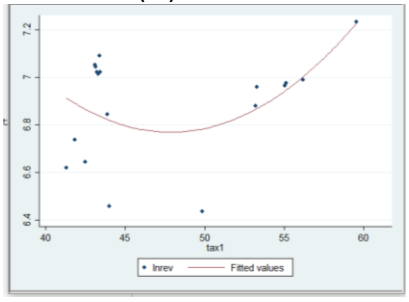
13. Hungary (HU)

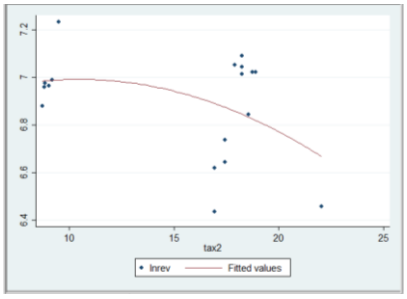


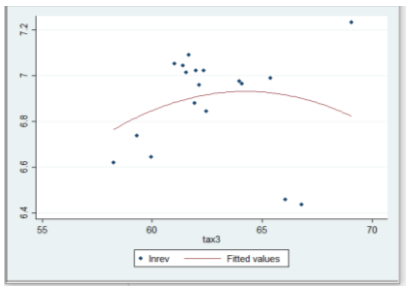




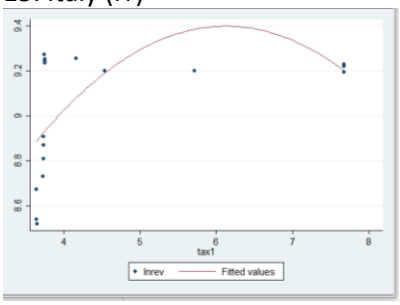
14. Ireland (IE)

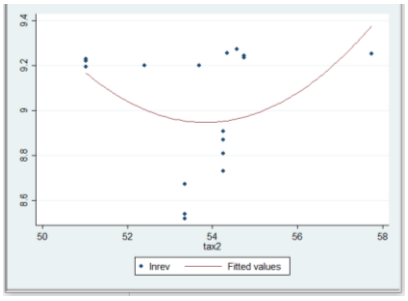


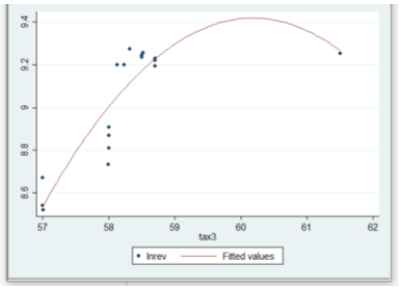




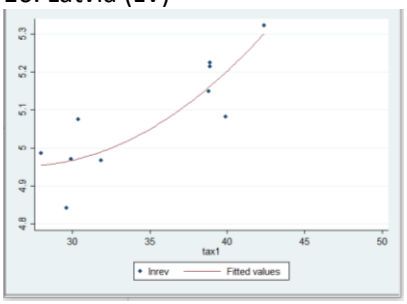
15. Italy (IT)

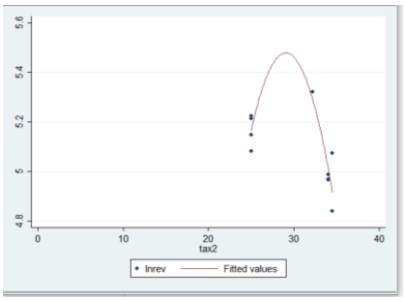


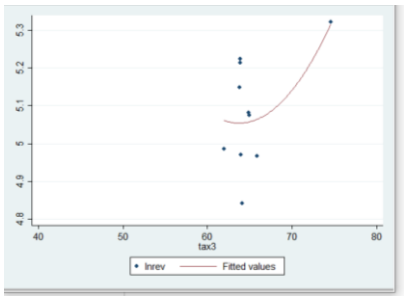




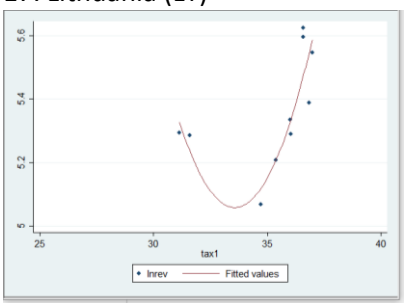
16. Latvia (LV)

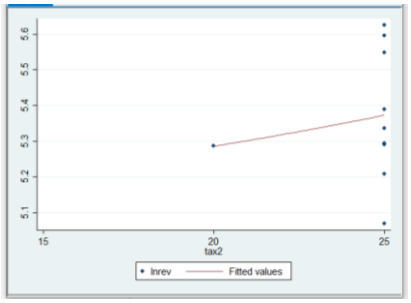


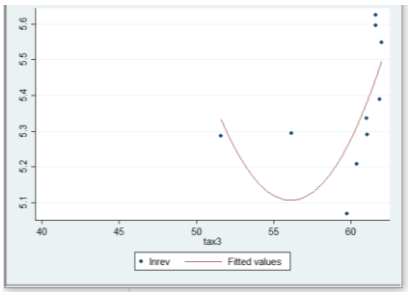




17. Lithuania (LT)







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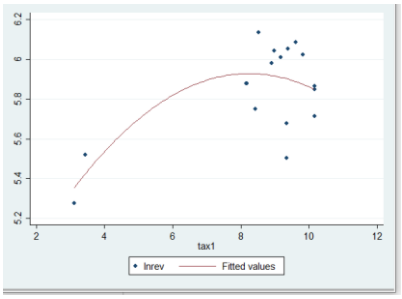

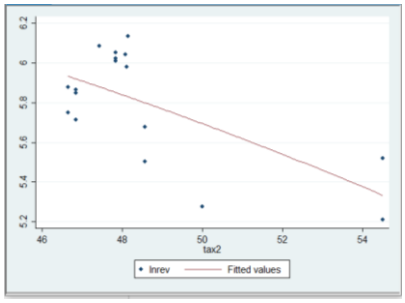

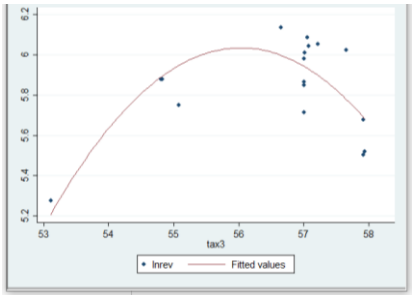

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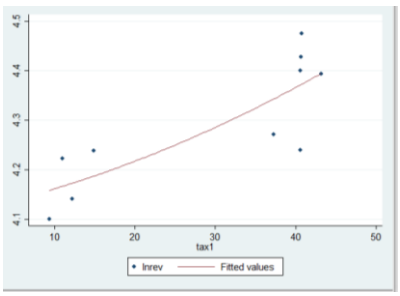
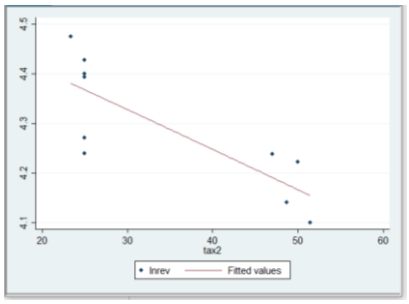
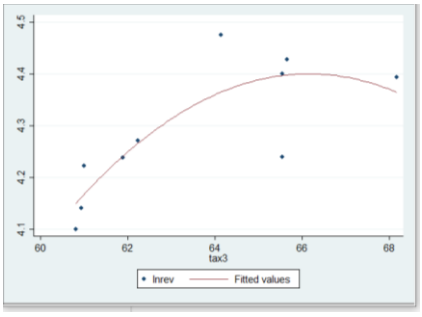
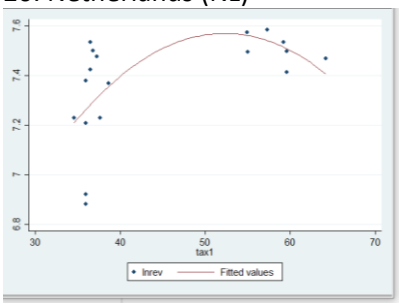
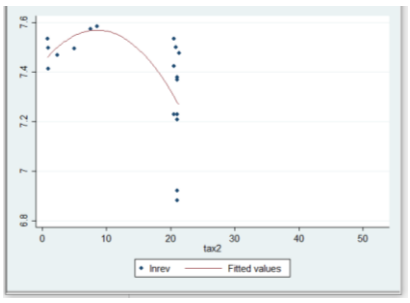


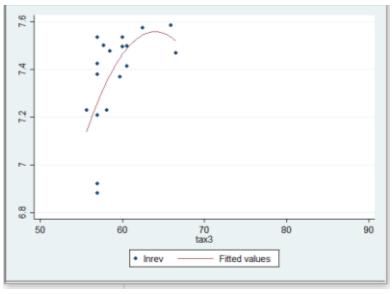




20. Netherlands (NL)







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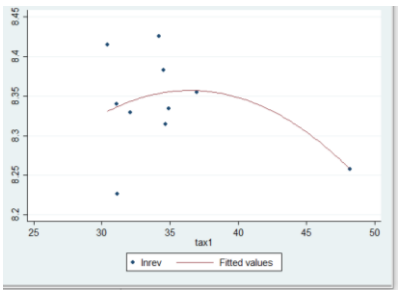
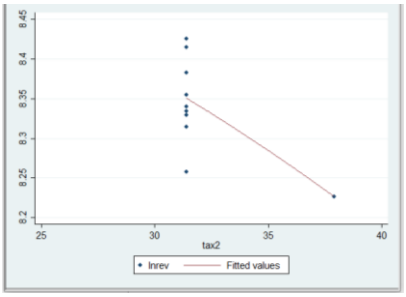
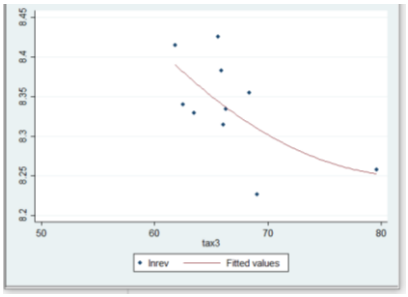
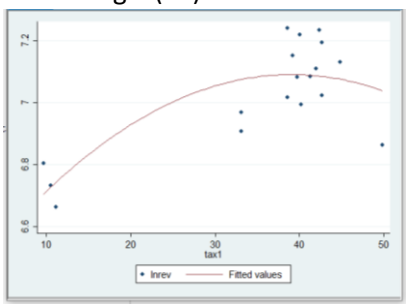
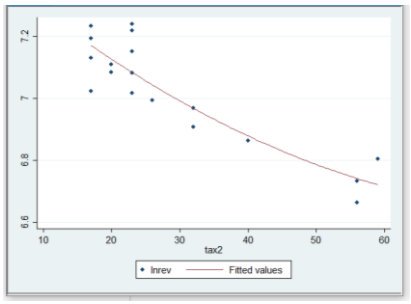


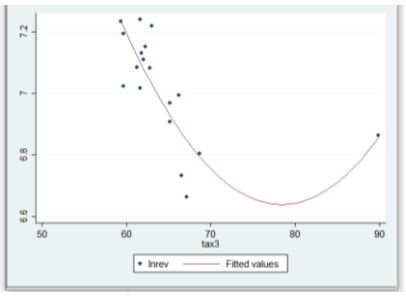




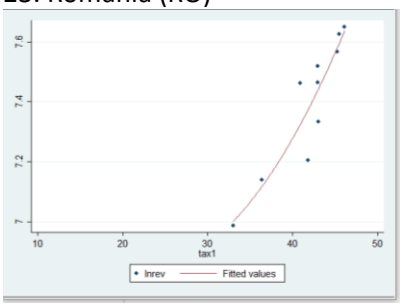
22. Portugal (PT)

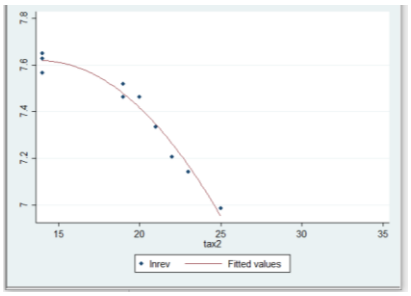


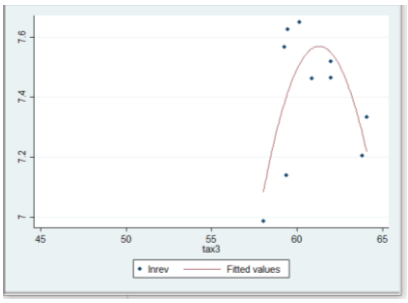




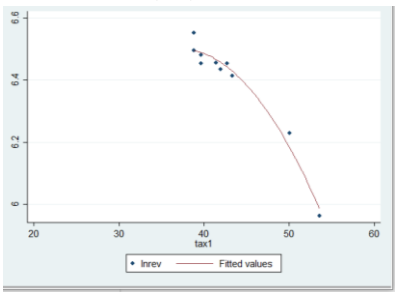
23. Romania (RO)

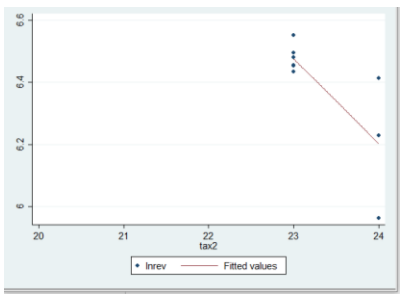


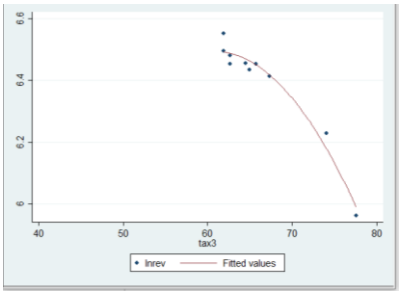




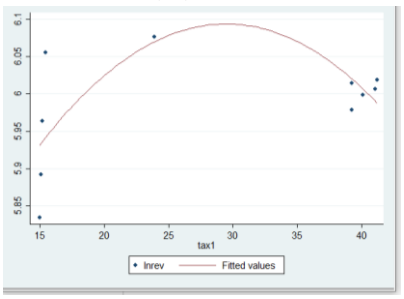
24. Slovakia (SK)

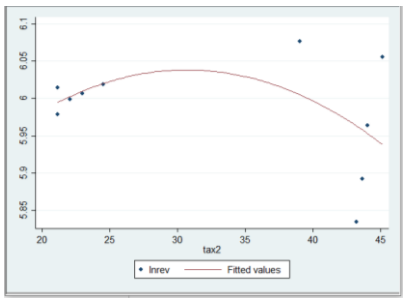


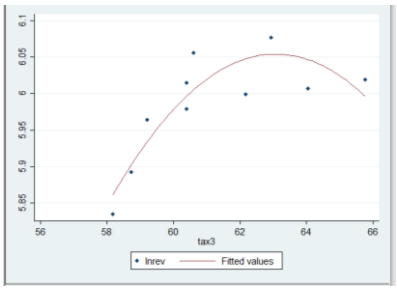




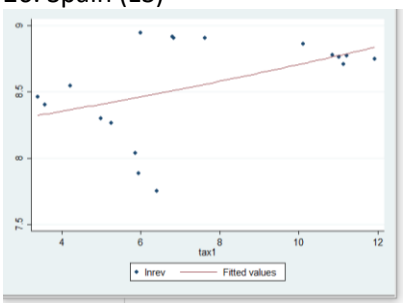
25. Slovenia (SI)

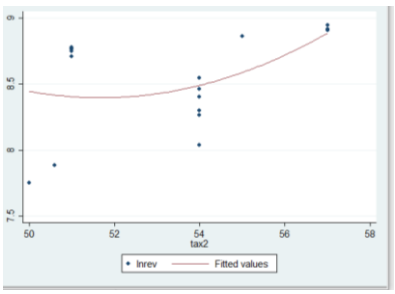


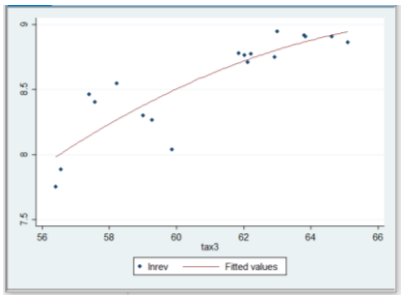




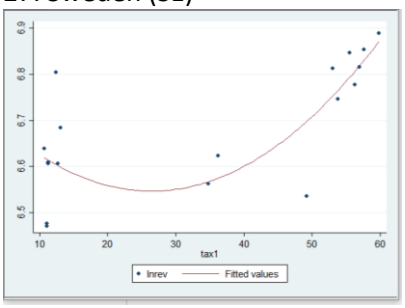
26. Spain (ES)

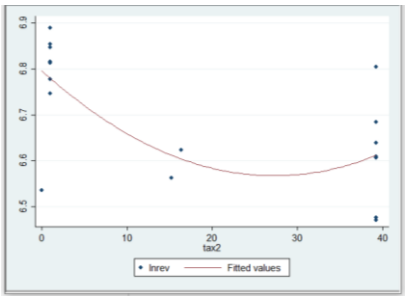


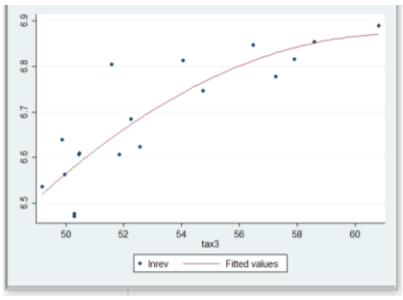




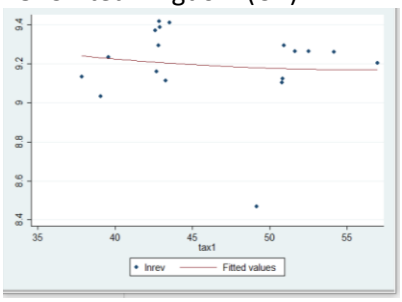
27. Sweden (SE)

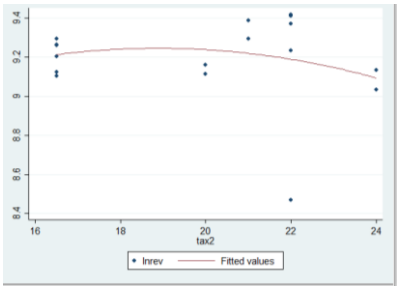






28. United Kingdom (UK)





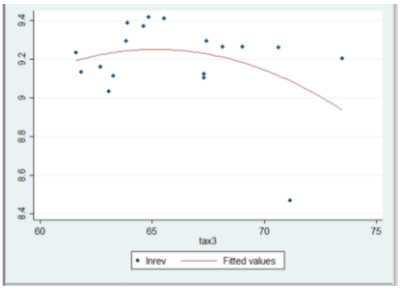


Table II. 1 List of countries and cigarette excise taxes.

		Average excise taxes		Changes in excise taxes		Total
		Specific	Ad valorem	Specific	Ad valorem	changes
Country	Tax scheme	(1)	(2)	(3)	(4)	(5)
Austria	N-C	18.67	41.05	1	0	1
Belgium	C	10.81	49.14	2	2	4
Bulgaria	C	40.38	27.59	5	4	9
Cyprus	C	22.55	37.95	3	2	5
Czech Republic	N-C	33.95	27.45	0	0	0
Denmark	C	48.86	6.97	4	2	6
Estonia	C	35.75	32.00	2	1	3
Finland	N-C	10.96	51.82	0	0	0
France	C	11.45	53.16	2	1	3
Germany	N-C	36.67	22.56	1	0	1
Greece	C	28.28	36.64	4	4	8
Hungary	C	29.76	27.84	3	1	4
Ireland	C	51.52	12.35	2	1	3
Italy	N-C	5.51	53.30	0	0	0
Latvia	C	35.93	29.38	3	2	5
Lithuania	C	35.37	24.55	1	1	2
Luxembourg	N-C	8.85	47.45	0	0	0
Netherlands	C	52.39	8.54	4	3	7
Poland	C	34.36	32.00	3	1	4
Portugal	N-C	41.34	19.55	1	0	1
Romania	C	41.87	18.64	3	1	4
Slovakia	C	42.56	23.27	2	0	2
Slovenia	C	29.64	31.79	2	2	4
Spain	N-C	9.49	53.55	0	1	1
Sweden	C	44.02	11.42	4	1	5
United Kingdom	C	49.09	18.36	3	1	4
Average		**31.16**	**30.70**	**-**	**-**	**-**
Total		**-**	**-**	**55**	**31**	**86**

Note: In column "Tax scheme", we split countries into Changing (C) and Non-Changing (N-C). The latter group contains countries that do not change excise taxes more than once over our sample period, which corresponds to 25% of the total number of countries with zero or one changes in their cigarette excise tax scheme. We define a change from year to year when the value is more than the mean value of the changes, i.e. 2.60% and 3.69% in the specific and the ad valorem tax, respectively.

Appendix III

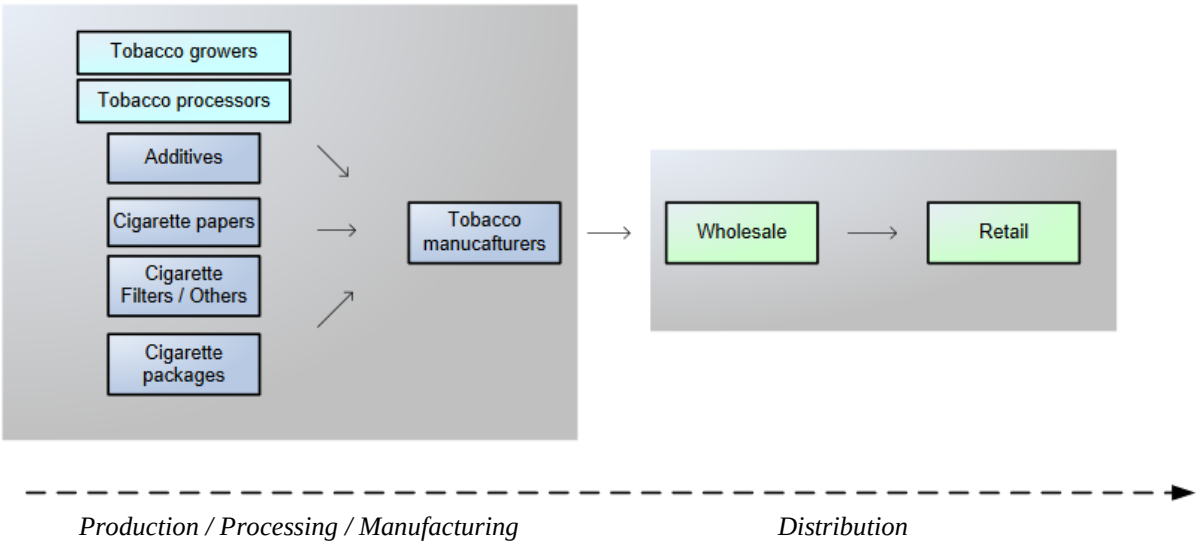
(CHAPTER 4)

Table III. 1 Tobacco supply activities.

Activity	General description	Examples	NACE (Rev. 1.1)
Farming	All tobacco works on the farm	Land preparation Delivery of cured tobacco to leaf processor	1.11 – Growing of cereals and other crops
Leaf marketing and processing	All activities after tobacco leaves farm and before ageing process	Leaf auctioning Leaf warehousing Leaf processing	1.11 – Growing of cereals and other crops
Product manufacturing	All aspects of production	Reordering Blending Leaf cutting Delivery of packed tobacco to wholesaler	16 – Manufacture of tobacco products
Product wholesale and retail	All activities to deliver tobacco	Selling tobacco products to consumer	51.25 – Wholesale of unmanufactured tobacco 51.35 – Wholesale of tobacco products 52.26 – Retail sale of tobacco

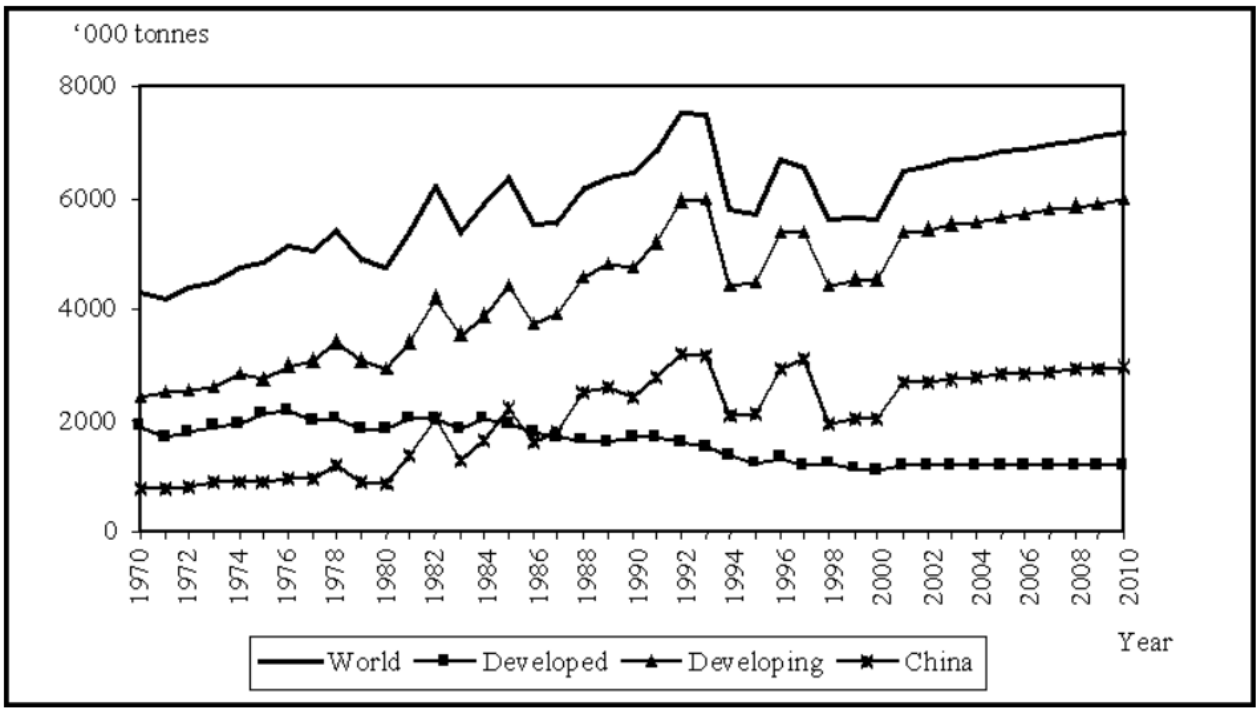
Source: World Bank, 1999.

Figure III. 1 Supply and value chain of tobacco products



Source: World Bank, 1999.

Figure III. 2 Tobacco leaf - production trends, 1970-2010 (dry weight).



Source: FAO (2003).

Table III. 2 Tobacco farms in EU 27[58] producing countries[59]

	2009		2008		2007	
Member State	**Tobacco Farmers**	**First Processors**	**Tobacco Farmers**	**First Processors**	**Tobacco Farmers**	**First Processors**
Bulgaria	42,412	44	37,000	44	36,718	42
Greece	14,340	4	14,909	5	14,701	5
Poland	14,291	6	14,388	6	14,377	6
Italy	6,538	22	6,758	23	7,360	26
Spain	2,503	4	2,547	3	3,341	3
France	2,277	1	2,482	1	2,751	1
Hungary	1,164	2	1,240	2	1,268	2
Germany	305	2	328	2	359	2
Romania	152	5	205	3	381	1
Portugal	174	4	180		102	
Belgium	72	5	88	8	90	8
Slovakia	0	1	61	1	61	1

Source: Nomisma (2010).

[58] EU-27 because Croatia had not joined in the EU in 2010. Croatia became the EU's 28th member state on July 2013.

[59] The first processing step is where raw tobacco leaves are graded into qualities.

Table III. 3 Fine-cut tobacco producers & EU market share (2010).

Producer EU	**Market Share (2010)**
Imperial Tobacco Group Plc	[30%-35%]
British American Tobacco Plc	[20%-25%]
Philip Morris International Inc	[5%-10%]
Japan Tobacco Inc	[5%-10%]
Gryson NV	[0-5%]
Pöschl Tabak Gmbh & Co KG	[0-5%]
Heintz van Landewyck Sarl	[0-5%]
Scandinavian Tobacco Group A/S	[0-5%]
Continental Tobacco Group	[0-5%]
Orion Czernek Jerzy	[0-5%]
Reynolds American Inc	[0-5%]
Zaklady Tytoniowe w Lublinie SA	[0-5%]
Dubek Ltd	[0-5%]
Tobacco Trading International Sp zoo	[0-5%]
Planta Tabak-Manufaktur Dr Manfred Obermann GmbH & Co	[0-5%]
Mac Baren Tobacco Co A/S	[0-5%]
Tabaqueira SA - Empresa Industrial de Tabacos SA	[0-5%]
Biggelaar Tabak BV	[0-5%]
Promotorzy Sp zoo	[0-5%]
Heupink & Bloemen Tabak BV	[0-5%]
Karelia Tobacco Co Inc	[0-5%]
Luxor Sp zoo	[0-5%]
Von Eicken GmbH	[0-5%]
Joh Wilh	[0-5%]
SEKAP SA	[0-5%]

Source: Matrix Report (2013), Euromonitor.

Table III. 4 Total Employment in Tobacco Manufacturing ('000s).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	1.1	1.1	1.1	1.2	1.1	1.1	1.0	1.0	0.9	1.0	-	-	-	-
Belgium	2.5	2.6	2.3	2.1	2.0	1.9	1.8	1.8	1.8	-	-	-	-	-
Bulgaria	11.5	12.1	13.0	11.6	13.2	10.1	7.7	5.8	5.6	5.0	4.9	5.0	4.3	-
Czech Republic	0.9	1.3	2.8	1.6	0.8	1.1	1.1	1.0	0.7	0.6	1.2	1.6	2.1	2.1
Denmark	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.3	-	-	-	-	-	-
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0.4	0.4	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	-	-	-	-
France	4.1	3.7	2.9	3.9	2.5	2.5	2.2	2.0	-	-	-	-	-	-
Germany	15.6	14.9	16.0	14.0	11.7	13.7	13.6	13.9	14.0	13.1	12.0	11.5	10.4	10.6
Greece	8.3	6.8	6.1	6.9	6.4	8.0	4.9	4.7	3.2	3.6	2.8	2.5	2.8	3.3
Hungary	2.9	2.8	2.7	3.4	2.2	0.9	1.1	1.2	0.9	1.0	-	-	-	-
Ireland	0.9	0.9	-	0.8	-	-	-	-	-	-	-	-	-	-
Italy	9.9	8.6	8.8	6.5	7.3	4.5	3.5	2.3	2.5	2.6	3.0	2.9	2.3	2.0
Netherlands	4.4	5.4	6.0	7.6	6.3	5.5	4.5	4.7	3.8	4.1	4.9	3.7	:	3.2
Poland	:	:	:	:	5.2	5.6	6.9	5.0	6.3	7.4	8.2	6.6	5.9	8.0
Portugal	1.3	1.4	1.4	1.3	1.3	1.3	1.1	1.0	0.7	-	-	-	-	-
Romania	4.1	8.3	4.7	4.8	3.2	3	2.5	1.8	-	-	-	-	-	-
Slovakia	1.0	0.9	0.9	0.9	0.4	0.4	0.3	0.0	0.0	0.0	:	0.0	0.0	0.0
Spain	11.9	9.0	6.6	5.9	8.3	9.0	11.8	8.1	6.2	4.5	3.5	4.7	4.6	3.
Sweden	1.0	1.0	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	-	-	-
Un.Kingdom	8.9	4.7	6	5.6	5.1	4.9	4.6	4.6	-	-	-	-	-	-

Source: FAOSTAT[60], International Labour Organization (ILO), 2014.

[60] Food and Agriculture Organization of the United Nations

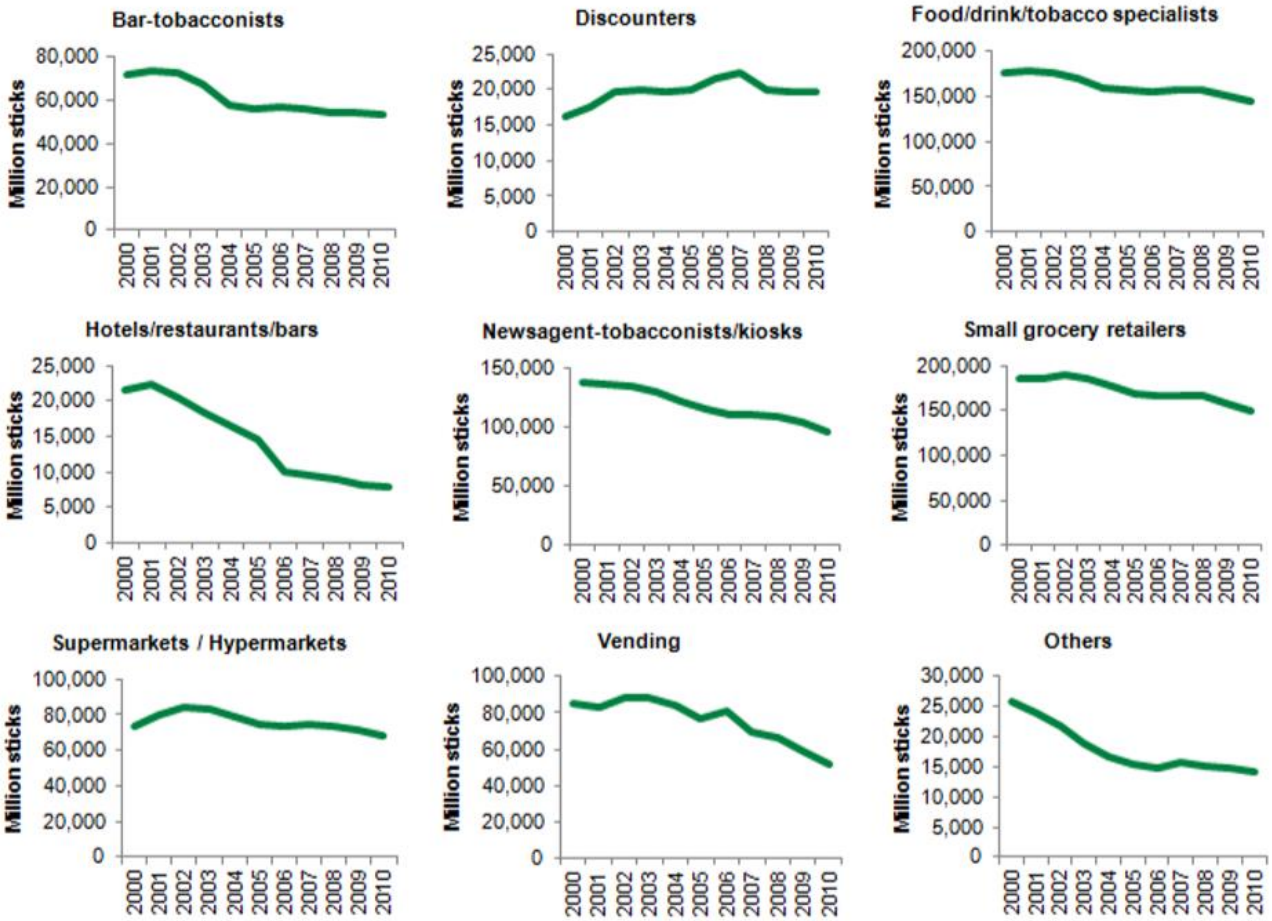
Table III. 5 Key indicators, manufacture of tobacco products, 2010.

	Number of enterprises	Turnover	Value added	Personnel costs	Investment in tangible costs
		(EUR million)			
EU-27	261	44,763	6,949	2,316	
Belgium	-	-	-	-	-
Bulgaria	27	687.8	92.2	49.3	11.9
Czech Republic	4	-	-	-	-2
Denmark	13	1,269.9	230.3	70.8	25.2
Germany	27	16,957.4	1,014.6	728.7	194.0
Estonia	0	0	0	0	0
Ireland	-	-	-	-	-
Greece *	4	552.9	309.8	94.2	15.2
Spain	43	1,004.3	441.1	173.0	22.8
France	5	1,227.6	538.3	199.5	-
Italy	4	677.9	280.7	70.4	22.4
Cyprus	-	-	-	-	-
Latvia	1	-	-	-	-
Lithuania	1	-	-	-	-
Luxembourg	1	-	-	-	-
Hungary	5	569.6	42.2	23.4	17.9
Malta	-	-	-	-	-
Netherlands	17	3,208.9	543.1	215.6	69.6
Austria	1	-	-	-	-
Poland	25	3,356	310	119.7	116.5
Portugal	4	171.3	66.2	37.7	8.1
Romania	13	514.1	-	-	-
Slovenia	0	0	0	0	0
Slovakia	-	-	-	-	-
Finland	1	-	-	-	-
Sweden	14	-	-	-	-
United Kingdom	11	12,301.9	2,169.9	190.5	111.3

*: 2009 data

Source: Eurostat (online data code: sbs_na_ind_r2)

Figure III. 3 Tobacco Retail Channels, (million sticks), by channel, EU 27 (2000-2010).



Source: Matrix Report (2013), Euromonitor.

Table III. 6 Shares of retail sale of tobacco products in EU and impact on revenue/profit loss for each retail channel.

Place of sale	Share of retail sales in EU (2010)	Impact of 2% decline in consumption (€ million)	
		Revenue loss	Profit loss
Tobacco specialists	23.8%	149.27	2.24
Newsagent-tobacconists/kiosks	24.7%	154.93	2.33
Supermarkets/discounters	14.6%	91.60	1.37
Hotels/restaurants/bars	1.3%	8.13	0.12
Vending machines	8.6%	53.93	0.81
Small grocery retailers	10.8%	67.73	1.01
Convenience stores	4.9%	30.73	0.46
Forecourt retail/ gas stations	8.9%	55.80	0.84
Others	2.4%	15.07	0.23
Total	100.0%	627.20	9.41

Source: Matrix report 2012; Euromonitor, European Commission, 2012.

Table III. 7 An example of cigarette pricing and taxation in Greece for the year 2016.

Tax	Tax rate	Tax base	Value per 1000 cigs) *	Value for 1 pack (20 cigs)
Specific tax (1)	**82.5 €**	* **1,000 cigs**	82.50 €	1.65 €
Ad valorem tax (2)	**20%**	** **185.5 €**	37.10 €	0.74 €
Vat (3)	**18.70%**	** **185.5 €**	34.69 €	0.69 €
Total tax (4)=(1)+(2)+(3)			154.29 €	3.09 €
Value excluding taxes (5)=(6)-(4)	**185.5 – 154.29**		**31.21 €**	**0.62 €**
W.A.P. (6) = (4)+(5)			**185.5 €**	**3.71 €**
* **50 packs * 20 cigarettes = 1,000 cigarettes**				
** **W.A.P.: 50 *3.71 € = 185.5 €**				

Source: Ministry of Economics of Greece, European Commission (DG TAXUD)