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Secular trends in tobacco consumption: the case of Italy, 1871-2010

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Abstract - This paper presents the first ever statistical reconstruction of annual tobacco consumption in Italy from 1871 to 2010. The time series of total tobacco is disaggregated into its four major components (cigars, cigarettes, cut tobacco, and snuff), both in physical and monetary term. Our task was largely facilitated by the peculiar institutional setting concerning the Italian case. From 1862 to recent years, the tobacco sector has been managed by the State under a regime of public monopoly so that a rich and detailed documentation is available. Using standard estimation techniques, demand models for aggregate tobacco are estimated for three separate sub-periods: 1871-1913, 1919-39, and 1946-2010. Price elasticities, estimated over a time period covering about one and a half centuries, belong constantly to a narrow [-.25, -.75] set. The result that the demand for tobacco is not elastic to its price constitutes apparently a re-invention of the wheel. Less so, when one considers that over the last 150 years policy perspectives and individual attitudes towards consumption of tobacco have changed dramatically.

Keywords: *Long-run, tobacco consumption, price and income elasticity of demand*
J.E.L. codes: *N43, N44, D12, C220*

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"*Cigarettes peril health, U.S. report concludes: 'remedial action' urged*"
(New York Times, January 12, 1964)

1 Introduction

This paper presents a detailed quantitative account of secular trends in tobacco consumption in Italy. A new dataset is developed by disaggregating annual consumption of total tobacco into its four major sub-aggregates (cigars, cigarettes, snuff, and cut-tobacco), both in physical and monetary terms. The time period covered goes from 1871 to 2010. Using standard models, price and income elasticities of demand are presented for three separate periods: 1871-1913, 1919-1939, and 1946-2010.

Cliometric works require generally two basic ingredients: good data and good empirical models. The case of tobacco represents from this perspective a case of major interest. To the happiness of economic historians, the sector is very well documented. The main reason is that in modern times, tobacco has always been an important source of States' revenues. Unsurprisingly, since the 19th century, the import, production and sale of tobacco were often run by Governments under a regime of public monopoly. Official documents and budget reports provide typically very accurate accounts of production and sales.[1] There is another, more technical in nature, reason. Tobacco consumption induces by its nature dependence. Present consumption is tied to past and perhaps future consumption. This basic fact has triggered a variety of empirical models aiming at representing adequately alternative dynamic behaviors.[2]

Besides data and modeling issues, the case of long-term tobacco consumption represents a fascinating research topic since Governments' and societies perspectives on the consumption of harmful goods have changed dramatically over time. Italy constitutes no exception. Italian policy makers of the 19th century were constantly at work to increase per-capita consumption of tobacco, mainly considered as a

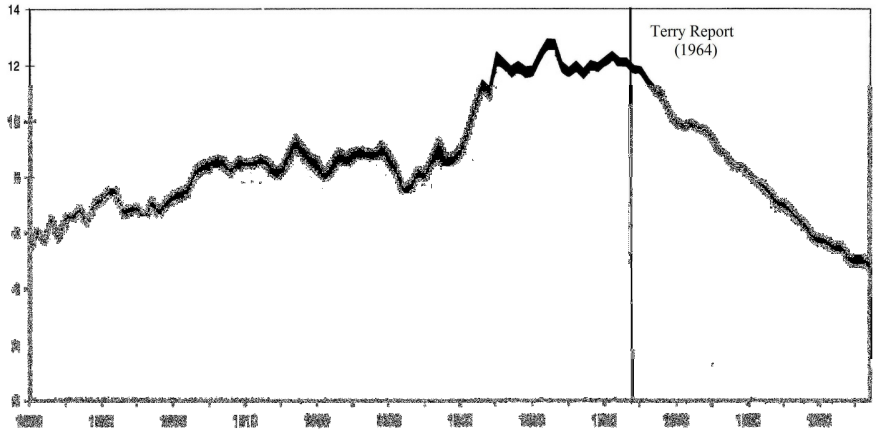
[1] Madsen (1916) examines the financial and industrial results obtained from the production and sale of tobacco with a special focus of those countries - France, Italy, Austria, Japan, Spain, and Sweden - with a regime of public monopoly.
[2] As the reader may want to verify, the vast majority of recent applied econometric books have at least a section devoted to the estimation of the demand for cigarettes.

major source of State's revenues.[3] In a 1878 report to the Parliament, the Italian Minister of Finance Agostino Magliani argued that per-capita consumption of manufactured tobacco in Italy (about 0.6 kilograms) was still too low when compared to that of other European countries (about 2.5 in Belgium, 1.5 in Germany, and 0.8 in France,).[4] The neat conclusion by Magliani was that "*in the Italian case there is still a long way to raise the price of tobacco without incurring in the risk of limiting the raise of its per-capita consumption*." Turning to the perspectives on tobacco consumption by Italians of the time, in 19th century the age of mass-press was only moving its first steps and the shift from elite to mass culture was far to come. Furthermore, the country was then characterized by enormous illiteracy rates, especially pronounced in Southern regions. As a result of all that, while it is true that a few authors suggested the negative consequence of smoking on individual health, it can be claimed that the majority of consumers were totally unaware of these negative effects.[5] That public health concerns were not a priority of the time also emerges rather neatly from official documents. In a Parliamentary address delivered in 1911, the Prime Minister Giolitti refused to contemplate banning young people from smoking (as had been done in Japan) on the grounds that it "*would have the immediate effect to make them all smoke, just to enjoy breaking the law with little risk of getting caught.*"[6]

Things have changed. Today, tobacco is widely recognized as a harmful good. Tobacco represents possibly the leading preventable cause of death in the world; it kills nearly 6 million people each year, including more than 600 thousands non-smokers who die from exposure to second-hand smoke[7]. Governments, international agencies, and NGOs pursue the goal of a "tobacco-free" society. Our referring to the "tobacco legislation" (instead of the once used "anti-tobacco legislation") is per-se telling of how deeply societies have changed their attitude towards tobacco. When did things change? Even though historians are generally skeptics about periodization and exact dating of social phenomena (*natura non facit saltum*, as the adage goes), the turning point in the way contemporary societies consider tobacco consumption is conventionally identified with the publication of the first Surgeon General's Report of 1964 in the USA (U.S. Department of health, education and welfare, 1964).

[3] Public revenues from sales of tobacco accounted for some ten per cent and more of total public revenues (Ciccarelli, 2012).
[4] Atti Parlamentari (1878), Allegato no. 7, p. 42.
[5] Scalzi (1868) represents a pioneering work on the consumption of tobacco and its negative relation with individual health. The author focuses in particular on the case of tobacco consumption in Rome at the time of Pius IX.
[6] Atti Parlamentari (1907), p. 11800. Interestingly enough, a recent study on tobacco sale to minors in contemporary Italy concluded that "A restriction of the legislation, increasing to 18 the minimum age for purchasing tobacco, would limit access to tobacco products by minors, only if adopted together with systematic and effective enforcement measures" (Gallus et al. 2009).
[7] World Health Organization (2011), p. 7.

Figure 1: Per-capita consumption of tobacco in the US, 1880-1995 (pounds)



Source: National Cancer Institute (1998), p. 22.

The Report stressed, for the first time in official publications, the existence of a causal relationship between smoking and lung cancer.[8] The echo of the Terry Report was enormous and its practical effects immediate, as the declining trend in per-capita consumption suggests (Figure 1). In the mid 1960s, cigarette packages distributed in the United States start carrying health warnings. A few years later, cigarette advertising was severely limited and banned altogether from radio and television. The echo of the Terry Report eventually reached Italian policy makers, too.[9] Tobacco legislation was updated accordingly. Since the mid-1970s, smoking on public places (including schools, hospitals, public transport, movie theaters, and public libraries) is banned by law; fines on advertising of tobacco products, an illegal activity since the early 1960, rose considerably since 1983. Tobacco packaging warnings were introduced in 1990.[10] The most recent legislation (a law passed in 2003, but in force as

[8] Nothing is entirely new under the sun. As noticed in Winkelstein (2002) the relation between smoking and lung cancer had been suggested by the medical literature before the Surgeon General's Report of 1964.

[9] The Terry report, named after Surgeon General Luther Terry, constitutes one of the most important documents in the recent history of public health. On the topic see the recent Warner (2013), and literature therein.

[10] A partial list of the recent legislation on tobacco includes: law no. 584, 11 November 1975 (public places and transport); law no. 428, 29 December 1990 (tobacco packaging warnings); law no. 3, 16 January 2003, the so called "Sirchia law" after

of 2005) has finally prohibited smoking in workplaces, bars and restaurants. Starting from January 2013 finally, tobacco products cannot be sold to individuals under the age of 18.[11]

We present estimates of long term price and income elasticities of tobacco demand. Demand elasticities are presented within an appropriate long temporal dimension to account for the secular change in the way Italians and Italy's policy makers have been looking at tobacco over the last 150 years. Somewhat surprisingly, our estimated price elasticities of demand for tobacco that are about constant over time (broadly confirming findings concerning recent decades by La Vecchia 1986, Gallus et al. 2003, Tiezzi, 2005, and Nguyen et al. 2012). The estimated price elasticity of demand belongs to a narrow (-.75, -.25) set. The estimated income elasticity of demand is always positive ranging from about .25 to 1.00 with an increasing temporal trend. That the demand for tobacco is not elastic to price constitutes admittedly a long-established stylized economic fact. However when one considers the long time period covered by our sample, the result appears not at all obvious. We next provide information on substitution/complementarity relationships among the main components of aggregate tobacco (snuff, cut, cigars, and cigarettes), by estimating a complete demand system. The estimated price elasticity of cigarette decreases considerably in the long run (from an estimated value of -.736 of the early 1871-1913 period to a much lower -.144 of the more recent 1945-2010 period), broadly confirming the general trends suggested from the aggregate analysis. Furthermore, the estimated cross-price elasticity points to an almost complete substitution between the non-cigarettes component of tobacco and cigarettes over time, and, most importantly, the consumption of tobacco is more and more characterized by an almost complete separability between cigarettes and non-cigarettes components of tobacco consumption (that is, the estimated cross-price elasticity of cigarettes to non-cigarettes components of total tobacco is very close to zero, while the opposite does not holds).

The remainder of the paper is organized as follow. Section 2 presents a summary of the medical and economic literature, stressing the fact that heterogeneous data and approaches might complicate the comparison of empirical findings concerning time periods that are considerably far apart. Section 3 introduces the new 1871-2010 tobacco dataset and provides details on the historical sources. Section 4

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the name of the then Minister of Health (workplaces, bars and restaurants, in force as of 10 January 2005). The annual reports of the *Istituto Superiore di Sanità* (ISS, Italian National Health Service) provide rich details on the matter. The ISS annual reports are available at http://www.iss.it/fumo (last accessed, January 2014).

[11] The most recent legislation concerns the e-cigarettes phenomenon. E-cigarettes are essentially a battery-powered cartridge that heats a liquid solution with various flavours (with or without nicotine). They are gaining increasing popularity among Italians.

focuses on aggregate tobacco demand and presents the estimated price and income elasticities of demand. Section 5 considers the main components of aggregate tobacco (cigars, snuff, cut, and cigarettes) and estimates elasticities based on a complete system of demand for the above components. Section 6 summarizes the main findings.

2 Literature review

This section provides an overview of the economic literature on the demand for tobacco. The contribution of the "founding fathers" is first briefly recalled, while the literature on the Italian case is then considered in some detail. The contribution by Schoenberg (1933) is credited to provide the first estimate of the demand function for cigarettes.[12] In that early hunting-and-gathering-stage the econometrics of tobacco consisted mainly in estimating static demand equations. The more recent contributions exploit the addictive nature of tobacco and estimate more elaborated demand models in which past and future consumption enter as explanatory variables of the current demand. A partial list of mandatory references in the field includes the pioneering research by Houthakker and Taylor (1966), followed by Hamilton (1972), Baltagi and Levin (1986), and the numerous applications of the rational addiction model -- due to the fundamental contribution by Becker and Murphy (1988) -- to the case of cigarettes smoking, a strand of literature inaugurated by Chaloupka (1991).[13]

The literature on tobacco consumption in Italy is rather sizeable and includes heterogeneous contributions. The medical literature is often sponsored by public national institutions including, above all, the *Istituto Superiore di Sanità* (ISS, Italian National Health Service) and non-profit research organizations (such as the Mario Negri Institute for Pharmacological Research). Studies are often based on sample surveys among which those carried out by the Istituto *Doxa*, the Italian branch of the Gallup International Association. Over time, the literature branched off into many directions ranging from the relation between maternal smoking and birth defects to the health consequences of second-hand smoke exposure. The medical study by La Vecchia (1986) is particularly close in spirit to our work. It considers trends in the prevalence of cigarette smoking in Italy using sample surveys conducted

[12] Thus Cameron (1998), p. 51.

[13] Cameron (1998) provides a valid, but somewhat dated, review of the literature. More recent reviews are provided, among others, by Chaloupka and Warner (2000), Escario and Molina (2001), DeCicca et al. (2002), Gallet and List (2003) reporting
in their Table 1 a list including 83 contributions, Farrelly et al. (2005), Lance et al. (2004), Adda and Cornaglia (2006).

between 1949 and 1983 and, of particular interest here, suggest that little change in smoking habits among Italians took place in the 1949-1983 period.[14]

Two strands can be identified in the economic literature, depending on the time period considered. The first one, more consolidated, focuses on the 20th century. The first study with a modern statistical approach is Manera (1963) who estimates a static demand model for tobacco with annual time series data covering the time interval 1900-1960. The analysis considers separately the consumption of four tobacco sub-aggregates (snuff, cut, cigars, and cigarettes) and three sub-periods of interest (1900-1915, 1918-1940, and 1945-1960). More recent studies tend to highlight the addictive nature of tobacco and extend thus the analysis to a dynamic framework. Tiezzi (2005) follows an eclectic approach and estimates a dynamic model of the demand for tobacco using both (pseudo) panel data at the regional level for the years from 1972 to 2000 and aggregate time series data at the national level on tobacco expenditure covering the time interval 1960-2002. She does so by fitting a rational addiction model where current consumption depends on both lagged and forward consumption and on the real price of tobacco. It emerges that "while the first dataset does not produce clear results in favor of the theory, the second supports the Becker model of addiction."[15] Pierani and Tiezzi (2009) provide empirical evidence on the joint consumption of tobacco and alcohol using a set of aggregate annual data covering the period 1960-2002. Own price elasticities are negative and the demand for tobacco appears to be more responsive than alcohol demand, although both responses are less than unity.

A second strand of the literature, focusing on the 19th century, is moving its first steps. A first contribution (Ciccarelli, 2012) describes the relevant historical sources and provides statistical reconstructions of annual regional tobacco consumption both in physical and monetary terms from 1871 to 1913. Interestingly, the estimated real expenditure on tobacco is cyclically "high" during the early 1870s, the early 1880s, and the *belle époque*, reproducing the general Kuznets-cycle pattern so often found in the main Italian macroeconomic aggregates of the time.[16] A second contribution (Ciccarelli and De Fraja 2014) estimates the demand for tobacco in post-unification Italy using annual data on tobacco consumption and its major components, at the provincial level. The authors argue that the historical period considered, from soon after the country's Unification to the eve of WWI, provides an ideal framework to study the consumption of tobacco given the virtual absence of restrictions on

[14] Forey et al. (2002) provides a detailed account of the medical literature.
[15] Thus (Tiezzi 2005, p. 233).
[16] See Fenoaltea (1988).

smoke imposed by the Italian policy makers of the time. Policy measures are seen by the authors as confounding factors operating against the best efforts of researchers attempting to disentangle signals from noise. The authors find empirical support for the rational addiction model.[17]

The current literature on tobacco consumption in Italy is thus characterized by very heterogeneous data, ranging from the micro data (sample surveys and pools) often adopted in the medical literature to annual aggregate (sales) data typically used in the economic literature. As a logical consequence, the estimation approaches follow the various branches of the micro- and macro-econometric literature.[18] The result is that the empirical findings of the various studies are often difficult to compare. Differences might be due to different sample periods considered, or different estimation methodology, or both. The present piece aims at contributing to the existing literature by providing an estimate of the demand for tobacco within an adequate long-run perspective, using for the various time periods considered the same (and well established) estimation approach applied to carefully reconstructed homogeneous time series of tobacco consumption.

3 The evolution of the institutional settings and the new tobacco dataset

Long run statistical reconstructions of the principal economic indicators are often a difficult task given the paucity of historical information at hand. The general rule is that data for recent decades are detailed and abundant while, going backwards, they tend to be scantier and scantier. The case of tobacco consumption in Italy, with data rich and accurate only up to the early 1980s, constitutes a paradoxical exception. The paradox is largely explained by the temporal evolution of the institutional settings behind the tobacco industry in Italy, reflecting essentially the rise and fall of State's intervention during the last 150 years.

In 1862, in the aftermath of the country's Unification, the public monopoly of tobacco was instituted by law. A few years later, under the urge of financial constraints, the young Italian State leased the

[17] Ciccarelli et al. (2013) use a detailed data set with product specific time-series at the provincial level for the years 1871-1887 to investigate the ability of the Italian State in fixing the selling prices of tobacco products in order to maximize monopoly profits.

[18] The need for a meta-analysis comparing the hetereogenous results of the literature concerning price elasticity of the demand for tobacco motivated the contribution by Gallet and List (Gallet and List 2003) reporting that "Estimating elasticities of cigarette demand has become commonplace amongst economists and policymakers. Synthesizing the various elasticities into a coherent message is quite challenging, however, as the point estimates are obtained using quite disparate modeling techniques and data. "

tobacco business to a private company (*Società Anonima per le Regìa Cointeressata dei Tabacchi*). The *Regìa* leased every government owned plant and equipment and was awarded the monopoly franchise for the manufacture and distribution of all tobacco-related products in the Kingdom from 1869 to 1883. The fifteen years contract with the *Regia* was not renewed and the State owned *Azienda dei Tabacchi* managed the tobacco industry starting 1884. Over time, with the mechanization of the production process, the tobacco industry was considered by Italian policy makers more and more as a proper industrial sector rather than just a fiscal monopoly.[19]

In 1927, a new public institution, the *Amministrazione autonoma dei monopoli di Stato* (AAMS) was created with the task of managing, under a regime of public monopoly, the import, production and sales of manufactured tobacco in Italy. The AAMS managed the Italian tobacco business up to 1997. Starting with the 1980s the main activities of the AAMS were radically transformed. The AAMS took over the management of national lotteries in the late 1980s and of the *Lotto* and instant lottery games in 1994, followed by *Bingo* in 2000. In 1998 the ETI (*Ente tabacchi italiani*), a new State owned company, inherited from the AAMS the management of the Italian market for tobacco. Following the consolidated AAMS tradition, ETI managed the production and sale of tobacco in Italy. It became a public company in 2000 and has been absorbed in 2003 by British American Tobacco, a private firm among the world leaders in cigarettes production.[20] Currently the core of AAMS activities is represented by, to quote their own slogan, guaranteeing a "Safe, Legal and Responsible Gaming", while monitoring the production and sale of tobacco represents essentially a residual activity.[21]

To summarize, the Italian tobacco sector was recently privatized and the public institution (AAMS) once managing the Italian market for tobacco shifted over time its attention from tobacco to gambling. As an inevitable consequence, the years of detailed annual reports on the production and sales of tobacco appears as memories of the past. On the contrary, the quantitative documentation on the gambling sector is growing rapidly. It constitutes perhaps a promising field of research for Italy's economic historians of future generations. We have thus recalled briefly the temporal evolution of the

[19] The early steps of mechanization of the Italian tobacco industry are considered in Ciccarelli and De Fraja (2014). When the Bonsack cigarette machine was perfected in the late 1880s, forty machines could meet the entire world demand. Technical details can be find in André Provost, *ingénieur en chef des manufactures de l'État*, providing an in depth description of the production process characterizing the manufacturing of tobacco products. The famous Bonsack machine is in particular described in Provost (1936), pp. 314-316.
[20] For a detailed long run account on the legal and institutional setting of the tobacco sector in Italy see Vetritto (2005).
[21] A summary of the legal and institutional settings of the tobacco sector in Italy from the years 1970-2001 is in Diana (2001).

institutions governing the Italian tobacco sector in the last 150 years. The bring-home conclusion is overall rather obvious (and well known to economic historians). Whenever the State has a direct interest in certain economic activities a rich documentation is usually available.

The data used in this paper refer to annual consumption of total tobacco and its major components (snuff, cut, cigars and cigarettes), in both physical (kilograms) and monetary (lire/euro) terms. The time period covered goes from 1871 to 2010. Data from 1871 to 1983 were collected from the annual budget reports of the various institutions (*Regía Cointeressata*: 1869-1883, *Azienda dei Tabacchi*: 1884-1927, *Amministrazione Autonoma dei Monopoli di Stato*: 1928-1983) from time to time entrusted to manage the tobacco business. With the obvious caveats of the case, too numerous to be listed even partially here, the above annual budget reports share the very same organization and, what proved to be particularly useful, always contain sales figures referring to both current and previous years, facilitating to preserve the temporal homogeneity of the time series being reconstructed. The 93 volumes at issue give, year by year and product by product, a very accurate quantitative account of tobacco (production and) consumption in Italy. Two clarifications are in order. First, the proposed "consumption" data are actually (legal) sales data, referring to ordinary sales of manufactured tobacco for consumption in Italy. They refer in particular to the cash payments made by authorized dealers (*tabaccai*) when buying snuff, cut, cigars, and cigarettes at the monopoly sale warehouses, distributed over the Italian territory. The sales considered in our dataset are "ordinary" in that they do not include those occurred at special prices to privileged categories (such as the merchant and military sailors, the diplomats, and other minor cases).[22] Furthermore, the sales are those "for consumption in Italy" in that sales of manufactured tobacco to foreign countries (export), which are regularly listed in separate chapters in the sources, are excluded.

The last official budget report by the AAMS was published in 1983. Some data on production and sale of tobacco for the subsequent years were released in various AAMS publications (*Rassegna MS*, published during the 1980s; *Rassegna Annuale*, published, to the best of our knowledge, between 1986 and 1990, and in 1995; *Rapporto Annuale,* released in various years).[23] But the accompanying text is typically terse and does not allow one to reconstruct temporally homogeneous series of aggregate tobacco consumption and, *a fortiori*, of its major components. In the lack of systematic sources, we

[22] Full references to the historical sources on tobacco are given in the Appendix.
[23] Annual reports of the AAMS for selected years are available at http://www.aams.gov.it/site.php?id=2455, last accessed February 2014.

obtained the data for the period 1984-2010 through personal communication with two institutions: the FIT (*Federazione Italiana Tabaccai*, the national association of Italian Tobacconists), and the AAMS.[24] The FIT dataset includes annual 1983-2000 data on aggregate tobacco consumption in both physical and monetary terms. Aggregate tobacco is also disaggregated into its four major components (snuff cut, cigars, and cigarettes). The AAMS dataset includes exactly the same information, but for the years 1994-2010. Both the FIT and AMMS dataset have admittedly a "take it or leave it" nature and consist essentially on annual data reported in tabular form. However, we were at least able to perform a set of reassuring consistency checks. First, we compared the 1970-1983 FIT data against those reported in the official standard annual budgets of the AAMS. The comparison was done separately for each component of total tobacco (snuff, cut tobacco, cigars, and cigarettes), both in physical and monetary terms, separately by years. Second, we compared the AAMS data against the FIT data on total sales of tobacco for the years 1980-1994. Finally, although admittedly not a decisive test, we compared the 1984-2010 data against the terse figures published annually by ISTAT (National Institute of Statistics).[25] After comparing the various sources, the tobacco dataset used in this paper borrows from the FIT dataset the quantitative information for the years 1983-1993, and from the AAMS dataset those for the years 1994-2010.

The demand for tobacco, estimated in the following sections, depends of course on price and income. Real price of tobacco was computed by deflating its nominal price by the ISTAT consumer price index (1913=1).[26] Nominal price of tobacco is indeed its unit value, evaluated by dividing nominal expenditure on tobacco by the corresponding physical consumption. Real income was obtained by deflating the GDP series by Baffigi (2011) by the mentioned CPI provided by Istat (2011). All estimations have been done using per-capita variables. Annual 1871-2010 population figures refer to individuals of age 15 or more and were obtained, as it is customary, by linear interpolation of census data. The second part of the paper considers the main sub-aggregates of total tobacco. In that framework, we also used total current expenditure for private consumption as reported in Baffigi (2011). To summarize, the full dataset covers the period 1871-2010 and includes 10 annual time-series on tobacco consumption: two series refer to total tobacco (per-capita physical consumption and real

[24] To have an idea of the wide geographical diffusion over the Italian territory of the FIT network the reader should consider that in year 2000 there were about 60,000 authorized dealers (*tabaccai*) . Given a natioanal territory (net of forests) of some 233,000 squared kilometers, one gets (60/233) the remarkable figure of about one *tabaccaio* each four squared kilometers.
[25] See, for instance, Istat (1987), p. 426, and Istat (1999), p. 397.
[26] The consumer price index (1913=1) is reported in Istat (2011), p. 896.

price); eight more series refer to per-capita consumption and real price of the four major components -- snuff, cut, cigars, and cigarettes -- of aggregate tobacco. Two additional variables enter the dataset: real income and real expenditure for private consumption.

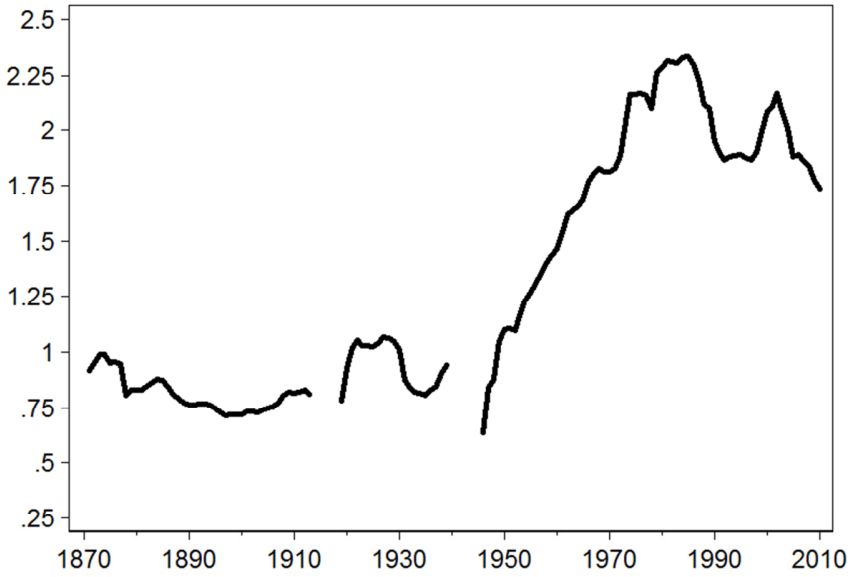
Figure 2 illustrates secular trends of tobacco consumption in Italy. The three pieces of time series reported refer to per-capita consumption during liberal Italy (1871-1913), the inter-wars period (1919-1939), and the post-WWII era. From end to end, per-capita consumption doubled rising from about one to about two kilograms. But the story is not one of a steady increase. Rather, per-capita consumption decreased considerably from 1871 to 1913, it fluctuated widely around a constant mean in the inter-wars period, to rise at an unprecedented pace from 1945 to 1985, when it reached it maximum level ever.[27] From 1985 on per-capita consumption decreased back to the 1970s level. The positive trend was reverted in the early 1980s, when consumption began to decline to reach back, in present day, the level of the early 1970s.[28]

From a comparison of Figures 1 and 2 two points emerge neatly. The first is that a long-term decrease in per-capita tobacco consumption occurred in one case (US) and not the other one (Italy). The second is that the turning point from positive to negative trend dates mid-1960s for the US and mid-1980s for Italy, marking a delay of about two decades.

[27] The inter-wars years registered a general reduction in international trades. Autarchy represented for Italy the new faith. The historical sources consulted show clearly that the Italian imports of tobacco (both the leaves and the manufactured products) fell considerably during the inter-wars period.

[28] The rapid upturn occurred after the turn of century appears admittedly odd. An explanation can be found in Joossens and Raw (2008), pp. 401-402. The authors provide estimates of seized tobacco (in tons) in Italy around the turn of the century and find that from 1998 to 2002 legal cigarette sales increased by 19% percent in Italy as a whole, by 121% in Campania, and by 55% in Apulia. They conclude that illicit cigarette sales became largely unavailable during that period forcing smokers to buy cigarettes on the legal markets. On estimating price elasticities when there is smuggling see Gruber et al. (2003).

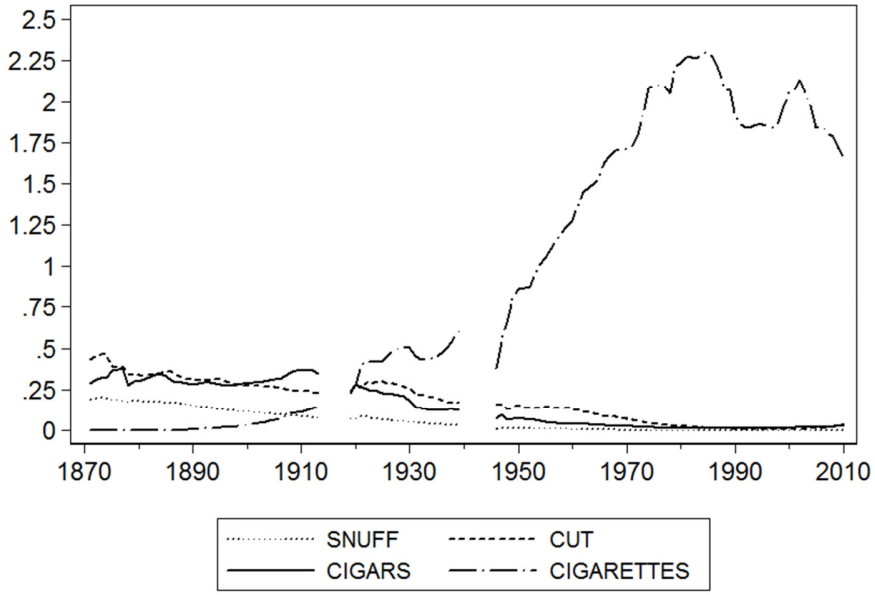
Figure 2: Per-capita consumption of tobacco in Italy, 1871-2010 (kilograms)



Source: see text.

Figure 3 illustrates trends in per-capita consumption of the major components of total tobacco. In 19th century cigars and cut-tobacco represented trendy products, snuff was of reduced relevance, while cigarettes consumption was moving rapidly its first steps (reaching about 20 percent of physical consumption already at the eve of WWI). The inter-wars period was characterized by a clear consolidation of cigarettes consumption with a share (in terms of physical sales) reaching about 2/3 of the national market. Starting with the 1950s the long term increase in aggregate tobacco consumption corresponds to an increase in its cigarettes component. The "non-cigarettes" component has a clear decreasing trend, reaching ignorable levels from the 1970s on. Recent trends are of some interest too.
As Table A1 shows the consumption of cut-tobacco, tied to the increasing diffusion of hand-rolled cigarettes, rose considerably in the more recent decade. A similar positive trend, from about year 2000 on, is also registered by the consumption of cigars.

Figure 3: Per-capita consumption of tobacco in Italy: major components, 1871-2010 (kilograms)



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4 The demand for tobacco: aggregate analysis

This section focuses on aggregate tobacco and illustrates the temporal evolution of both the short- and long-run income and price elasticities of demand. These measures of responsiveness were calculated after estimating an error correction model (ECM) of tobacco consumption. The approach is well established in the literature since the seminal Engle and Granger (1987) contribution. Here, it seems appropriate to recall briefly the essential features of our estimation strategy. Consider the conventional static (long-run) demand model:

$$C_t = a_0 + a_1 Y_t + a_2 P_t + u_t \qquad (1)$$

where C and P represent per-capita consumption and real price of tobacco, respectively, while Y denotes real per-capita income. A potential problem with the above regression is that, as it is well known, when regression variables are not stationary, the results are statistically meaningless. A possible way out, often adopted in the past, is to run the above regression on first differenced variables

$$\Delta C_t = b_0 + b_1 \Delta Y_t + b_2 \Delta P_t + v_t \qquad (2)$$

This short-run representation has been in turn criticized on a substantial ground: by first differencing the data, the long-run relations between *C*, *Y*, and *P* are washed away altogether. Engle and Granger (1987) provided a sound solution able to reconcile statistical and economic considerations in a unified framework. The proposed error correction mechanism consists essentially of the following two steps. First, time series properties are examined with the purpose of specifying their order of integration and the long-run equation (1) is then estimated by dynamic OLS (DOLS).[29] The stationarity of the DOLS residuals - verified with appropriate unit roots tests - is then considered evidence of a long run relationship between *C*, *Y*, and *P* that in technical jargon are said to be "cointegrated." In a second step, the lagged residuals ($\hat{u}_{t-1}$) are used as additional explanatory variable in equation (2). These residuals are interpreted as deviations from the long-run relation and thus represent the "error" to be "corrected" in the subsequent periods.

The resulting error correction model (ECM) merges equations (1) and (2), and may be written as:

$$\Delta C_t = \gamma_0 + \gamma_1 \Delta Y_t + \gamma_2 \Delta P_t + \gamma_3 \hat{u}_{t-1} + \varepsilon_t \qquad (3)$$

where the parameter γ_3 tied to the error correction term $\hat{u}_{t-1}$ measures the extent to which consumption tend to revert to long-run equilibrium. The parameters from the short- and long-run demand functions are not directly interpretable as elasticities, representing often the (derived) parameters of interest. [30]

[29]The dynamic OLS (DOLS) procedure was proposed in Stock and Watson (1993). The main idea is that of adding leads and lags of differenced explanatory variables (*Y* and *P* in our case) to the static cointegration relation (Equation 1 in our case) so as to eliminate small-sample bias resulting from correlation between the error term and the explanatory variables. Equation (1) reported in the main text omits, for the sake of brevity, the lead and lags effectively incorporated in the actual estimation procedure.

[30]Following the prevailing empirical literature, the potential impact of qualitative variables and control policies (e.g., smoking restrictions, ban on smoking for minors, health information, warning labels on packaging, demographic factors and change in consumer preferences) has been modelled adding ad hoc dummies and a linear trend in the long-run regression. Previous econometric studies find negative and significant effects of the above independent variables on tobacco consumption (Chaloupka and Warner, 1999; Saffer and Chaloupka, 1999). In our case, dummies modeling both short-lived and permanent effects do not show such clear cut results. Hence, since they did not add much in term of explanatory power but had a cost in term of degree of freedom, were eventually dropped. The main technical details and diagnostic tests of the

Table 1 reports the estimated price and income elasticities for the three time period considered. Panel A refers to the years from 1871 to 1913. Panel B to the years from 1919 to 1939. Panel C to the years from 1945 to 2010. This last panel, referring to the most recent period, constitutes a good starting point for the analysis. The estimates (see Table 1, Panel C) appear in line with those reported in the international literature concerning the more recent decades. Chaloupka and Warner (2000) and Gallet and List (2003) represent useful references in that summarize the findings of a wide set of scientific contributions. The first work is a chapter of the Handbook of Health Economics by leading authors in the field and provides, by its very nature, a very detailed summary of the literature. The second study represents an impressive research effort comparing estimation results from 86 empirical studies of the demand for cigarettes. It emerges that the prevailing values of estimated price elasticities reported in the literature range between -0.3 and -0.5. Turning to the Italian case, the literature has found price elasticities with a median value of, respectively, -0.41 and -0.75, for the short- and long-run case (Escario e Molina, 2001a; Tiezzi, 2005; Gallus *et al*., 2003; Pierani e Tiezzi, 2009). The work by Nguyen *et al*. (2012), which is close in spirit to our approach, presents finally estimates based on an error correction model for Italy (1970-2009). The study reports an estimate of the short-run price elasticity of cigarette demand equals to − 0.373 while the corresponding short-run income elasticity is 0.098 (although the latter is not statistically significant). Comparing the estimates reported in Table 1 Panels A-B, to those reported in the prevailing literature for the periods 1871-1913 and 1919-1913 represents a sterile exercise given that the latter include only a very limited number of contributions.[31]

While the comparison with the literature is thus somewhat reassuring the figures reported in Table 1 are per se of some interest. When judged in light of the so called "triple s rule" (sign, size, and significance) the proposed estimates, with the exception of the estimated short-run income elasticities, pass the test. First, estimated elasticities have the correct signs, *i.e.*, the demand of tobacco is negatively (positively) related to price (income) both in the short- and long-run. Second, the short-run elasticities are always lower (in absolute terms) than the corresponding long-run ones, as expected when dealing with

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Engle and Granger procedure and the estimated coefficients of both the cointegration and the ECM regression (respectively Equations 1 and 3) are available upon request from the authors.

[31]To the best of our knowledge, Manera (1963) represents the only quantitative work considering the demand for tobacco in Italy during the inter-wars period. Contributions referring to the 19th century are not great in number. Ciccarelli (2012) provides a detailed review of the historical sources with data on tobacco sales but the estimates are very tentative. Ciccarelli and De Fraja (2014) represents thus the only historical study reporting price and income elasticities of the demand for tobacco. Again, as for the inter-wars period, the literature is simply too thin to provide credible benchmarks.

consumption of addictive goods. Third, changes in income tend to affect tobacco consumption only in the long-run (short-run income elasticities are numerically negligible and not significant). Fourth, the short- and long-run estimates confirm that tobacco demand is inelastic to its own price and increasingly so over time. Fifth, at the equilibrium tobacco is a normal good and the response of consumption to income tends to decrease over time.

Table 1: Estimated demand elasticities, 1871-2010[a]

	short-run	long-run
A. 1871 – 1913:		
price	−0.476	−0.519
	(0.116)	(0.075)
income	0.089	0.767
	(0.141)	(0.084)
B. 1919 – 1939:		
price	−0.353	−0.394
	(0.067)	(0.042)
income	−0.161	0.675
	(0.105)	(0.249)
C. 1946 – 2009:		
price	−0.256	−0.366
	(0.099)	(0.037)
income	0.092	0.580
	(0.155)	(0.021)

[a] Short-run price elasticities (see equation 3) are defined as the product between γ_2 and the price to consumption ratio (P/C). Similarly, short-run income elasticities are defined as the product between γ_1 and the income to consumption ratio (Y/C). Long-run price elasticities (see equation 1) are defined as the product between a_2 and (P/C). Similarly, long-run income elasticities are defined as the product between a_1 and (Y/C). In computing both the short- and the long-run elasticities, the (P/C) and the (Y/C) ratios are evaluated at the mean value of the reference period. Numbers in parenthesis represent approximate asymptotic standard errors.
Source: see text.

Figure 4 extends the results reported in Table 1 to a more general framework that accounts for the whole temporal profile of price and income elasticities. As already in Table 1, the three panels (A, B, and C) refer respectively to the pre-WWI period, to the interwar years (1919-1938), and to the years from 1946 to the present day. In each panel the bold lines, always above the zero line, represent long-run income elasticities, while the dotted lines, always below the zero line, refer to long-run price elasticities[32].

[32]Estimated elasticities are always significant as confidence intervals, not included in Figure 4, never cross the zero line.

Figure 4: Long-run elasticities, 1871-2010[a]

[a] Long-run price elasticities (see equation 1) are defined as the product between a_2 and the time variant ratio (P_t / C_t); the ratio is evaluated by inserting the current value of tobacco price (P_t) and consumption (C_t). Long-run income elasticities (see equation 1) are defined as the product between a_1 and the time variant ratio (Y_t / C_t); the ratio is evaluated by inserting the current values of income (Y_t) and consumption (C_t). When evaluating (P_t / C_t) and (Y_t / C_t), t =1871, 1872,…, 1913 in Panel A; t =1919, 1920,..., 1939 in Panel B; and t =1946, 1947,... , 2010 in Panel C.

Source: see text.

A convenient starting point to consider Figure 4 is to assume a "sea line" perspective, and to look more at it as a whole, rather than at its three elementary components (Panels A-C). By doing so, it emerges that the estimated income elasticities are constantly within the [0, 1] set implicating that tobacco has never been considered as a luxury good by Italians. Turning to price elasticities, the estimates suggest rather neatly that even considering a lengthy 1871-2010 period, their value belongs constantly to a narrow [-0.25, -0.75] set implying that the demand for aggregate tobacco has always been fairly rigid to its own price. At a first glance, that the demand for tobacco is not particularly elastic to its own price may be considered just the umpteenth confirmation of a long established fact. But a more fair consideration of our findings suggests that this is not quite true. Our work provides, for the very first time, estimates of price elasticities within a homogenous framework. Homogeneity concerns here two dimensions equally relevant. The first concerns the data behind our findings. Our results are based on annual consumption (sales indeed) data that have been carefully reconstructed starting, year by year, from the quantitative evidence reported by the historical sources.[33] The second is what could be called, to coin a phrase, a temporally-homogeneous approach. By adopting a well consolidated empirical strategy, the error correction model (ECM), to each temporal segment considered we provide results

[33] Annual consumption (sales) data in physical terms (million kilograms) for the years from 1870 to 2010 are reported in Table A1.

that are fully comparable over different sample periods. The current literature provides us with a wide set of empirical findings that are often not directly comparable because the various studies are based on data of very different nature (micro *vs* macro data) and, inevitably, different empirical approaches. In the light of the above considerations, our finding that the estimated price elasticities belong to a narrow [-0.25, -0.75] set for the whole 1871-2010 period seems to represent a brand-new result. And that result is particularly surprising when one consider how radically both Italian policy makers and consumers perspective on tobacco have changed over time (a point dealt with in the introductory section to the present piece).

5 The demand for tobacco: disaggregated analysis

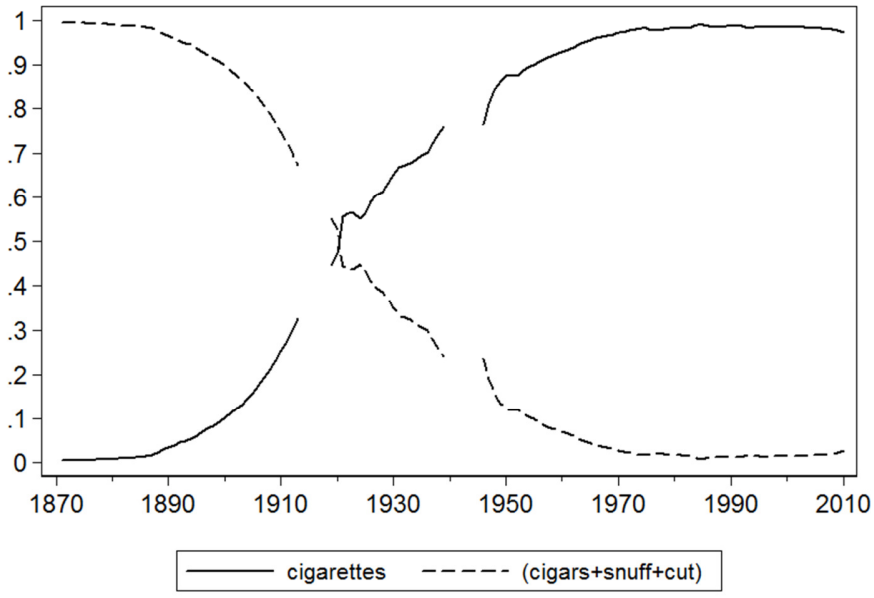
Over our lengthy investigation period public policy towards tobacco consumption has changed dramatically. Traditionally, government's interest was to boost consumption so as to maximize public revenues from tobacco taxation. Starting from the late seventies of the twentieth century, however, the objective of increasing public revenues through increased taxation has been in conflict with that of decreasing tobacco consumption and its negative externalities. While the first objective is more easily met in presence of low and negative price elasticities, using price responsiveness to reduce consumption requires, other things being equal, large and negative own price elasticities. In fact, as argued in previous sections, the price elasticity of demand for total tobacco has remained within a narrow (-0.75, -0.25) range throughout the investigation period, while consumption has boomed in the post WWI era, to peak in the early 1980s, and to decline thereafter.

We investigate the pattern of expenditure on the four tobacco products for the purpose of understanding whether and how such pattern over time can provide any clue for the stable price elasticity of demand that we observe over 150 years. Total tobacco expenditure has represented a very small fraction of total consumers' outlay throughout the entire investigation period and has followed an inverted U shape, increasing between the first (1871-1913) and the second (1919-1946) time interval from 1.6% to 3.0% of total current expenditure, and then decreasing to 2.2% between 1946 and 2009.

Regarding the evolution of per-capita expenditure on the four tobacco products (Figure 3), in the late nineteenth and early twentieth century the largest expenditure share is on cigars followed by cut tobacco, but their consumption gradually declines to around zero over time. Expenditure on cigarettes,

on the other hand, starts low in the late nineteenth century, but increases to 2.5% of total outlay (amounting to over 96% of the total expenditure on tobacco products) in the most recent years. In fact, as shown by Figure 5, there has been an almost total replacement of cigarettes to the other tobacco products over time. While in 1871 snuff, cut and cigars covered 99% of tobacco expenditure, in 2010 cigarettes represented 97% of such expenditure.

Figure 5: Tobacco expenditure: budget shares, 1871-2010



Source: see text.

To provide further information on substitution/complementarity relationships, in what follows we compute own and cross-price elasticities for the four tobacco products starting from the parameters of a complete system of demand including, besides tobacco, a composite commodity for the remaining consumption goods. The functional form chosen is the Almost Ideal Demand System (AIDS, Deaton and Muellbauer, 1980). The estimated demand functions are the following budget shares:

$$w_i = \alpha_i + \sum_j c_{ij} \ln p_j + b_i \ln\left(\frac{Y}{P}\right) \qquad (4)$$

where Y is total expenditure, p_j is the price of the j[th] tobacco product, P is approximated by the Stone linear price index, defined as $\ln P = \sum_i w_i \ln p_i$, and the parameters c_{ij} are defined as $c_{ij}=1/2(c^*_{ij} + c^*_{ji})=c_{ji}$. A linear time trend is also included. Demand functions (4) satisfy integrability, *i.e.* are consistent with utility maximization, when the following parametric restrictions hold: adding-up, homogeneity, and symmetry. Finally, the matrix of the substitution effects must be negative semi-definite. In estimation, we drop the composite commodity equation to accommodate adding-up. [34] From the demand system (4) the matrix of uncompensated price and income elasticities can be calculated as in Green and Alston (1990, page 444).

Table 2 shows the uncompensated (Marshallian) price and income elasticities, along with their standard errors, derived from the estimated parameters of the demand system (using the fitted budget shares calculated at the sample mean of the three investigation periods: 1871-1913, 1919-1939, and 1946-2009). We here focus on the most interesting own-price and cross-price elasticities and their pattern over time. All own-price elasticities are significant, with the correct sign and satisfy the theoretical properties. Cigarettes' price elasticity follows a U shape going from -0.736 in the pre-wars period to -1.286 during the inter-wars period, to -0.144 in the latest period, pointing to cigarettes as an increasingly price inelastic good. This pattern is consistent with the literature (Gallet and List, 2003) finding an increasingly unelastic cigarettes price elasticity in the most recent years. The price elasticity of cigars seems to follow a similar pattern going from -0.419 to -1.893 from the first to the second time period and to -0.477 in the most recent period. Own price elasticities for snuff and cut tobacco decrease between the first and the second sub-period, while in the third period they are irrelevant as the budget shares for these products are zero. Overall, this is mainly a story of cigarettes own-price elasticity and it seems broadly consistent with the pattern observed in Figure 4.

Cross-price elasticities convey information on complementarity or substitution relationships among the five products. We are particularly interested in substitution relationships. Each entry of Table 2 shows the percentage change in the quantity of the goods listed in rows following a 1% price change of the goods listed on the columns. In the first period cigarettes and cigars are substitutes, but such a substitution relationship is not symmetric, with cigarettes being a stronger substitute to cigars (0.340)

[34] The estimated parameters of the linear AIDS demand system, as well as the compensated price elasticities, are available from the authors upon request.

Table 2: Uncompensated Price Elasticities, Income Elasticities and Budget Shares.

1871 - 1913

	Snuff Tobacco	Cut Tobacco	Cigars	Cigarettes	Other goods	Income elasticity
Snuff Tobacco	**-0.478**	**0.496**	-0.000	**0.184**	**-0.422**	**0.220**
	(0.007)	**(0.007)**	(0.001)	**(0.003)**	**(0.101)**	**(0.108)**
Cut Tobacco	**0.184**	**-0.759**	**0.400**	**0.073**	-0.226	**0.328**
	(0.004)	**(0.005)**	**(0.009)**	**(0.001)**	(0.126)	**(0.137)**
Cigars	-0.000	**0.197**	**-0.419**	**0.031**	-0.127	0.319
	(0.000)	**(0.005)**	**(0.014)**	**(0.001)**	(0.166)	(0.178)
Cigarettes	**0.442**	**0.472**	**0.340**	**-0.736**	**-1.862**	**1.283**
	(0.032)	**(0.034)**	**(0.031)**	**(0.019)**	**(0.507)**	**(0.547)**
Other goods	**-0.002**	**-0.004**	**-0.007**	**-0.001**	**-0.996**	**1.010**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.002)**	**(0.002)**
Budget shares	0.002	0.004	0.009	0.001	0.983	

1919 - 1939

	Snuff Tobacco	Cut Tobacco	Cigars	Cigarettes	Other goods	Income elasticity
Snuff Tobacco	-0.003	**0.050**	**-0.166**	**-0.302**	0.481	-0.235
	(0.148)	**(0.008)**	**(0.010)**	**(0.063)**	(1.192)	(1.193)
Cut Tobacco	**0.009**	**-0.086**	**-0.167**	**0.733**	-0.358	0.206
	(0.000)	**(0.021)**	**(0.022)**	**(0.023)**	(0.269)	(0.264)
Cigars	**-0.004**	**-0.246**	**-1.893**	**-1.887**	3.606	0.244
	(0.001)	**(0.018)**	**(0.249)**	**(0.533)**	(1.942)	(2.142)
Cigarettes	**-0.002**	**-0.143**	**-0.552**	**-1.286**	**1.541**	0.135
	(0.001)	**(0.008)**	**(0.061)**	**(0.042)**	**(0.766)**	(0.814)
Other goods	**-0.000**	**-0.006**	**0.018**	**0.014**	**-1.053**	**1.027**
	(0.000)	**(0.000)**	**(0.000)**	**(0.001)**	**(0.031)**	**(0.032)**
Budget shares	0.001	0.004	0.006	0.020	0.969	

1946 - 2009

	Snuff Tobacco	Cut Tobacco	Cigars	Cigarettes	Other goods	Income elasticity
Snuff Tobacco	**-0.644**	**-0.426**	**0.190**	**0.333**	1.075	-0.527
	(0.211)	**(0.255)**	**(0.112)**	**(0.128)**	(3.225)	(3.115)
Cut Tobacco	**-0.009**	**-0.290**	**0.162**	**1.002**	-0.445	-0.419
	(0.001)	**(0.093)**	**(0.021)**	**(0.115)**	(0.881)	(0.703)
Cigars	**0.013**	**0.484**	**-0.477**	-0.124	-2.036	2.140
	(0.005)	**(0.189)**	**(0.205)**	(0.108)	(3.200)	(0.428)
Cigarettes	**0.000**	**0.018**	**-0.000**	**-0.144**	-0.156	0.282
	(0.000)	**(0.000)**	**(0.000)**	**(0.023)**	(0.220)	(0.201)
Other goods	**-0.000**	**-0.001**	**-0.000**	**-0.022**	**-0.996**	**1.019**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.006)**	**(0.006)**
Budget shares	0.000	0.000	0.000	0.025	0.975	

Note: Standard Errors in Italics below coefficients. Bold entries correspond to rejection of H_0 at the 5% significance level for a two tailed test.

than cigars are to cigarettes (0.031). Cigars become a strong complement of cigarettes in the period

between the two world wars (-1.887) while cigarettes are much weaker complements of cigars (-0.552) in the same sub-period, meaning that demand for cigarettes decreases much less following an increase in the price of cigars compared to the decrease in the demand for cigars following an increase in the price of cigarettes. In the third investigation period we do not detect any significant relationship between the two. This is not surprising given that the budget share for cigars drops to zero in the third period and cigarettes absorb almost all of the demand for tobacco. This dynamics is consistent with the gradual and steady replacement of cigarettes to cigars. Indeed, we do not detect any relationship significantly different from zero between cigarettes and the other tobacco products - snuff and cut – in the last period. Even though both snuff and cut tobacco consumption are substitutes of cigarettes and such substitution relationship is particularly strong for cut tobacco (1.002), their budget shares amount to practically zero thus making any substitution irrelevant. On the other hand, cigarettes consumption is insensitive to variations in the price of either cut or snuff tobacco.

Our analysis highlights thus a clear replacement of cigarettes to cigars (and other products). Indeed in the first investigation period the mean of own price elasticities for snuff, cut and cigarettes is -0.552, a figure in line with what we find in Section 4. In addition, the large drop in the absolute value of cigarettes' own price elasticity between the second and the third sub-period is also consistent with the increasingly inelastic demand for tobacco detected in Section 4 between 1946 and 1980.

6 Conclusions

This paper presents estimates of the demand for tobacco in Italy using a long-run perspective. To this end we provide a new dataset (see Table A1) of annual consumption of aggregate tobacco and its four major components (snuff, cut, cigars, and cigarettes) from 1871 to 2010. The proposed statistical reconstructions are largely based on the annual budget reports of the various firms and institutions entrusted over the last 150 years to manage the Italian monopoly of tobacco. Demand for tobacco, as of any other good indeed, depends on price and income. To proxy for the latter, the paper uses the recent estimates of long-run GDP presented in Baffigi (2011, 2013).

Traditionally, Italian policy makers have considered tobacco as a major source of public revenues while health related issues, in a country of illiterates as it was XIX century Italy, were ignored altogether. Official past documents report explicitly that the Government's urgent goal was to raise per-capita consumption of tobacco to a level comparable to the one prevailing in other European countries.

Society's opinion around tobacco consumption has changed dramatically over time. In the present days smoke related problems in Italy are mainly considered as an inconvenient legacy from past generations. But this perspective represents only a modern achievement, largely fostered by the recent tobacco legislation.

In light of the above considerations, it was somewhat surprising to find long run price elasticities of aggregate tobacco that throughout the lengthy 1871-2010 period belong constantly to a narrow (-.75, -.25) set, much in line with estimates produced for the recent decades by the current literature (La Vecchia, 1986; Gallus et al. 2003, Tiezzi, 2005, Nguyen et al. 2012).

This regularity, however, hides a story of a steady and increasing substitution of cigarettes for other tobacco products, as shown in the disaggregated analysis. Not only cigarettes consumption has gradually replaced consumption of all the other products. Our analysis also reveals an increasingly strong, and asymmetric, separability between cigarettes and other products, i.e. cigarettes demand is insensitive to price variations of the other tobacco products, but the opposite does not hold. This finding, coupled with an increasingly unelastic cigarettes price elasticity seems good news for the government, as it suggests that a further increase in cigarettes' taxation would not result in decreasing public revenues, but rather in increasing consumption of tobacco products other than cigarettes.

Appendix A. Sources and methods.

This appendix provides an account of the sources and methods used to assemble the new 1871-2010 tobacco data set used in this paper. The description is here limited to the years from 1918 to 2010, while a full account on the pre-WWI period can be found in Ciccarelli (2012).

Tobacco

The 1871-2011 "consumption" data used in this paper are effectively data on ordinary sales of manufactured tobacco for consumption in Italy. To be more precise our figures refers to the cash payments made by authorized dealers (*tabaccai*) when buying snuff, cut, cigars, and cigarettes at the monopoly sale warehouses, uniformly distributed over the Italian territory. Each *tabaccaio*, with a certain profit, provide then retail sales to the consumers.

The sales considered in our dataset are "ordinary" in that they do not include those occurred at special price to privileged categories (the merchant and military sailors, the diplomatic corps, and few more ones). Our data set includes sales of tobacco products manufactured abroad. The sales are "for consumption in Italy" in that exports of tobacco products manufactured in Italian factories are always excluded from the present dataset.

The data for the years from 1918 to 1939 are from two main sources. The data for the fiscal years from 1918-19 to 1927-28 are from the annual reports of the Azienda dei tabacchi (see, for instance, Ministero delle finanze. Direzione generale dei monopoli industriali (1921), Allegato a alla Tavola 3, pp. 64-65). The data for the fiscal years from 1928-29 to 1938-39 are from the annual reports of the Amministrazione dei monopoli di Stato (see, for instance, Amministrazione dei monopoli di Stato (1940a), Allegato b alla Tavola 2, pp. 48-49, and Amministrazione dei monopoli di Stato (1940b), Tavola 5, pp. 24-33).

The data for the years 1940-1944 are not surprisingly particularly problematic. The "annual" budget reports corresponding to the fiscal years 1942-43 to 1944-45 were only presented in a single volume published in the late 1940s (Amministrazione dei monopoli di Stato, 1949). The publication only include a few pages, and reports the total revenues from sales of total tobacco. Detailed data on the annual sales in physical terms for the years 1940-41 to 1944-45 are reported in particular in Amministrazione autonoma dei monopoli di Stato (1947-48 ca), part II, table 8 pp. 20-29 but as the introduction to part I of the same source indicates "starting with the fiscal year 1945-46 the ordinary activity of the monopoly was carried over again regularly over the whole national territory" (Amministrazione autonoma dei monopoli di Stato (1947-48 ca), part I, p. 9, free translation by the authors). In the light of the above considerations the data for the years 1941 to 1944 are in this paper ignored.[35]

The data for the years 1945 to 1983 are from the annual budget reports of the Amministrazione autonoma dei monopoli di Stato (data for the year 1975 are for instance reported in Amministrazione autonoma dei monopoli di Stato (1976), allegato 3, pp. 31-49). For the sake of completeness we note that starting with the fiscal year 1948-49 the source become a bit less detailed with respect to the sales of imported manufactured tobacco. A complete breakdown of imported products into snuff, cut, cigars,

[35] The year of publication for the annual budget reports referring to the fiscal year 1947-48 is not reported in the source.

and cigarettes is reported only for the physical sales (expressed in kilograms), while expenditure data only refer to the total and not to the main 4 sub-aggregates. A similar limitation, not concerning this paper, occurs for the sales of manufactured tobacco at the local (both regional and provincial) level. Starting with the year 1983 official data on tobacco consumption were only published occasionally in a set of heterogeneous sources. In the lack of official annual budget reports, the data for the years 1983-2010 are those kindly provided by the leading institutions managing the tobacco sector in Italy (AAMS and FIT). The data have admittedly a "take it or leave it" nature and consist essentially on annual figures reported in tabular form. However, as detailed in the main text, we run a set of reassuring consistency checks.

Population

The data refer to the present population of age 15 and more, as reported in the population censuses taken in the year 1871, 1881, 1901, 1911, 1921, 1931, 1936, 1951, 1961, 1971, 1981, 1991, 2001, and 2011. The figures for the remaining years were obtained by linear interpolation.

Cost of living

The cost of living index (1913 = 1) is from in Istat (2011), p. 896 ("Tavola 21.5 Indice dei prezzi al consumo per le famiglie di operai e impiegati, 1861-2010").

GDP

The GDP figures used in this paper are those reported in Baffigi (2011) and are available at: http://www.bancaditalia.it/pubblicazioni/pubsto/quastoeco/QSE_18, last accessed December 2013. The estimates are also illustrated in the more recent Baffigi (2013).

Table A1. Consumption of tobacco, 1871-2010 (million kilograms).

A. 1871-1913

	(1) snuff	(2) cut	(3) cigars	(4) cigarettes	(5) total
1871	3.46	7.88	5.22	0.02	16.58
1872	3.61	8.26	5.58	0.02	17.47
1873	3.70	8.51	5.90	0.03	18.14
1874	3.67	8.53	6.09	0.03	18.32
1875	3.54	7.26	6.88	0.03	17.71
1876	3.60	7.26	7.02	0.03	17.91
1877	3.50	7.31	6.99	0.04	17.84
1878	3.40	6.62	5.27	0.03	15.32
1879	3.53	6.51	5.73	0.03	15.80
1880	3.51	6.54	5.83	0.03	15.91
1881	3.46	6.50	6.08	0.04	16.08
1882	3.46	6.67	6.34	0.05	16.52
1883	3.46	6.76	6.62	0.05	16.89
1884	3.44	6.94	6.82	0.05	17.25
1885	3.41	7.16	6.64	0.06	17.27
1886	3.41	7.09	6.13	0.07	16.70
1887	3.40	6.82	5.90	0.08	16.20
1888	3.35	6.45	5.90	0.11	15.81
1889	3.28	6.28	5.85	0.15	15.56
1890	3.18	6.33	5.73	0.19	15.43
1891	3.08	6.32	5.88	0.24	15.52
1892	2.98	6.29	6.05	0.31	15.63
1893	2.90	6.42	6.06	0.34	15.72
1894	2.83	6.53	5.97	0.37	15.70
1895	2.73	6.50	5.82	0.42	15.47
1896	2.66	6.30	5.77	0.47	15.20
1897	2.61	6.05	5.79	0.52	14.97
1898	2.58	6.00	5.94	0.58	15.10
1899	2.56	5.92	6.07	0.66	15.21
1900	2.51	5.86	6.13	0.76	15.26
1901	2.47	5.96	6.30	0.88	15.61
1902	2.39	5.92	6.42	0.99	15.72
1903	2.34	5.82	6.52	1.11	15.79
1904	2.30	5.87	6.72	1.27	16.16
1905	2.25	5.90	6.89	1.44	16.48
1906	2.23	5.79	7.02	1.63	16.67
1907	2.21	5.67	7.44	1.93	17.25
1908	2.18	5.62	7.96	2.34	18.10
1909	2.14	5.54	8.29	2.58	18.55
1910	2.04	5.53	8.41	2.64	18.62
1911	1.95	5.59	8.49	2.83	18.86
1912	1.90	5.60	8.62	3.19	19.31
1913	1.83	5.47	8.24	3.55	19.09

Table A1, *cont.*

B. 1919-1939

	(1) snuff	(2) cut	(3) cigars	(4) cigarettes	(5) total
1919	1.86	6.02	6.25	5.83	19.96
1920	1.96	7.27	7.34	7.37	23.94
1921	2.27	6.87	7.02	10.53	26.69
1922	2.29	7.86	6.73	11.04	27.92
1923	2.05	7.70	6.57	11.24	27.56
1924	1.93	8.09	6.53	11.28	27.83
1925	1.87	8.17	6.33	11.63	28.00
1926	1.83	7.96	6.20	12.64	28.63
1927	1.78	7.97	6.31	13.66	29.72
1928	1.75	7.86	6.21	14.10	29.92
1929	1.64	7.64	5.97	14.56	29.81
1930	1.62	7.40	5.37	14.53	28.92
1931	1.50	6.55	4.20	13.05	25.30
1932	1.39	6.42	4.03	12.67	24.51
1933	1.29	6.29	3.82	12.63	24.03
1934	1.24	6.06	3.76	12.98	24.04
1935	1.19	5.87	3.69	13.22	23.97
1936	1.14	5.61	3.81	14.23	24.79
1937	1.11	5.19	3.92	15.35	25.57
1938	1.10	5.40	4.01	17.10	27.61
1939	1.05	5.38	3.99	18.64	29.06

C. 1946-2010

	(1) snuff	(2) cut	(3) cigars	(4) cigarettes	(5) total
1946	0.41	5.58	2.55	12.72	21.26
1947	0.63	5.34	3.29	19.07	28.33
1948	0.58	4.54	2.39	22.35	29.86
1949	0.59	5.19	2.51	27.71	36.00
1950	0.61	5.32	2.52	29.89	38.34
1951	0.59	5.18	2.51	30.53	38.81
1952	0.58	5.03	2.37	30.89	38.87
1953	0.54	4.99	2.34	33.76	41.63
1954	0.54	5.17	2.25	36.52	44.48
1955	0.54	5.27	1.97	38.20	45.98
1956	0.51	5.26	1.85	40.40	48.02
1957	0.50	5.10	1.77	42.66	50.03
1958	0.50	5.23	1.67	44.91	52.31
1959	0.48	5.25	1.61	46.58	53.92
1960	0.46	5.14	1.58	48.31	55.49

Table A1 *cont.*

C. 1946-2010, *cont.*

	(1) snuff	(2) cut	(3) cigars	(4) cigarettes	(5) total
1961	0.44	4.87	1.55	51.86	58.72
1962	0.41	4.55	1.56	55.83	62.35
1963	0.40	4.28	1.51	57.15	63.34
1964	0.37	4.12	1.49	58.60	64.58
1965	0.33	3.80	1.32	60.62	66.07
1966	0.28	3.52	1.34	64.64	69.78
1967	0.29	3.57	1.21	66.66	71.73
1968	0.25	3.38	1.24	68.45	73.32
1969	0.21	3.22	1.20	68.56	73.19
1970	0.19	2.91	1.06	69.53	73.69
1971	0.17	2.71	1.07	70.83	74.78
1972	0.16	2.46	0.99	74.17	77.78
1973	0.15	2.33	0.92	80.13	83.53
1974	0.14	2.06	0.93	87.50	90.63
1975	0.13	1.83	0.83	88.75	91.54
1976	0.12	1.75	0.75	89.74	92.36
1977	0.11	1.50	0.78	90.29	92.68
1978	0.10	1.45	0.66	88.82	91.03
1979	0.10	1.31	0.69	96.82	98.92
1980	0.09	1.24	0.72	98.70	100.75
1981	0.08	1.19	0.74	100.97	102.98
1982	0.08	1.05	0.75	101.64	103.52
1983	0.08	0.95	0.74	102.19	103.96
1984	0.07	0.87	0.74	104.28	105.96
1985	0.07	0.79	0.72	105.31	106.89
1986	0.05	0.73	0.71	104.71	106.20
1987	0.05	0.68	0.90	102.18	103.81
1988	0.05	0.63	0.87	97.58	99.13
1989	0.05	0.58	0.85	97.45	98.93
1990	0.04	0.55	0.84	90.90	92.33
1991	0.04	0.52	0.86	89.11	90.53
1992	0.03	0.44	0.74	88.19	89.40
1993	0.04	0.63	0.88	88.62	90.17
1994	0.03	0.51	0.69	89.45	90.68
1995	0.03	0.55	0.72	89.85	91.15
1996	0.03	0.53	0.69	89.36	90.61
1997	0.03	0.52	0.73	89.23	90.51
1998	0.03	0.54	0.76	91.00	92.33
1999	0.02	0.52	0.83	95.92	97.29

Table A *cont.*

C. 1946-2010, *cont.*

	(1) snuff	(2) cut	(3) cigars	(4) cigarettes	(5) total
2000	0.01	0.49	0.91	100.35	101.76
2001	0.01	0.51	0.94	101.60	103.06
2002	0.01	0.52	1.03	105.22	106.78
2003	0.01	0.54	1.06	101.58	103.19
2004	0.01	0.67	1.12	98.85	100.65
2005	0.01	0.78	1.10	92.82	94.71
2006	0.01	0.86	1.18	93.81	95.86
2007	0.01	1.01	1.26	92.82	95.10
2008	0.01	1.25	1.31	91.99	94.56
2009	0.01	1.56	1.41	89.15	92.13
2010	0.01	2.00	1.68	87.03	90.72

Source: see text.

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