Thank You for Smoking! How Loopholes Between the EU and Switzerland Create Big Rents for Big Tobacco

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Abstract:

While loopholes are ubiquitous in many industrial sectors, estimating their economy effects is challenging. Using an example from the tobacco industry, this paper illustrates how loopholes are exploited, and quantifies their economic effects. After 2004, the EU effectively bans the production of cigarettes exceeding maximum yield limits of 10 mg tar, 1 mg nicotine, and 10 mg carbon monoxide, whereas Switzerland still allows the production of stronger cigarettes for the export market. I identify the effect of this loophole by carefully constructing various comparison groups, and quantify it by implementing a difference-in-difference estimator. I show that the loophole creates big rents in the form of additional foreign sales for Big Tobacco (i.e., the world's five biggest tobacco companies). In the decade from 2004 to 2014, Big Tobacco's foreign sales were between $1.5 billion and $2.5 billion higher than they would have been without the loophole.

JEL Codes: F14, L51

#1163

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1 Introduction

> We don't sell Tic Tacs, for Christ's sake, we sell cigarettes. And they're cool, available, and addictive. The job is almost done for us. (Budd Rohrabacher, called BR, head of the tobacco lobby, in the film Thank you for Smoking)[1]

The job is almost done for Big Tobacco selling cigarettes. Thank you for smoking! However, in the face of public health awareness less people light up and selling Tic Tacs might have become easier than selling cigarettes. With sales dragging, Big Tobacco may have less qualms about exploiting loopholes. After 2004, the production of cigarettes that exceed maximum yield limits on tar, nicotine and carbon monoxide of 10-1-10 mg per cigarette is effectively banned in the EU (Directive 2001/37/EC). However, in Switzerland it is still legal to produce strong cigarettes for the export market, undermining the EU's tobacco policy, and creating a loophole for Big Tobacco. Lo and behold, cigarette exports of Switzerland to countries with laxer or no maximum yield limits skyrocketed after 2004, more than tripling in a decade (Figure 1). This suggests that the loophole in Switzerland's tobacco policy created big rents for Big Tobacco in Switzerland.

Sources: Gaulier & Zignago (2010), Wikipedia (2016)
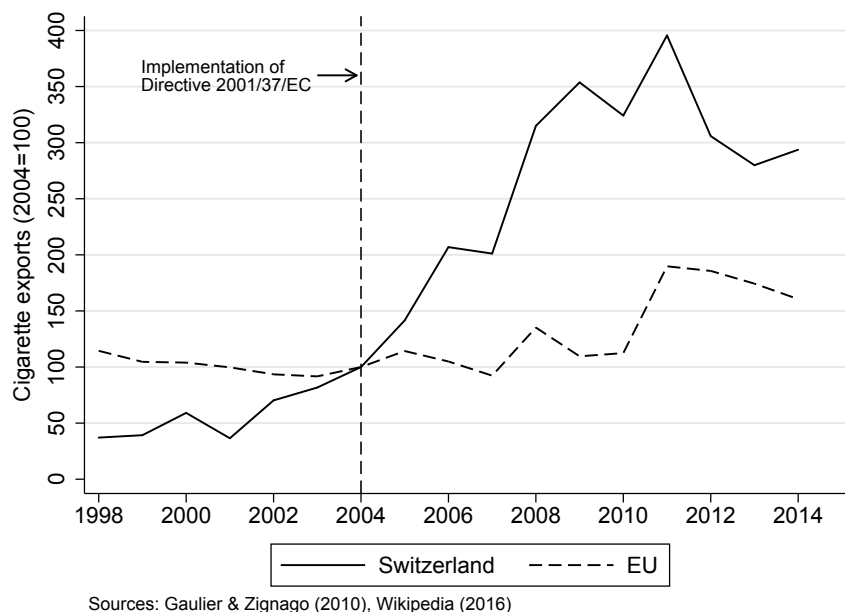
Figure 1: Switzerland's and the EU's cigarette exports to countries with no or laxer maximum yield limits than 10-1-10

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[1]The title of this paper is borrowed from the 1994 satirical novel by Christopher Buckley of the same title about a lobbyist working for Big Tobacco in the United States (Big Tobacco refers to the world's five biggest tobacco companies). In 2006, the book was made into a film of the same title written and directed by Jason Reitman starring Aaron Eckhart, William H. Macy and Robert Duvall.

This paper studies the effects of loopholes or regulatory differences across countries as illustrated by the case of regulatory differences in tobacco laws between the EU and Switzerland. The goal is to isolate and quantify the rent created for Big Tobacco in Switzerland due to differences between the EU's and Switzerland's maximum yield limits imposed on exported cigarettes. I isolate the rent by carefully constructing various comparison groups, and quantify it by implementing a difference-in-difference (DiD). Putting the results in context, I discuss the economic importance of the rent for Big Tobacco in particular, and the EU and Switzerland in general.

The main contribution of this paper is to estimate the rent from international regulatory loopholes in terms of product standards. Regulatory loopholes are ubiquitous in many sectors such as finance (i.e., bank secrecy laws, tax laws) or merchant shipping (i.e., flags of convenience). Since loopholes undermine the original purpose of a policy, they are highly relevant for policy makers. However, often it is very challenging to isolate and quantify the effects of regulatory loopholes. Most of the literature on loopholes focuses on international tax laws (e.g., Hines and Rice 1994, Gresik 2001). In the international economics literature, regulations or standards that affect international trade are discussed as non-tariff measures (NTMs), and with falling tariffs worldwide, have gained increasing attention. The literature on NTMs is mostly concerned with measuring the effects of NTMs on international trade flows by estimating ad-valorem tariff equivalents, and the creation of and distribution of rents between exporters and importers (Ferrantino 2006, Bannister 1994).

I estimate rents between $150 million and $280 million per year in terms of cigarette exports for Big Tobacco. In other words, Switzerland's cigarette exports are between $150 million and $280 million per year higher than they would be if Switzerland closed the loophole for Big Tobacco. Given an average profit margin of 30 per cent, this means additional profits between $0.5 billion and $0.8 billion over a decade for Big Tobacco. Since around 80 per cent of value added is created in Switzerland, the Swiss economy also benefits substantially from the loophole in Switzerland's compared to the EU's tobacco policy.

The remainder of the paper is organized as follows. Section 2 discusses in detail the EU's tobacco policy reform and its implications as well as how the effect of regulatory differences can be identified. In Section 3, the tobacco industry and global smoking trends are described. Section 4 introduces the data. In Section 5, the estimation strategy and baseline models are explained. Sections 6 and 7 present and discuss the results in detail. Section 8 concludes.

2 Tobacco policy and identification strategy

2.1 Tobacco policy reform in the EU

In May 2001, the EU parliament passed Directive 2001/37/EC with the goal of reforming and harmonizing the EU Member States' laws on the manufacturing and sale of tobacco products (EU 2001). Directive 2001/37/EC introduced stringent labeling requirements in the form of general (e.g., Smoking kills) and additional (e.g., Smokers die younger) warnings. However, at the heart of the policy reform were the maximum yield limits on tar, nicotine and carbon monoxide (also referred to as TNCO ceilings or 10-1-10 standard) specified in paragraphs 1 and 2 of Article 3 (EU 2001):

1. From 1 January 2004, the yield of cigarettes released for free circulation, marketed or manufactured in the Member States shall not be greater than: 10 mg per cigarette for tar; 1 mg per cigarette for nicotine; 10 mg per cigarette for carbon monoxide.

2. By way of derogation from the date referred to in paragraph 1, as regards cigarettes manufactured within, but exported from, the European Community. Member States may apply the yield limits laid down in this Article as from 1 January 2005 but shall in any event do so by 1 January 2007 at the latest.

2.2 Tobacco policy reform in Switzerland

Switzerland reformed its tobacco law in 2004. From 1 November 2004, the yield of cigarettes sold in Switzerland cannot exceed: 10 mg per cigarette for tar, 1 mg per cigarette for nicotine, and 10 mg per cigarette for carbon monoxide (Article 8; CH 2004).[2] This is Switzerland's equivalent to paragraph 1 of Article 3 in Directive 2001/37/EC. However, Switzerland has not introduced an equivalent regulation to paragraph 2 of Article 3 in Directive 2001/37/EC also imposing the 10-1-10 standard on cigarettes manufactured within, but exported from, Switzerland. Of course, cigarettes exported need to meet maximum yield limits in place in the destination market.

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[2]The Swiss parliament is currently debating a reform of Switzerland's tobacco law (NZZ 2017). The reform wants to prohibit advertisements of tobacco products in public places, newspapers, the Internet, and movie theaters, as well as sales promotions. Furthermore, the legal minimum age for cigarette purchases will be harmonized across Swiss cantons, and electronic cigarettes become equivalent to regular cigarettes. However, the adoption of the 10-1-10 standard for cigarettes produced in Switzerland and sold abroad is not planned (NZZ 2015).

2.3 Implications and identification strategy

Implications

Paragraph 2 of Article 3 in the EU's Directive 2001/37/EC implies that after 1 January 2007 cigarettes produced in any EU Member State must adhere to the 10-1-10 standard regardless of where those cigarettes are sold and consumed. Article 3 has created a *regulatory loophole* for Big Tobacco because Switzerland has not introduced a regulation imposing the 10-1-10 standard on cigarettes produced in Switzerland for the export market. In other words, this regulatory difference implies that cigarette producers in the EU are no longer allowed to produce strong cigarettes whereas cigarette producers in Switzerland can still produce strong cigarettes for the export market (Figure 2). Note that in the EU as well as in Switzerland cigars have never been subject to TNCO ceilings.
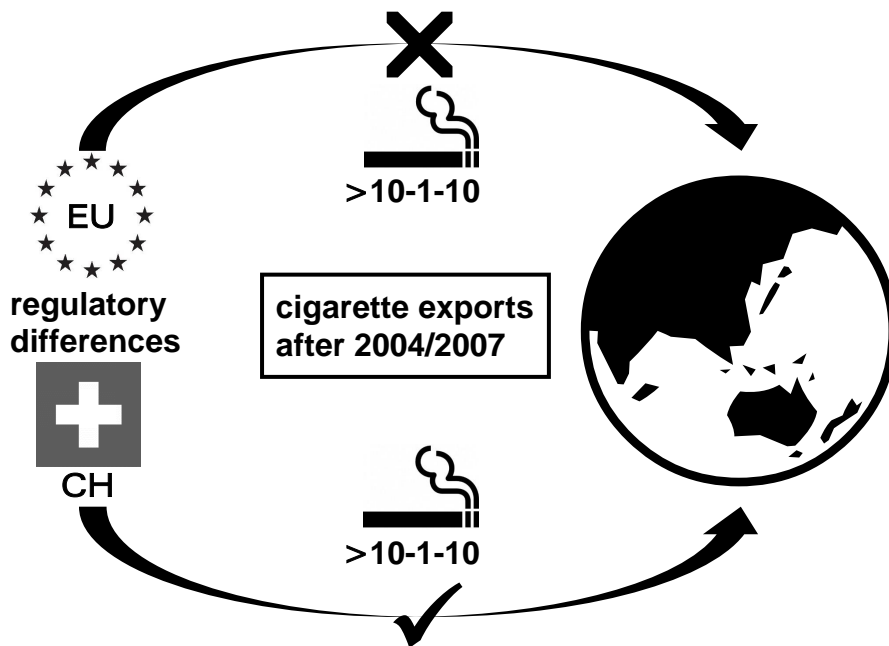
Figure 2: Effect of regulatory differences between EU and CH on cigarette exports

To the best of my knowledge, the EU Member States are the only countries that impose TNCO ceilings on cigarettes produced on their territory regardless of where they are consumed. So, why look at the case of Switzerland? Because the regulatory loophole only seems to matter for premium brands for which the country of production is an important characteristic in the product differentiation strategy. In Switzerland, mostly premium brands are produced and mainly exported to the Middle East and Asia

where "Made in Switzerland" is a seal of quality for which customers are willing to pay higher prices (20 Minuten 2009). Furthermore, customers in those markets also have a preference for strong cigarettes, that is, cigarettes exceeding the 10-1-10 standard (NZZ 2012). Thus, the difference in tobacco regulation between the EU and Switzerland, in combination with "Made in Switzerland", creates a competitive advantage for cigarette producers in Switzerland. According to NZZ, a daily Swiss newspaper,

> Two aspects justify the [cigarette] production in Switzerland. On the one hand, the Parisienne production for the domestic market. On the other hand, the export of cigarettes to the Middle East. In the case of exports, not only "Swiss Made" matters, but also the fact that here [in Switzerland], in contrast to the EU Member States, it is allowed to produce cigarettes for the export market which do not meet the domestic standards for tar and carbon monoxide emissions (but of course those of the destination market). (NZZ 2014a)

That the loophole created by Switzerland is important for Big Tobacco also becomes evident when reading the answer BAT Switzerland's CEO gave to the question if BAT has already presented its position to the Federal Government in Switzerland: "Yes, of course. We have presented our position directly as well as via the cigarette manufacturer's association. We are the second-largest employer in the canton of Jura. Thus, we also talk to the cantonal government and make our position clear" (20 Minuten 2009).

In sum, there exists demand for strong premium brand cigarettes made in Europe. Absent the regulatory difference in tobacco laws between Switzerland and the EU, cigarette producers would no longer be able to meet that demand after 2007. Thus, the loophole in Switzerland's tobacco law creates an economic rent for cigarette producers in Switzerland in terms of "abnormal" exports (i.e., foreign sales). How do I identify and quantify the effect of the regulatory loophole on Swiss cigarette exports?

Identification strategy

I identify the effect of regulatory differences in tobacco laws between the EU and Switzerland on Swiss cigarette exports based on variation across (a) country groups and (b) product groups. In particular,

- Strategy A: compare Swiss cigarette exports to countries with identical and different TNCO ceilings than the EU after the introduction of Directive 2001/37/EC.

- Strategy B: compare Swiss cigarette exports to Swiss cigar exports, both to countries with different TNCO ceilings than the EU after the introduction of Directive 2001/37/EC.

Strategy A identifying the effect of regulatory differences from variation across countries is a natural starting point. However, it has the following drawbacks. First, there might be unobserved factors affecting market development in countries with the same TNCO ceilings as the EU very differently over time from countries with different TNCO ceilings than the EU. Second, Swiss cigarette exports to countries with the same TNCO ceilings as the EU might be affected by the introduction of Directive 2001/37/EC due to portfolio adjustments or reallocation of production within multinational cigarette producers. Strategy B is supposed to address both issues as follows. On the one hand, most health trends and smoking regulations in a given country concern smoking in general, and do not discriminate between cigarette and cigar smoking. On the other hand, cigarette producers do not produce cigars in Switzerland, and vice versa, such that there are no portfolio or reallocation issues.

In addition to Swiss cigarette exports (volume in $), I also look at Swiss market shares defined as cigarette imports of country i from Switzerland in terms of total cigarette imports of country i. Market shares allow me to better take general-equilibrium effects into account, and serve as a robustness check.

3 Tobacco Industry and Global Smoking Trends

Worldwide, about 1 billion adults smoke. The global tobacco market is estimated at $770 billion, of which the global cigarette market is about $700 billion (BAT 2017). However, the WHO is fighting the global tobacco epidemic, and the number of people smoking has been declining since the Surgeon General's 1964 report in the US (WHO 2017).

3.1 Cigarette Producers

The global cigarette industry is dominated by the following five large multinational corporations, also referred to as Big Tobacco, Philip Morris International (PMI), British American Tobacco (BAT), Japan Tobacco International (JTI), Imperial Tobacco (IMT) and China National Tobacco Corporation (CNTC). Big Tobacco is big money. Despite declining sales, Big Tobacco are still highly profitable corporate giants (Table 1). In 2014, Big Tobacco earned combined total revenues of almost $100 billion from cigarette sales (excluding CNTC), of which $20 billion were export sales (Gaulier and Zignago 2010).

In the huge Chinese market, which embodies a third of all male smokers worldwide, 98 per cent of all cigarettes are sold by CNTC, a state monopoly (Financial Times 2016; The Tobacco Atlas 2017). CNTC is in a league of its own, employing more than 500,000 people in China and generating about \$170 billion in revenues, more than the other cigarette producers combined (Bloomberg 2014). However, less than 1 per cent of cigarettes produced by CNTC are exported (Fang et al. 2016).

Table 1: Earnings of Big Tobacco

	net sales (billions)	earnings (billions)	earnings margin
Japan Tobacco (JTI)	¥2,043.5	¥573.7	0.28
British American Tobacco (BAT)	£13.9	£4.5	0.33
Philip Morris International (PMI)	\$28.0	\$10.9	0.39
Imperial Tobacco (IMT)	£12.6	£1.4	0.11

Notes: Table shows averages based on 2007-2014. Net sales are sales excluding excise taxes. Earnings for JTI is based on Earning before Interest, Taxes, Depreciation and Amortization (EBITDA), earnings for BAT, PMI and IMT is based on earnings before taxation. All numbers refer to the global tobacco business of JTI, BAT, PMI and IMT.
Sources: Japan Tobacco Inc. (2015), British American Tobacco (2015), Philip Morris International (2015), Imperical Tobacco Group (2015)

In Switzerland, Big Tobacco produces the following premium brand cigarettes for the domestic Swiss market and for the export market (BAT 2017; JTI 2017; PMI 2017). BAT produces Pall Mall, Kent, Lucky Strike and Parisienne in Boncourt (canton of Jura), JTI produces Camel, Winston, Benson & Hedges and Natural American Spirit in Dagmersellen (canton of Lucerne), and PMI produces Marlboro, Philip Morris, Muratti and Chesterfield in Neuchâtel (canton of Neuchâtel). In total, big Tobacco employs almost 5,000 people in more rural areas of Switzerland (Swiss Cigarette 2017). IMT and CNTC do not produce cigarettes in Switzerland.

Big Tobacco produces cigarettes in the EU as well. BAT operates factories in Germany, Hungary, Poland and Romania (BAT 2017), JTI in Germany and Romania (JTI 2017), and PMI in Czech Republic, Greece, Italy (filters), Lithuania, Netherlands (semi-manufactured goods), Poland, Portugal and Romania (PMI 2017). IMT produces cigarettes in Belgium and the Netherlands, Germany, Poland and Spain whereas CNTC does not produce in Europe. In recent years, Big Tobacco has reduced production due to declining sales in Europe, and reallocated production capacities from Western to Eastern European countries (NZZ 2014b).

3.2 Cigar Manufacturers

The cigar market is less concentrated than the cigarette market but a considerable part is dominated by few large European companies like the Scandinavian Tobacco Group (e.g., Cohiba and Bolivar), Altadis (e.g., Montecristo and Romeo y Julieta) or Oettinger Davidoff AG (e.g., Davidoff cigars). These companies manufacture their handmade premium cigars mostly in the Dominican Republic and Honduras. Cigars have never been Big Tobacco's core business. At the beginning of 2017, BAT has announced that it will remove Dunhill cigars from its portfolio (cigar aficionado 2017).

In Switzerland, two manufacturers produce cigars. Burger Söhne AG manufacture cigars (e.g. Dannemann, Rössli) in Brissago (canton of Ticino), and Villiger Söhne AG manufacture cigars (e.g. Rio 6, Villiger Export) in Pfeffikon (canton of Lucerne).[3] Both cigar manufacturers are medium-sized enterprises, employing in total more than 200 people in Switzerland. Burger Söhne and Villiger Söhne are among the world's ten largest cigar manufacturers (Cigar Clan 2008; ROi Online.ch 2013). Note that Burger Söhne and Villiger Söhne have never produced cigarettes in Switzerland, and Big Tobacco has never manufactured cigars in Switzerland.

While traditional cigar markets are Western Europe and the USA, most cigar manufacturers see a bright future in Asian and Middle Eastern markets (Cigar Journal 2014).

3.3 Global smoking trends and health considerations

During the 19th century and the beginning of the 20th century smoking used to be en vogue and very much the norm, at least for men. Until in 1964, when the first Surgeon General's report in the US on smoking and health concluded that (cigarette) smoking is related to lung cancer and chronic bronchitis. This marked the beginning of the worldwide anti-smoking movement. In the last 30 years, the global age-standardized prevalence of daily smoking among men has decreased approximately 10 per cent (The Tobacco Atlas 2017). Today, non-smoking is becoming the norm, 78 per cent of the world's population aged 15 years or older do not smoke (WHO 2017).

According to the World Health Organization (WHO 2017), "the tobacco epidemic is one of the biggest public health threats the world has ever faced, killing more than 7 million people a year." WHO is committed to fighting the global tobacco epidemic with its Tobacco Free Initiative (TFI) and the WHO Framework Convention on Tobacco Control (WHO FCTC) advising member countries to issue warnings on the dangers of

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[3]Until 2008 Wuhrmann Cigars AG produced cigars in Rheinfelden (canton of Aargau), when they were acquired by Villiger Söhne AG.

smoking, implement bans on advertising and increase tobacco taxes.

Figure 3: Example of WHO anti-tobacco campaign

Among countries' most popular regulation of tobacco products are TNCO ceilings. TNCO ceilings refer to the upper values of the total aerosol residue (tar), nicotine and carbon monoxide contents as measured by a cigarette smoking machine calibrated to ISO standards (Wikipedia 2016). However, the effect of TNCO ceilings on health is controversial since TNCO emissions are measured in laboratory settings, which differ from actual smoking behavior as people might just smoke more cigarettes to receive the same nicotine intake (WHO 2003).

4 Data

I observe bilateral trade flows of cigarettes (HS 6-digit 2402.20) and cigars (HS 6-digit 2402.10) between 109 countries (including Switzerland) for every year from 1998 until 2014.[4] The data on bilateral trade flows is provided by Gaulier and Zignago (2010). Data

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[4]The sample of 109 countries is due to data availability on covariates. I retain only countries for which I observe all covariates for all years between 1998 and 2014. I choose the observation period of 1998 until 2014 because in 2014 the EU parliament passed Directive 2014/40/EU, replacing Directive 2001/37/EC. The new directive implements stricter rules on labeling and packaging, as well as, tracking of cigarettes to combat illegal trade.

on TNCO ceilings are taken from Wikipedia (2016).[5] I further control for market size and access using data on GDP per capita (current \$), population and free trade agreements (FTA) provided by Head et al. (2010) as well as bilateral exchange rate movements provided by World Bank (2017), tobacco policy using data on total ad-valorem tax rates of cigarettes and prices of the most-sold cigarette brand (measured in intern. \$), as well as smoking prevalence using age-standardized smoking rates for males and females provided by WHO (2016). Summary statistics and the complete list of countries in the sample can be found in Appendix A.

5 Estimation

5.1 Strategy A: variation across country groups

Identification Strategy A is based on the comparison of Switzerland's cigarette exports to countries with different and identical TNCO ceilings to the 10-1-10 standard, respectively. Our baseline specification is:

$$Y_{it} = \alpha + \delta TNCO_{it} + \sum_k \gamma_k CTRY_{ki} + \sum_s \lambda_s YEAR_{st} + X_{it}\beta + \varepsilon_{it} \tag{1}$$

where Y_{it} denotes either Swiss exports EX_{it} (in million \$) of cigarettes (HS6 2402.20) to country i in year t, or Switzerland's market share MS_{it} as measured by Switzerland's share in total cigarette imports of country i in year t.

$TNCO_{it}$ is a dummy variable that takes the value 1 if country i has a different TNCO standard than the 10-1-10 standard *after* 2004 when Directive 2001/37/EC came into effect. In particular, TNCO takes the value 1 if Swiss cigarette exports go to a country with TNCO ceilings that are higher in either tar (T), nicotine (N) or carbon monoxide (CO), or there are no TNCO ceilings at all.[6] Since cigarettes produced in and exported from the EU cannot exceed 10-1-10 in either T, N or CO after 2004 (transition period from 2005 until 2007), deviations from the 10-1-10 standard create export opportunities for Big Tobacco producing cigarettes in Switzerland. These export opportunities would not exist in the absence of the regulatory loophole in Switzerland, and create (economic) rents for Big Tobacco.

The sums $\sum \gamma_k CTRY_{ki}$ and $\sum \lambda_j YEAR_{jt}$ are sets of country and year dummies, respectively. Country fixed-effects control for unobserved country-specific effects that

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[5]Whenever possible, I have verified the sources cited on Wikipedia. In all the cases I checked, the information stated on Wikipedia has been correct.

[6]For example, Saudi Arabia (SAU) has TNCO ceilings of 10-0.6-12. However, the EU can only export cigarettes with TNCO ceilings of 10-0.6-10 whereas Switzerland can export relatively stronger cigarettes with TNCO ceilings of 10-0.6-12.

are constant over time (e.g., distance to Switzerland), and time fixed-effects control for year-specific effects that are common to all countries (e.g., global financial crisis). To account for time-varying factors affecting cigarette consumption in a country that might possibly also be correlated with TNCO regulation, we include the vector of controls X_{it}. In particular, we control for market size and access measured by GDP per capita, population size, free trade agreement (FTA) and (nominal) exchange rate movements, tobacco policy as reflected in taxes on cigarettes (total ad-valorem tax) and prices of cigarettes (price of most sold brand), as well as smoking behavior proxied by smoking prevalence of adult males and females (age-standardized rate).

Equation (1) essentially implements a difference-in-differences (DiD) estimator, which we estimate with ordinary least squares (OLS), matching on observables. The coefficient δ of the variable $TNCO_{it}$ identifies the effect of regulatory differences between Swiss and EU tobacco laws, that is, TNCO ceilings, by comparing Swiss cigarette exports of countries with a 10-1-10 standard to countries with different TNCO ceilings. To address the issue of possible serial correlation in the error term (Bertrand et al. 2004), we report cluster-robust standard errors (clustered on destination country).

Identification strategy A depends on the assumption of common trends before 2004 in Swiss cigarette exports to countries with a 10-1-10 standard after 2004, and countries with different TNCO ceilings than the 10-1-10 standard after 2004. To probe this assumption, we include country-specific (linear) time trends $\sum_l \theta_l \left(CTRY_{li} \times t \right)$.

5.2 Strategy B: variation across product groups

Identification Strategy B is based on the comparison of Switzerland's cigarette exports to countries with different TNCO ceilings than the 10-1-10 standard to Swiss cigar exports also to countries with different TNCO ceilings than the 10-1-10 standard. Our baseline specification is:

$$Y_{ijt} = \alpha + \delta CIG04_{jt} + \phi CIG_j + \sum_k \gamma_k CTRY_{ki} + \sum_s \lambda_s YEAR_{st} + X_{it}\beta + \varepsilon_{ijt} \quad (2)$$

where Y_{ijt} denotes either Swiss exports EX_{it} (in million \$) of product j (cigarettes HS6 2402.20 or cigars HS6 2402.10) to country i in year t, or Switzerland's market share MS_{ijt} as measured by Switzerland's share in total cigarette or cigar imports of country i in year t.

$CIG04_{jt}$ is a dummy variable that takes the value 1 if product j is cigarettes *after* 2004 and thus, is affected by the regulatory difference in TNCO ceilings between Switzerland and the EU.

CIG_j takes the value 1 if product j is cigarettes and thus, absorbes unobserved

differences between cigarettes and cigars that are constant over time. Again, the sums $\sum \gamma_k CTRY_{ki}$ and $\sum \lambda_j YEAR_{jt}$ are sets of country and year dummies, respectively. The vector X_{it} includes the same time-varying controls as in Strategy A. To probe the assumption of common trends before 2004 across country and product groups, we include country-specific as well as product-specific (linear) time trends, that is, $\sum_l \theta_l (CTRY_{li} \times t)$ and $\sum_n \eta_n (CIG_{ni} \times t)$.

6 Results and common trends

## 6.1 Common trends and differences across groups

First, before discussing the results, I look at the evolution of cigarette and cigar exports and market shares before and after Directive 2001/37/EC came into effect in 2004.

Figure 4 shows the evolution of Swiss cigarette exports and market shares across countries with different TNCO ceilings and the 10-1-10 standard (Strategy A). Whereas cigarette exports and market shares to countries with the 10-1-10 standard are relatively constant over time, cigarette exports and market shares to countries with different TNCO ceilings than the 10-1-10 standard skyrocket after 2004. Importantly, the evolution of cigarette exports and market shares before 2004 is very similar across both country groups.
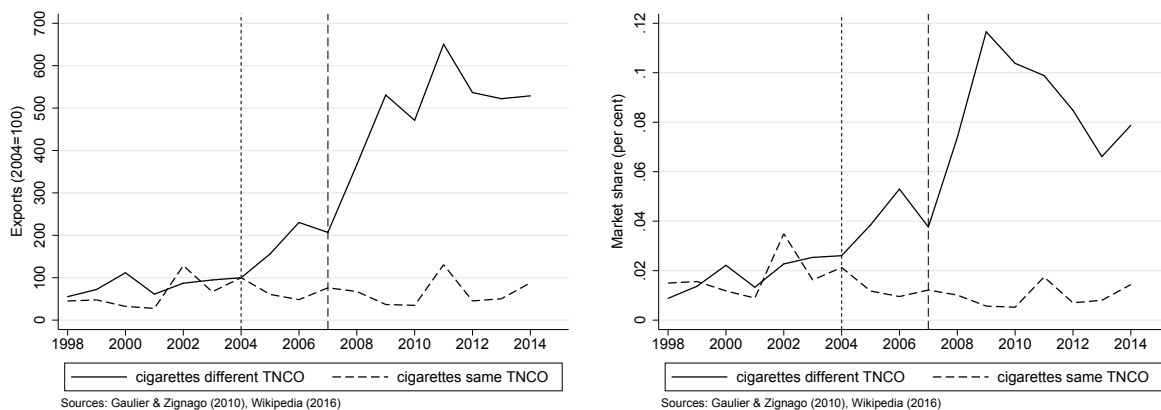
Figure 4: Evolution of Swiss cigarette exports and market share to countries with identical and different TNCO ceilings than the 10-1-10 standard after 2004 (Strategy A)

Similarly, Figure 5 shows the evolution of Swiss cigarette and cigar exports and market shares to countries with different TNCO ceilings than the 10-1-10 standard (Strategy B). Cigar exports and market share remain constant between 1998 and 2014 whereas cigarette exports and market shares explode after 2004. Again, the evolution of exports and market shares across product groups is very similar before 2004.
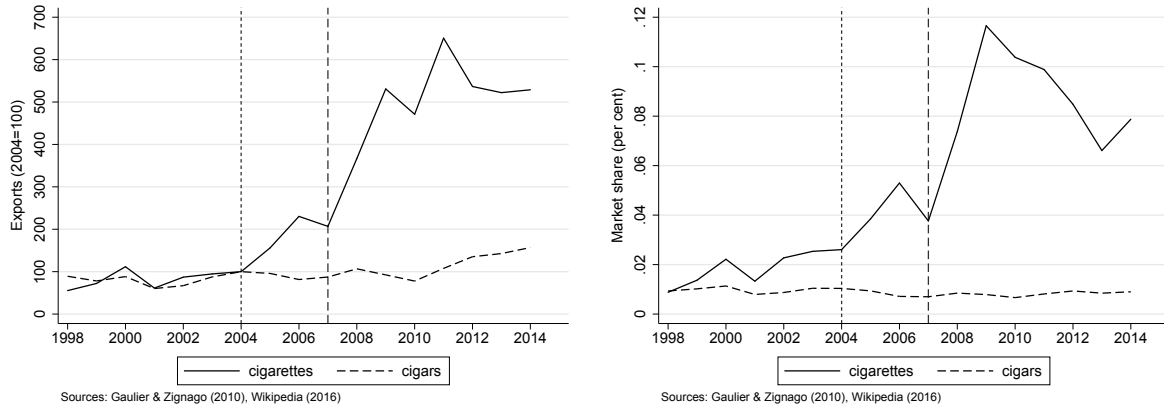
Figure 5: Evolution of Swiss cigarette and cigar exports and market shares to countries with different TNCO ceilings than the 10-1-10 standard after 2004 (Strategy B)

Second, I look at differences across groups before Directive 2001/37/EC came into effect in 2004. Columns in Table 2 compare means of outcomes and controls across country groups (Strategy A). Obviously, countries with the 10-1-10 standard (same TNCO) are different in almost all aspects from countries with different TNCO ceilings than the 10-1-10 standard. The rows Difference in exports and market shares compare means of outcomes across product groups (Strategy B). Cigarette exports and market shares differ significantly from cigar exports and market shares before 2004. However, systematic differences in the levels across groups are not a main concern, since they can be controlled for in the empirical models (Blundell and Costa Dias 2000).

6.2 Results

Table 3 shows the results from estimating models (1) and (2) with OLS. The rows TNCO and CIG04 show the coefficient δ identifying the rent of Big Tobacco in Switzerland in terms of export sales and market shares due to regulatory differences in tobacco laws between Switzerland and the EU (i.e., TNCO ceilings for cigarette exports). Columns (1)-(3) under Strategy A refer to model (1) and columns (4)-(6) under Strategy B to model (2). For Strategy A and B each, columns step-wise include controls, and country- and product-specific time trends. The panel Exports refers to the outcome variable of Swiss cigarette exports in million $ whereas the panel Market share refers to the outcome variable of Swiss cigarette market shares in per cent.

Based on Strategy A, I estimate a rent for Big Tobacco between $3.3 million and $6.6 million in terms of export sales. Including covariates and country-specific time trends affect both the size and statistical significance of the coefficient estimates. The estimated rent in terms of market share is about 4.2 percentage points. Whereas the results from

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Table 2: COMPARISON ACROSS GROUPS BEFORE 2004

	Same TNCO	Different TNCO	Difference
Outcomes			
Swiss cigarette exports (in million $)	3.84	0.95	2.89***
Swiss cigar exports (in million $)		0.04	
Difference in exports		-0.91***	
Swiss cigarette market share	0.02	0.02	0.00
Swiss cigar market share		0.01	
Difference in market shares		-0.01***	
Controls			
Market size and access			
GDP per capita (constant 2010 $)	19788	4370	15418***
Population (in millions)	26.8	55.8	-29*
FTA	0.78	0.09	-0.69***
Δ Nominal exchange rate (CHF/LCU)	-0.02	-0.04	0.02
Tobacco policy			
Total ad-valorem tax rate cigarettes	0.74	0.43	0.31***
Price most sold cigarette brand (int. $)	3.52	1.30	2.22***
Smoking behavior			
Smoking prevalence male (age-standardized rate)	0.39	0.41	-0.02
Smoking prevalence female (age-standardized rate)	0.28	0.13	0.15***

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. P-values are for a test of equality of means.

Sources: Gaulier and Zignago (2010), Head et al. (2010), WHO (2016), Wikipedia (2016), World Bank (2017)

Strategy B are a bit hazy, the results based on Strategy B are much clearer, both, in terms of size and statistical significance. They suggest that the rent in terms of exports is on average about $3.5 million per year, or in terms of market size around 4.5 percentage points. Both Strategy A and B yield very similar results suggesting an annual rent for Big Tobacco in Switzerland of approximately $3.5 million in additional foreign cigarette sales, or additional 4.5 percentage points in market shares for Switzerland. Nevertheless, due to Strategy A's shortcomings discussed in Section 2.3, in general, I consider Strategy B's results to be more reliable.

Table 3: OLS ESTIMATES FOR SWISS EXPORTS AND MARKET SHARE

	Strategy A			Strategy B		
	(1)	(2)	(3)	(4)	(5)	(6)
Exports						
TNCO	4.24*	6.64*	3.28			
	(2.36)	(3.97)	(2.45)			
CIG04				3.57**	3.57**	3.56**
				(1.70)	(1.70)	(1.73)
Market share						
TNCO	0.045**	0.030	0.042**			
	(0.020)	(0.025)	(0.018)			
CIG04				0.045***	0.045***	0.045***
				(0.016)	(0.016)	(0.016)
Controls		✓	✓		✓	✓
Country-specific time trends			✓			✓
Product-specific time trends						✓
Observations	1836	1836	1836	2924	2924	2924

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Notes: Clustered (on destination country) standard errors in parentheses. All models include time and country fixed-effects. Controls include market size and access (GDP p.c., population, dummy for free trade agreement, annual change in bilateral nominal exchange rate), tobacco policy (total ad-valorem tax on cigarettes, price of most sold cigarette brand), and smoking behavior (age standardized rate of smoking for adult males and females).
Sources: Gaulier and Zignago (2010), Head et al. (2010), WHO (2016), Wikipedia (2016), World Bank (2017)

Cigarette exports of Switzerland to countries with different TNCO ceilings than the 10-1-10 standard are on average about $3.5 million higher than they would be in the absence of regulatory differences between the EU and Switzerland. In the balanced

sample, there are 79 countries out of 108 countries with different TNCO ceilings than the 10-1-10 standard after 2004. This implies that Big Tobacco in Switzerland exports cigarettes worth about $280 million more due to regulatory differences every year, or $2.8 billion over 10 years. Figure 7 in Appendix A shows that this effect is driven by cigarette exports to countries in the Middle East and to Japan.

Switzerland has on average about a 4.5 percentage points higher market share in cigarette imports of countries that have different TNCO ceilings than the 10-1-10 standard after 2004 due to regulatory differences. Between 2004 and 2014, average cigarette imports of countries with different TNCO ceilings than the 10-1-10 standard in the balanced sample were approximately $3.25 billion. This means that total Swiss cigarette exports were on average about $150 million higher per year, or $1.5 billion in 10 years. Switzerland's market share in cigarette imports of countries with different TNCO ceilings than the 10-1-10 standard increases by about 5.5 percentage points from 2.5 per cent in 2003 to almost 8 per cent in 2014. The results in Table 3 suggest that 4.5 percentage points were due to regulatory differences. Whereas the EU's market share in countries with different TNCO ceilings than the 10-1-10 standard remains constant around 32 per cent, the rest of the world's (ROW) market share drops from about 66 percent to approximately 61 percent. This suggests that Switzerland gained on average market shares at the expense of the ROW.

7 Discussion

I start by discussing the issue of trade diversion. I argue that there is no trade from Switzerland diverted away from the EU to countries with no 10-1-10 standard, which suggests that the estimated rent is a net gain for Big Tobacco. I then go on an discuss the economic importance of the rent for Big Tobacco, Switzerland and the EU by looking at profit margins and value-added. Last, I show that while the loophole suggests substantial gains for Big Tobacco and the Swiss economy in general and some cantons in particular, Swiss tobacco farmers haven't been able to benefit from it.

7.1 Trade diversion?

Big Tobacco may earn a rent in Switzerland. However, if there is trade diversion between Switzerland and the EU, the overall net effect might be zero for Big Tobacco. In other words, what Big Tobacco gains in Switzerland they might loose in the EU.

Table 4 shows the results of estimating models (1) and (2) for the EU Member States. The results suggest that there is no trade diversion between Switzerland and the EU, and the estimated rent is a net gain for Big Tobacco. The coefficients identifying the

effect of regulatory differences in TNCO ceilings after 2004 are small and statistically not significant.

Table 4: OLS ESTIMATES FOR EU EXPORTS AND MARKET SHARE

	Strategy A		Strategy B	
	Exports	Market share	Exports	Market share
TNCO	-1.03	0.00		
	(0.83)	(0.00)		
CIG04			0.46	0.00
			(0.29)	(0.00)
Observations	47736	47736	75820	75820

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Clustered (on destination country) standard errors in parentheses. All models include time and country fixed-effects (for both origin and destination country), all controls (market size and access, tobacco policy, and smoking behavior) as well as country- and product specific time trends.

Sources: Gaulier and Zignago (2010), Head et al. (2010), WHO (2016), Wikipedia (2016), World Bank (2017)

7.2 Profits and value-added

The estimated rent for Big Tobacco in Switzerland due to regulatory differences in terms of annual export sales is between $150 million and $280 million. Considering that the average earnings margin of Big Tobacco (i.e., JTI, BAT, and PMI) is around 30 per cent, this implies excessive profits for Big Tobacco in Switzerland between $50 million and $80 million per year or between $0.5 billion and $0.8 billion in 10 years. If exports do not directly go to the final consumer, this estimate might be distorted by transfer pricing (i.e., tax optimization through profit shifting).

How much of the rent is value-added in Switzerland? Most of the principle components of a cigarette such as raw tobacco, cigarette paper, and filters are imported (Swiss Cigarette 2017, 20 Minuten 2009). I estimate value-added by subtracting the value of imported raw tobacco (HS6 2401.10, 2401.20, 2401.30), cigarette filter (HS6 5601.22) and cigarette paper (HS6 4813.10, 4813.20, 4813.90) from the value of exported cigarettes (HS6 2402.20). Between 2004 and 2014, average revenue from cigarette sales abroad were around $675 million, whereas the cost of imported intermediates (raw tobacco, filters, and paper) was, on average, about $150 million. Thus, about 80 per cent of the rent, or between $120 million and $220 million are value-added created in

Switzerland. Or, from the perspective of the EU, this is value-added not created in the EU.

7.3 Agricultural Sector: Tobacco production in Switzerland

The previous analysis gives the somewhat misleading impression that Switzerland is an important player in the global tobacco industry. While this may be true for cigarette and cigar production, Swiss tobacco cultivation plays a negligible role in the global raw tobacco market as well as in Swiss agriculture. Furthermore, Swiss tobacco plays a negligible role for cigarette producers, however, it is somewhat more important for cigar manufacturers.

Tobacco cultivation in Switzerland slowly began in the mid-17th century after tobacco consumption became first fashionable during the Thirty Years' War (Pick 2016). Until around 1750 various cantons banned tobacco consumption for fear of moral corruption and fire hazards. During the 18th and 19th century smoking tobacco became more and more popular until almost all cantons lifted their bans and tobacco cultivation in Switzerland became more widespread. However, Swiss tobacco cultivation has never been very competitive due to its moderate quality and relatively high production costs (Olivier Pauchard 2015). Thus, with the exceptions of World War I and II, when the cultivation area temporarily increased due to a lack of imports, the area used for tobacco cultivation and number of planters has steadily declined since the beginning of the 20th century.

Figure 6 suggest that the regulatory loophole for Big Tobacco in Switzerland had no impact on the decline of Swiss tobacco cultivation. The number of planters as well as cultivation area have declined pari passu with the overall number of Swiss farms and Swiss farm area.
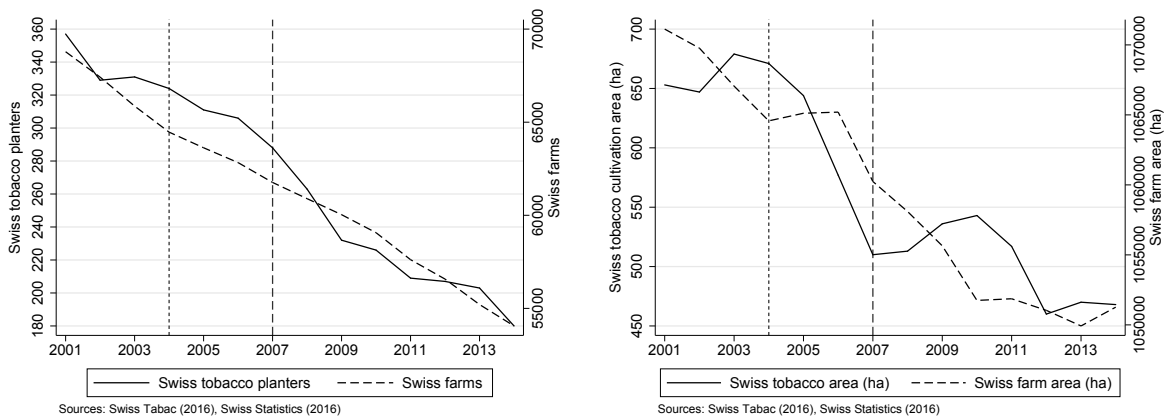
Figure 6: Number of Swiss tobacco planters and farms (left-hand panel), and Swiss tobacco cultivation area and total farm area (right-hand panel)

8   Conclusion

Loopholes are ubiquitous in many industrial sectors. However, estimating their economic effects is challenging. By looking at Big Tobacco, this paper illustrates how loopholes are exploited, and quantifies their economic effects. In particular, I look at differences in maximum yield limits for export cigarettes between the EU and Switzerland. Whereas the EU bans the production of cigarettes exceeding 10-1-10 mg per cigarette (i.e., 10 mg tar, 1 mg nicotine, and 10 mg carbon monoxide per cigarette) after 2004, Switzerland still permits the production of stronger cigarettes for the export market. I argue that this loophole creates a rent in the form of additional foreign sales for Big Tobacco between $150 million and $280 million per year. In other words, in the decade from 2004 to 2014, Big Tobacco's foreign sales were between $1.5 billion and $2.8 billion higher than they would have been without the loophole. Considering Big Tobacco's profit margins of around 30 per cent and a value-added of about 80 per cent in Switzerland, this loophole creates a substantial economic rent for Big Tobacco and Switzerland.

Whereas the private gains from exploiting the loophole can be measured relatively precisely, the social costs are more difficult to measure. A comprehensive welfare analysis is beyond the scope of this paper. Nevertheless, I try to assess the social costs. First, Switzerland's gains come at the expense of the EU. The additional profits earned by Big Tobacco in Switzerland due to the loophole are profits not earned in the EU. On the one hand, this implies a lower tax revenues in the EU and therefore, more pressure on public spending in some regions. On the other hand, this could also explain the intensified competition among EU Member States for Big Tobacco's production facilities. Second, the loophole created by Switzerland undermines the EU's health policy. The consequences for people's health in countries with no or laxer maximum yield limits than the 10-1-10 standard are even harder to capture since the effects of maximum yield limits on health are controversial.

This analysis further illustrates that in the competition of countries in a globalized economy for jobs and tax revenue loopholes can play a major role. While a skilled workforce (e.g., education policy) and institutions (e.g., rule of law, political stability) may be necessary conditions for attracting multinational firms, I show that they are by no means sufficient. Facing footloose multinational firms, a country's strictly dominant strategy might well be to create loopholes by deviating from other countries regulations. Policy recommendations obviously depend on whether one takes a country-level or global point of view.

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A   Appendix: Data

A.1   Country list

Table 5 shows all 108 countries in the balanced sample excluding Switzerland. Except for EU Member States (as of 2014, 25 countries), Albania, Brazil, Island, Norway, and Switzerland all countries have either no TNCO ceilings (i.e., 62 countries) or they exceed the 10-1-10 standard (i.e., 17 countries).

Table 5: COUNTRY LIST

Country	ISO3	T	N	CO	Country	ISO3	T	N	CO
Albania	ALB	10	1	10	Kyrgyz Republic	KGZ			
Argentina	ARG				Cambodia	KHM			
Armenia	ARM	14	1.2		Kiribati	KIR			
Australia	AUS				Korea, Rep.	KOR			
Austria	AUT	10	1	10	Lao PDR	LAO			
Azerbaijan	AZE				Lebanon	LBN			
Belgium	BEL	10	1	10	Liberia	LBR			
Benin	BEN				Sri Lanka	LKA			
Burkina Faso	BFA				Lithuania	LTU	10	1	10
Bangladesh	BGD				Latvia	LVA	10	1	10
Bulgaria	BGR	10	1	10	Morocco	MAR			
Bahrain	BHR	10	0.6	12	Moldova	MDA	15	1.2	
Bosnia and Herzegovina	BIH				Mexico	MEX			
Belarus	BLR				Mali	MLI			
Bolivia	BOL				Malta	MLT	10	1	10
Brazil	BRA	10	1	10	Mongolia	MNG			
Barbados	BRB				Mozambique	MOZ			
Brunei Darussalam	BRN	15	1.3		Mauritius	MUS			
Canada	CAN				Malawi	MWI			
Chile	CHL				Malaysia	MYS	20	1.5	
China	CHN	15			Niger	NER			
Cameroon	CMR				Nigeria	NGA			
Congo, Rep.	COG				Netherlands	NLD	10	1	10
Colombia	COL				Norway	NOR	10	1	10
Comoros	COM				Nepal	NPL			
Cabo Verde	CPV				Oman	OMN	10	0.6	12
Costa Rica	CRI				Pakistan	PAK			

Table 5 – continued from previous page

Country	ISO3	T	N	CO	Country	ISO3	T	N	CO
Czech Republic	CZE	10	1	10	Panama	PAN			
Germany	DEU	10	1	10	Philippines	PHL			
Denmark	DNK	10	1	10	Poland	POL	10	1	10
Dominican Republic	DOM				Portugal	PRT	10	1	10
Egypt, Arab Rep.	EGY	15	2		Paraguay	PRY			
Spain	ESP	10	1	10	Romania	ROM	10	1	10
Estonia	EST	10	1	10	Russian Federation	RUS			
Finland	FIN	10	1	10	Saudi Arabia	SAU	10	0.6	12
Fiji	FJI				Senegal	SEN			
France	FRA	10	1	10	Singapore	SGP			
United Kingdom	GBR	10	1	10	Sierra Leone	SLE			
Georgia	GEO	10	1		Slovak Republic	SVK	10	1	10
Greece	GRC	10	1	10	Slovenia	SVN	10	1	10
Honduras	HND	14	1.1		Sweden	SWE	10	1	10
Croatia	HRV				Seychelles	SYC			
Hungary	HUN	10	1	10	Thailand	THA			
Indonesia	IDN				Tonga	TON			
India	IND				Turkey	TUR	12	1	10
Ireland	IRL	10	1	10	Tanzania	TZA			
Iceland	ISL	10	1	10	Uganda	UGA			
Israel	ISR				Ukraine	UKR	12	1.2	
Italy	ITA	10	1	10	Uruguay	URY			
Jamaica	JAM				United States	USA			
Jordan	JOR	10	1	15	Vietnam	VNM	24	2.2	
Japan	JPN				Samoa	WSM			
Kazakhstan	KAZ	14	1.2		South Africa	ZAF	12	1.2	
Kenya	KEN				Zambia	ZMB			

Note: All countries in (balanced) sample. Belgium includes Luxembourg. T, N, and CO show upper limits on tar (T), nicotine (N) and carbon monoxide (CO) in place after 2004 (median values). The following countries in the sample have TNCO ceilings but the year of introduction is unknown: Belarus (14-1.2-none), Croatia (12-none-none), Mongolia (15-1.4-none), and Korea, Rep. (8-0.7-none). Since all these countries have in either T, N, or CO higher or no ceilings than the 10-1-10 standard after 2004, they are classified as if they had no TNCO standards during the whole observation period.

Sources: Gaulier and Zignago (2010), Wikipedia (2016)

A.2 Summary statistics

Table 6 shows summary statistics for 108 countries in the (balanced) sample during the observation period 1998 until 2014.

Table 6: SUMMARY STATISTICS 1998-2014

|	min	mean	max	sd
TNCO regulation	0.00	0.75	1.00	0.43
Outcomes				
Swiss cigarette exports (in million $)	0.00	3.52	222.89	16.19
Swiss cigar exports (in million $)	0.00	0.06	1.12	0.15
Swiss cigarette market share	0.00	0.05	0.82	0.12
Swiss cigar market share	0.00	0.06	0.38	0.08
Controls				
Market size and access				
GDP per capita (current $)	131	11797	100819	15779
Population (in millions)	0.08	52.79	1364.27	169.26
FTA	0.00	0.32	1.00	0.47
Δ Nominal exchange rate (CHF/LCU)	-4.00	-0.02	0.50	0.13
Tobacco policy				
Total ad-valorem tax rate cigarettes	0.01	0.52	0.99	0.23
Price most sold cigarette brand (int. $)	0.04	2.45	15.90	2.39
Smoking behavior				
Smoking prevalence male (age-standardized rate)	0.07	0.38	0.83	0.14
Smoking prevalence female (age-standardized rate)	0.00	0.14	0.52	0.12

Note: Summary statistics based on 1,836 observations (= 17 years × 108 countries). TNCO regulation is an indicator variable taking the value 1 if a country's TNCO regulation is different from the 10-1-10 standard after 2004. Free Trade Agreement (FTA) is an indicator variable taking the value 1 if Switzerland has a FTA with a trading partner. Total (ad-valorem) tax rate includes excise taxes, import duties, VAT and other taxes as applicable. Data provided by WHO (2016) on tax rates and cigarette prices are available for the years 2008, 2010, and 2012, and data on smoking prevalence are available for the years 2000, 2005, 2010 and 2012. Missing years have been imputed using generalized linear models (GLM) with a logit link function and Binomial distribution for tax rates and age-standardized smoking rates (avoiding predictions outside the zero-one interval), and a log link function and Poisson distribution for cigarette prices (avoiding predictions of negative or zero prices).
Sources: Gaulier and Zignago (2010), Head et al. (2010), WHO (2016), Wikipedia (2016), World Bank (2017)

A.3 Export structure

Figure 7 shows the change in mean cigarette exports after 2004 to countries without a 10-1-10 standard. The effect is driven by changes at the intensive and not the extensive margin of trade. Only with a few countries emerge small trade flows after 2004 (right

panel). The rent is driven mostly by changes in exports to countries in the Middle East like Saudi Arabia, Israel, Lebanon or Bahrain, and countries in Asia like Japan and Russia (left panel).
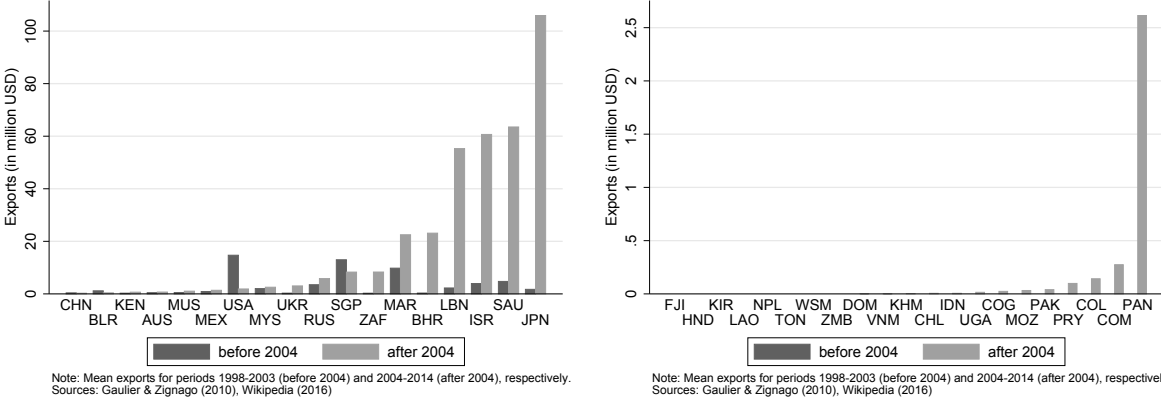
Figure 7: Change in Swiss cigarette exports to countries with no 10-1-10 standard at the intensive margin (left panel) and the extensive margin (right panel)