Promoting convergence and closing gaps: a blueprint for the revision of the European Union Tobacco Tax Directive

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ABSTRACT

Background and aims Despite the European Union (EU) Tobacco Tax Directive (TTD), a lack of convergence in EU tobacco prices promotes high levels of cross-border shopping and down-trading from factory-made (FM) to roll-your-own tobacco (RYO) cigarettes. This study presents a blueprint for reform, whereby minimum taxes are related to the overall price level in the EU and where taxation of RYO is related to that of FM.

Methods Longitudinal data on prices and taxes on FM and RYO in 25 member states over 2011–2019 are used to estimate econometric models for their weighted average prices as a function of taxes. Two scenarios are simulated with the models' estimates: a baseline scenario for the actual tax stance pertaining to 2020 and a reform scenario implementing the blueprint.

Results The baseline results show that, while the prices of both products have experienced a slight increase since 2016 in real terms, the dispersion in the prices of FM across countries has increased and the difference in the prices of RYO within countries has widened. The results for the reform scenario show dispersion would diminish both EU-wide and in hotspots for cross-border sales of FM. The reform would also lead to a substantial reduction in the price gap between FM and RYO.

Conclusion To promote price convergence and close the price gap between FM and RYO, the revised TTD should ensure minimum FM taxes track a measure of their average EU price, and RYO taxes are related to FM taxes.

INTRODUCTION

Previous research has highlighted shortcomings in the structure of tobacco excise duties in the European Union (EU) from the point of view of public health. Two features stand out as symptoms of such limitations as far as the prices of the main combustible products, factory-made (FM) cigarettes and roll-your-own tobacco (RYO), are concerned: a wide variation in prices for the same product across member states; and a substantial price gap between different products within member states.[1–5] For example, in 2019, a packet of 20 FM cigarettes cost €8.56 on average in France but just €4.54 in Spain, while in Finland, the price gap between the average packet of 20 FM cigarettes and the average price of enough RYO to make 20 cigarettes was €4.42.[6]

These shortcomings are acknowledged by the European Commission in its recent evaluation[7] of the functioning of Council Directive 2011/64/EU, known as the Tobacco Tax Directive (TTD).[8] In particular, the Commission identified the lack of convergence in prices creates an incentive for undesired high levels of cross border shopping, and that taxes induce substitution of FM for RYO. The European Council, on the examination of the evidence presented by the evaluation, has reached similar conclusions and has prompted the Commission to propose legislative reform to address these issues, noting that 'action at EU level is required in order that minimum excise duty rates regain traction in terms of making an effective contribution to reducing consumption of tobacco products'.[9]

What sort of 'action at the EU level' might be incorporated within a revised TTD in order to deliver on these desiderata? As the Council suggests, an important lever is the set mandatory minimum excise tax (MET) that tobacco products must bear. The current directive's MET for FM is 60% of the weighted average price (WAP) prevailing in the domestic market, but in no case less than €90 per 1000 cigarettes (article 10.2 in the TTD). The MET on fine cut tobacco intended for RYO cigarettes is 48% of the WAP, or, alternatively, €60 per kilogram (article 14.3). Beyond these minimum levels, member states have freedom to set domestic rates and there is no mechanism preventing wide disparities in the resulting tax burdens either for the same product across (often bordering) countries or for close substitutes such as FM and RYO within the same country. In these circumstances, two provisions appear as potential solutions.[2] First, the revised TTD should anchor the MET on cigarettes to a representative measure of prices across the whole EU, so that tax policies enacted in one member state have a knock-on effect on the rest of member states and, as a result, no member state would be able to act as a tax laggard by simply pegging its domestic rates just above the fixed minima required currently. Second, the MET for RYO should be linked to that borne by FM.

With a view to contributing with empirical evidence to the reform of the TTD, and tax policies beyond the EU, this study simulates the application of these two provisions. It does so by estimating their effects on the levels of prices in individual member states as well as on the distribution of prices in the EU at large and the particular impact on four 'hotspots' for cross-border shopping of FM (centred around Finland, Poland, Greece and France).[10]

METHODS

Data

The analysis is based on econometric models for the WAP of FM and RYO as a function of taxes for a panel of 25 countries. These are the 28 States that

belonged to the European Union on 1 January 2020 minus, due to missing data on RYO prices, Malta, Cyprus and Luxembourg. While the UK formally exited the EU on 31 January 2020, its close ongoing relationship with the EU, and the special arrangements for Northern Ireland in the Brexit withdrawal agreement mean that this part of the UK sharing a land border with the Republic of Ireland will continue to be subject to the TTD.[11] For these reasons, tobacco tax policies in the EU will continue to have important spillover effects in the UK, and vice versa, for the foreseeable future. On a more technical note, its inclusion contributes to maximising the degree of price and tax variation on which the identification of price responses to tax changes hinges.

Yearly data on the WAP of a pack of 20 cigarettes in these countries were obtained from the European Commission's Communication and Information Resource Centre for Administrations, Businesses and Citizens (CIRCABC) database[12] for the period 2011–2019, while data for the yearly WAP of 20 RYO sticks were obtained from the Euromonitor Passport Database[13] for the period 2011–2018. This assumed 0.7 g of tobacco per RYO cigarette, which is broadly in line with the median weight found in a study of 18 European countries.[14] Data on both products' WAP for years 2011 through to 2013 are missing for Croatia due to its late accession to the EU.

Finally, data on tax rates applied to FM and RYO in these countries for the period 2011–2020 were obtained from the CIRCABC database. All monetary figures are expressed in inflation adjusted € of 2020 by means of the Harmonised Consumer Price Index provided by Eurostat.[15]

Econometric models

Previous research has shown that the variation in the WAP of FM and RYO can be statistically explained by underlying variation in the minimum tax revenue on a per-quantity basis that results from the combination of specific taxes, ad valorem taxes and METs (either those set by the TTD or domestically) applied to tobacco products in each EU member state.[2] Consequently, the econometric models are specified as follows:

$$\mathrm{WAP}^{\mathrm{FM}}{}_{it} = \alpha^{\mathrm{FM}} + \beta^{\mathrm{FM}}\,\mathrm{M}^{\mathrm{FM}}{}_{it} + \gamma^{\mathrm{FM}}{}_{i} + \varepsilon^{\mathrm{FM}}{}_{it},$$

$$\mathrm{WAP}^{\mathrm{RYO}}{}_{it} = \alpha^{\mathrm{RYO}} + \beta^{\mathrm{RYO}}\,\mathrm{M}^{\mathrm{RYO}}{}_{it} + \gamma^{\mathrm{RYO}}{}_{i} + \varepsilon^{\mathrm{RYO}}{}_{it},$$

where the superscripts FM and RYO stand for FM and RYO, respectively, the subscript i refers to the ith member state in our sample of 25 and the time subscript t runs from 2011 to 2019 (2018) in the case of FM (RYO tobacco).

The effect of tax policies on WAPs is subsumed in the second term of the right-hand side of the equations. The explanatory variable M is a measure of the minimum tax applied in country i and year t resulting from the corresponding tax rules and is formally defined as follows:

For FM, $\mathrm{M}^{\mathrm{FM}}{}_{it}$ is the maximum of the following three values:

1. The combined effect of the domestic rates for the specific tax and the domestic ad valorem tax applied to FM in country i and year t.
2. The domestic MET applied to FM in country i and year t, if applicable.
3. The EU TTD MET applied to FM as per the values, periods and exemptions specified article 10 of the TTD.

And for RYO, $\mathrm{M}^{\mathrm{RYO}}{}_{it}$ is the maximum of:

i. The combined effect of the domestic rates for the specific tax per unit of product and the domestic ad valorem tax applied to RYO tobacco in country i and year t.
ii. The domestic MET per unit of product in country i and year t, if applied.
iii. The EU TTD MET applied to RYO as per the values, periods and exemptions specified in article 14 of the TTD.

The γ terms are country binary indicators that capture unobserved fixed effects, and the ε terms are random disturbances.

Baseline and reform scenarios

The model estimates are used to predict the values of the WAP of the two products in both a baseline and a reform scenario. While the baseline scenario uses the tax stance prevailing at the time of writing this article (autumn 2020), the reform scenario adds a fourth possible rule for identifying the minimum level of tax that must be applied to each product in each individual country.

For FM, this new rule specifies that the minimum tax rate should be at least equal to a fraction of the EU-wide WAP ($\mathrm{EUWAP}^{\mathrm{FM}}$) realised 1 year earlier (since the $\mathrm{EUWAP}^{\mathrm{FM}}$ for the current year would not yet be known). For the purposes of this illustration, the fraction is (arbitrarily) set at 60% of such weighted average. For RYO, the reform scenario adds the fourth rule that the rate of taxation should be completely equalised with that of cigarettes within the given country (assuming each RYO stick uses 0.7 g of tobacco). As with FM, this is an illustrative choice on our part, based on the broadly equal harms[5] caused by the two products, and such equalisation could be at a lower level (eg, 80%).

In formal terms, the baseline scenario is characterised by the values of $\mathrm{M}^{\mathrm{FM}}{}_{i2020}$ and $\mathrm{M}^{\mathrm{RYO}}{}_{i2020}$, resulting from the tax rates currently in place[6] and decision-making rules 1–3 for FM, and i-iii for RYO, as outlined above.

In the reform scenario (denoted with the '' superscript), these values are replaced by $\mathrm{M}^{\mathrm{FM}'}{}_{i2020}$ and $\mathrm{M}^{\mathrm{RYO}'}{}_{i2020}$, which are defined as the maximum of:

For FM, the maximum of rules 1–3 and new rule 4,

4. $\mathrm{M}^{\mathrm{FM}'}{}_{i2020} = 0.6 \times \mathrm{EUWAP}^{\mathrm{FM}}{}_{2019}$.

For RYO tobacco, the maximum of rules i–iii and new rule iv

iv. $\mathrm{M}^{\mathrm{RYO}}{}_{i2020} = \mathrm{M}^{\mathrm{FM}}{}_{i2020}/\mathrm{g}$,

where g is the assumed weight per stick of RYO (0.7 g herein).

That is, if the baseline minimum tax for RYO (as determined by rules i–iii) does not equal that for FM within a given country, a new MET for RYO would be introduced. Thus, tax changes in the FM market would automatically impact the taxation of the RYO market by design, thereby helping to minimise price differentials. Furthermore, since the taxation of FM is related to the EUWAP, and the taxation of RYO is related to that of FM, rates of RYO taxation in each country will also be linked to the convergence mechanism.

STATISTICAL ANALYSIS

The models' parameters are estimated by ordinary least squares (OLS) on a sample constituted by the pooled data. Since the explanatory variables include country dummies, OLS are in this case equivalent to the fixed effects estimator for panel data. The predictions of WAPs in the baseline and the reform scenarios are conditional on such country fixed effects.

CIs are computed from 400 bootstrapped draws of the models' parameter estimates, yielding 400 sets of bootstrapped results. These draws are obtained by sampling from a multivariate normal using the Cholesky decomposition of the variance–covariance matrix of the models' parameter estimates.[16] CIs are reported between square brackets after the corresponding point estimate.

Table 1 Baseline scenario

	Minimum excise tax FM cigarettes	Minimum excise tax RYO tobacco	WAP FM cigarettes	95% CI	WAP RYO tobacco	95% CI	Price gap	95% CI
AT	151.8	120.0	4.97	4.90 to 5.04	2.75	2.51 to 2.97	2.23	2.01 to 2.45
BE	191.7	104.6	6.28	6.17 to 6.37	2.01	1.76 to 2.25	4.27	4.06 to 4.50
BG	90.5	77.7	2.65	2.64 to 2.65	1.64	1.61 to 1.66	1.01	0.696 to 1.30
CZ	112.7	95.6	3.53	3.48 to 3.57	2.03	1.90 to 2.15	1.50	1.29 to 1.71
DE	163.6	71.0	5.89	5.82 to 5.96	2.00	1.95 to 2.04	3.89	3.70 to 4.08
DK	235.1	181.0	7.10	6.79 to 7.41	3.63	3.19 to 4.06	3.47	3.16 to 3.74
EE	138.7	89.6	4.07	3.91 to 4.21	0.91	0.789 to 1.02	3.16	2.93 to 3.38
EL	117.5	170.0	3.79	3.76 to 3.81	3.53	3.41 to 3.65	0.26	0.064 to 0.463
ES	131.5	98.8	4.46	4.45 to 4.46	2.37	2.33 to 2.40	2.09	1.88 to 2.27
FI	292.3	180.5	7.88	7.47 to 8.28	3.03	2.61 to 3.43	4.85	4.51 to 5.18
FR	314.0	281.0	9.08	8.69 to 9.45	5.41	4.63 to 6.17	3.67	3.33 to 4.01
HR	111.2	107.9	3.62	3.55 to 3.68	2.26	2.09 to 2.42	1.36	1.03 to 1.65
HU	103.0	61.8	3.69	3.64 to 3.72	1.43	1.36 to 1.50	2.26	2.06 to 2.45
IE	395.1	379.8	11.88	11.4 to 12.2	8.03	7.43 to 8.62	3.85	3.49 to 4.20
IT	141.3	130.0	4.81	4.80 to 4.82	2.60	2.50 to 2.70	2.21	2.01 to 2.41
LT	108.5	78.5	3.41	3.31 to 3.51	1.61	1.47 to 1.74	1.80	1.59 to 2.00
LV	114.7	75.0	3.58	3.49 to 3.66	2.32	2.22 to 2.40	1.26	1.05 to 1.46
NL	238.3	156.0	7.12	6.90 to 7.32	3.40	3.01 to 3.77	3.72	3.47 to 4.01
PL	103.9	49.0	3.24	3.20 to 3.28	1.43	1.42 to 1.44	1.81	1.58 to 2.00
PT	136.8	175.0	4.43	4.42 to 4.43	3.68	3.36 to 3.99	0.75	0.529 to 0.964
RO	109.0	98.1	3.73	3.70 to 3.75	3.15	3.13 to 3.16	0.58	0.274 to 0.891
SE	149.6	181.1	5.59	5.50 to 5.66	4.83	4.67 to 4.97	0.76	0.532 to 0.976
SI	114.0	94.0	3.67	3.62 to 3.71	2.46	2.32 to 2.58	1.21	1.00 to 1.41
SK	100.1	76.7	3.25	3.23 to 3.25	2.54	2.53 to 2.53	0.71	0.522 to 0.938
UK	330.4	248.6	10.19	10.0 to 10.3	6.47	6.35 to 6.57	3.73	3.48 to 3.95
Mean	167.8	135.3	5.28	5.18 to 5.36	3.02	2.95 to 3.08	2.26	2.15 to 2.34
SD	89.2	81.1	2.39	2.31 to 2.47	1.66	1.61 to 1.70	1.35	1.27 to 1.44
CV	0.5	0.6	0.45	0.44 to 0.46	0.55	0.53 to 0.56	0.60	0.57 to 0.63
Median	131.5	107.9	4.43	4.20 to 4.54	2.54	2.43 to 2.64	2.09	1.90 to 2.20
IQR			2.66	2.43 to 2.89	1.52	1.36 to 1.66	2.46	2.15 to 2.68
IQR to median			0.60	0.55 to 0.66	0.60	0.52 to 0.65	1.17	1.02 to 1.32

Minimum excise tax FM cigarettes is expressed in € per 1000 FM cigarettes.
Minimum excise tax RYO tobacco is expressed in € per 1000 g of fine cut tobacco.
WAP FM cigarettes is expressed in € per 20 FM cigarettes.
WAP RYO tobacco is expressed in € per 20 sticks equivalent of fine cut tobacco (ie, 14 g).
AT (Austria), BE (Belgium), BG (Bulgaria), CZ (Czech Republic), DE (Germany), DK (Denmark), EE (Estonia), EL (Greece), ES (Spain), FI (Finland), FR (France), HR (Croatia), HU (Hungary), IE (Ireland), IT (Italy), LT (Lithuania), LV (Latvia), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), UK (United Kingdom)
CV, coefficient of variation; FM, factory-made; RYO, roll-your-own tobacco; WAP, weighted average price.

Data processing and statistical analyses have been carried out in Stata V.15.1 special edition.

RESULTS

The econometric models explain a large share of the variation in the WAP of the two products. In the case of FM (RYO), the R-squared statistic is 97.8% (98%). Likewise, the country effects are jointly significant in the models for both products. As for the effect of taxes, the coefficient for M^{FM} shows that for every €1 increase in the minimum tax applied on 20 cigarettes, their WAP is expected to rise by €1 [0.8, 1.125], which implies that increases in minimum tax rates are typically passed on entirely (ie, fully shifted) to retail prices. The coefficient for M^{RYO} shows that, for every €1 increase in the minimum tax applied on the amount of RYO necessary to roll 20 sticks (14 g), their WAP is expected to increase by €0.86 [0.42, 1.28]. This implies that increases of the minimum taxes on RYO are typically under-shifted to retail prices.

The first two columns of table 1 present the values of M^{FM}_{i2020} and M^{RYO}_{i2020} for the countries included in the study, and the rest of columns present the predictions for WAP^{FM} and WAP^{RYO} in the baseline scenario, along with their difference. The bottom rows of the table contain summary measures for the distributions of those outcomes: mean, SD, coefficient of variation (CV), median, IQR and the ratio of the IQR to the median (IQR to median).

Focusing first on cigarettes, the baseline tax rates are expected to produce a distribution of WAPs for year 2020 with a mean of €5.28 [5.18, 5.36], a median of €4.43 [4.20, 4.54] and an IQR of €2.66 [2.43, 2.89]. It is useful to compare these figures with their inflation-adjusted observed counterparts for year 2016, the first year for which data are available for all countries included in the analysis. In this regard, we note a slight increase in the mean WAP (€4.82 in 2016), no change in the median (€4.44 in 2016) and an increase in the IQR (€2.32 in 2016).

As for RYO, the expected distribution of WAPs given the baseline tax rates has a mean of €3.02 per 20 sticks [2.95, 3.08], a median of €2.54 [2.43, 2.64] and an IQR of €1.52 [1.36, 1.66]. These figures imply a slight increase in the average WAP with respect to its counterpart 5 years ago (€2.75 in 2016), but no change in either the median price (€2.46 in 2016) or the IQR (€1.37 in 2016).

The average price gap (on a 20 sticks basis) between the two products that we may expect given the tax rates in the baseline scenario is €2.26 [2.15, 2.34], which is greater than that observed in 2016 (€2.06).

Table 2 presents the values for $M^{FM'}_{i2020}$ and $M^{RYO'}_{i2020}$ in its two leftmost columns. The proposed tax reform would imply increases in the minimum tax rates for FM in all but eight of the countries included in the analysis (Belgium, Germany, Denmark, Finland, France, Ireland, Netherlands and the UK) and increases in the minimum tax rate on RYO in all countries. The average (across the sample of countries) minimum tax on cigarettes would increase from the baseline value of €167.8 to €195.5 per 1000 sticks. That of RYO from €135.3 to €279 per 1000 g.

Given the new tax rates, FM cigarettes WAPs would increase by €0.58 [0.50, 0.66] on average, while the WAPs of RYO would increase by €1.74 [1.50, 1.99] on average.

Concerning general price convergence, note that the IQR in the distribution of FM cigarettes WAPs in the reform scenario decreases to €1.75 [1.45, 1.95], which is significantly smaller than its counterpart in the baseline scenario. The distribution of WAPs for RYO in the reform scenario has an IQR of €1.68 [1.36, 1.84]. This point estimate is larger than its counterpart in the baseline scenario, although the CI for the estimates overlap, so we cannot rule out the hypothesis of no change in the spread of the distribution according to this statistic. However, given the overall increase in the WAPs of RYO tobacco, the CV and the IQR to mean ratio are more pertinent gauges of the effect of the reform on price convergence than the SD, and these two metrics are significantly smaller than in the baseline scenario.

As for convergence within the four subsets of countries identified as hotspots of cross-border shopping of FM cigarettes,[10] the reform scenario is expected to ameliorate price differentials. Finland, Estonia and Latvia form the first of these hotspots. In the baseline scenario, both Estonia (€4.07 [3.91, 4.21]) and Latvia (€3.58 [3.49, 3.66]) undercut Finland €7.88 [7.47, 8.28]. In the reform scenario, the WAP in Estonia and Latvia would be expected to rise to €4.52 [4.28, 4.75] and € 4.53 [4.26, 2.79], respectively. In the second hotspot, the cheapest country is Poland €3.24 [3.20, 3.28], undercutting Denmark (€7.10 [6.79, 7.41]), Germany (€5.89 [5.82, 5.96]) and Sweden (€5.59 [5.50, 5.66]). The reform would push the WAP in Poland to €4.42 [4.15, 4.68]. In the third hotspot, Bulgaria (€2.65 [2.64, 2.65]) undercuts Greece (€3.79 [3.76, 3.81]), and the reform is expected to rise the WAP in the two countries to €4.10 [3.82, 4.37] and €4.68 [4.48, 4.88], respectively. The fourth hotspot has France €9.08 [8.69, 9.45] as its pivotal country, which is undercut by Spain €4.46 [4.45, 4.46]. The reform is expected to push the WAP in Spain to €5.06 [4.93, 5.18]. In all cases, the differential between countries would be reduced.

Turning now to the second shortcoming, the average price gap between FM and RYO, which in the baseline scenario is €2.26 [2.15, 2.34] per 20 sticks, would be reduced to €1.09 [0.78, 1.41]. The greatest change in the gap would be attained in Finland (−€2.86 [−3.2 to –2.4]), with reductions in the size of the gap estimated for all countries but one, Greece, where we estimate a slight increase (€0.18 [0.061, 2.95]). This occurs because in the baseline scenario Greek taxes on RYO are marginally above our proposed equivalisation with FM. As both FM and RYO prices increase in the reform scenario, the minimum rules remove this previous difference, creating a marginal increase in the absolute gap, which nonetheless represents a much smaller fraction of the price of either product than in the baseline scenario.

DISCUSSION

The results for the baseline situation reflecting the current tax stance suggest that, while the prices of both FM and RYO have experienced a slight increase over 2016–2020, FM price dispersion across countries has increased and, at the same time, their difference with respect to the price of RYO within countries has widened. These long-standing problems do indeed require 'action at the EU level', as the European Council recognises.

The results for the reform scenario suggest that FM price dispersion would diminish when measured over the EU at large and, most importantly, in the subsets of countries that have been identified as hotspots for cross-border sales. As Stoklosa has pointed out,[3] reducing price differentials between countries, by means of price increases in the cheaper country as the proposed reform would do, has a double impact on tobacco sales: the reduction originated by higher prices in the exporting country plus the reduction originated by the reduced availability of cheap FM across the border in the importing country.

As for the differential between FM and RYO within countries, the results for the reform scenario suggest a substantial bridging of the price gap, which would be halved on average. This could have significant impact on the trend of FM cigarette smokers down-trading to RYO tobacco instead of quitting.

This study does not address the effect of the reform on the levels of illicit trade and cross-border purchases with neighbouring non-EU nations, factors that might impinge on the policy response. Nor does it estimate effects on price differentials within product and within country, which are important concerns for the design of tobacco tax reforms.[17] Nonetheless, it is worthwhile to consider that aiming for price rises via increases in minimum quantity taxes, as the proposed reform would do, reduces the dispersion of product prices at the domestic level.[18] Moreover, as Hiscock *et al* argue,[19] when coupled with standardised packaging, rises in this type of taxes are passed on to retail prices faster, so the increasing adoption in EU member states of the latter non-price control measure[20] can be expected to enhance the effects of the reform in this regard.

Another limitation of this study is that the 60% figure used for the definition of the reform affecting cigarettes is somewhat arbitrary, as is the choice to fully equivalise taxation between FM and RYO. However, rather than producing results for several other values and carry out a sensitivity analysis, it should be noted that the purpose of the analysis is to illustrate the functioning of a reform designed to deliver on the desiderata discussed at the start. The actual value of such fractions, along with the rhythms/speed of implementation and potentially applicable transition periods, are valuable degrees of freedom in the political negotiations needed to advance in the process of tax convergence. Furthermore, some evaluation/adjustment of such rules might be required over time considering potential market responses. The assumption of 0.7 g of tobacco per stick could also be considered somewhat arbitrary. Studies indicate there is considerable variation in how RYO is used to make cigarettes in Europe, so this figure might not be an appropriate equivalent for all the countries included.[5 14] It should be remembered, however, that the intention is to set MET rates, so countries where smokers use less than 0.7 g in RYO cigarettes (and hence can make more cigarettes

Table 2 Reform scenario

	Minimum excise tax FM cigarettes	Minimum excise tax RYO tobacco	WAP FM cigarettes	95% CI	WAP RYO tobacco	95% CI	Price gap	95% CI	Change WAP FM cigarettes	95% CI	Change WAP RYO tobacco	95% CI	Change in price gap	95% CI
AT	160.4	229.1	5.15	5.04 to 5.25	4.06	3.21 to 4.91	1.09	0.761 to 1.41	0.18	0.156 to 0.198	1.32	1.14 to 1.49	−1.14	−1.3 to −0.96
BE	191.7	273.8	6.28	6.17 to 6.37	4.05	2.83 to 5.26	2.22	1.82 to 2.61			2.04	1.77 to 2.31	−2.04	−2.3 to −1.7
BG	160.4	229.1	4.10	3.82 to 4.37	3.47	2.63 to 4.30	0.63	0.234 to 1.03	1.45	1.27 to 1.62	1.83	1.58 to 2.07	−0.37	−0.61 to −0.11
CZ	160.4	229.1	4.52	4.28 to 4.76	3.64	2.75 to 4.52	0.88	0.566 to 1.24	0.99	0.870 to 1.10	1.61	1.39 to 1.82	−0.62	−0.82 to −0.40
DE	163.6	233.7	5.89	5.82 to 5.96	3.97	2.99 to 4.93	1.93	1.60 to 2.24			1.96	1.70 to 2.22	−1.96	(−2.2 to −1.7
DK	235.1	335.9	7.10	6.79 to 7.41	5.50	4.17 to 6.82	1.60	1.15 to 2.02			1.87	1.62 to 2.11	−1.87	−2.1 to −1.6
EE	160.4	229.1	4.52	4.28 to 4.75	2.59	1.67 to 3.50	1.93	1.59 to 2.27	0.45	0.396 to 0.504	1.68	1.46 to 1.90	−1.23	−1.4 to −0.99
EL	160.4	229.1	4.68	4.48 to 4.88	4.25	3.78 to 4.70	0.44	0.194 to 0.702	0.89	0.782 to 0.996	0.71	0.619 to 0.808	0.18	0.061 to 0.295
ES	160.4	229.1	5.06	4.93 to 5.18	3.94	3.16 to 4.71	1.12	0.855 to 1.39	0.60	0.526 to 0.670	1.57	1.36 to 1.78	−0.97	−1.1 to −0.75
FI	292.3	417.5	7.88	7.47 to 8.28	5.89	4.13 to 7.64	1.99	1.45 to 2.55			2.86	2.48 to 3.24	−2.86	−3.2 to −2.4
FR	314.0	448.6	9.08	8.69 to 9.45	7.43	5.70 to 9.15	1.65	1.13 to 2.14			2.02	1.75 to 2.29	−2.02	−2.2 to −1.7
HR	160.4	229.1	4.64	4.38 to 4.90	3.72	2.86 to 4.57	0.92	0.531 to 1.32	1.02	0.897 to 1.14	1.46	1.26 to 1.65	−0.44	−0.63 to −0.24
HU	160.4	229.1	4.88	4.61 to 5.14	3.45	2.43 to 4.47	1.43	1.07 to 1.79	1.19	1.04 to 1.33	2.02	1.75 to 2.28	−0.83	−1.0 to −0.55
IE	395.1	564.4	11.88	11.4 to 12.2	10.26	8.60 to 11.9	1.62	1.08 to 2.10			2.23	1.93 to 2.52	−2.23	−2.5 to −1.9
IT	160.4	229.1	5.21	5.12 to 5.29	3.80	3.13 to 4.46	1.41	1.15 to 1.68	0.40	0.347 to 0.442	1.20	1.03 to 1.35	−0.80	−0.94 to −0.63
LT	160.4	229.1	4.49	4.18 to 4.80	3.43	2.43 to 4.42	1.06	0.670 to 1.39	1.08	0.946 to 1.20	1.82	1.57 to 2.06	−0.74	−0.97 to −0.49
LV	160.4	229.1	4.53	4.26 to 4.79	4.18	3.20 to 5.14	0.35	0.021 to .711	0.95	0.833 to 1.06	1.86	1.61 to 2.10	−0.91	−1.1 to −0.66
NL	238.3	340.4	7.12	6.90 to 7.32	5.62	4.19 to 7.05	1.49	1.03 to 1.97			2.23	1.93 to 2.52	−2.23	−2.5 to −1.9
PL	160.4	229.1	4.42	4.15 to 4.68	3.61	2.57 to 4.64	0.81	0.460 to 1.19	1.18	1.03 to 1.31	2.17	1.88 to 2.46	−1.00	−1.2 to −0.70
PT	160.4	229.1	4.92	4.82 to 5.01	4.33	3.71 to 4.95	0.58	(0.332 to 0.838)	0.49	0.431 to 0.548	0.65	0.566 to 0.740	−0.16	−0.24 to −0.07
RO	160.4	229.1	4.80	4.57 to 5.02	4.73	3.96 to 5.49	0.07	−0.32 to 0.484	1.07	0.937 to 1.19	1.58	1.37 to 1.79	−0.51	−0.72 to −0.29
SE	160.4	229.1	5.81	5.77 to 5.84	5.41	5.28 to 5.53	0.41	0.198 to 0.612	0.22	0.197 to 0.251	0.58	0.502 to 0.656	−0.35	−0.42 to −0.27
SI	160.4	229.1	4.63	4.40 to 4.86	4.09	3.19 to 4.98	0.55	0.216 to 0.883	0.97	0.846 to 1.07	1.63	1.41 to 1.84	−0.67	−0.87 to −0.44
SK	160.4	229.1	4.50	4.25 to 4.74	4.38	3.50 to 5.24	0.12	−0.19 to 0.476	1.25	1.10 to 1.40	1.84	1.59 to 2.08	−0.59	−0.83 to −0.33
UK	330.4	472.1	10.19	10.0 to 10.3	9.16	7.77 to 10.5	1.03	0.598 to 1.45			2.70	2.34 to 3.05	−2.70	−3.0 to −2.3
Mean	195.5	279.2	5.85	5.68 to 5.99	4.76	4.47 to 5.06	1.09	0.78 to 1.41	0.58	0.50 to 0.64	1.74	1.50 to 1.99	−1.16	−1.4 to −0.92
SD	71.1	101.6	2.00	1.95 to 2.05	1.80	1.72 to 1.88	0.61	0.55 to 0.71	0.51	0.44 to 0.56	0.56	0.48 to 0.63	0.83	0.74 to 0.92
CV	0.4	0.4	0.34	0.33 to 0.35	0.38	0.36 to 0.39	0.56	0.48 to 0.73	0.88	0.88 to 0.88	0.32	0.31 to 0.31	−0.72	−0.8 to 0.61
Median	160.4	229.1	4.92	4.80 to 5.13	4.09	3.83 to 4.40	1.06	0.72 to 1.37	0.49	0.42 to 0.54	1.83	1.58 to 2.09	−0.91	−1.16 to 0.64
IQR			1.75	1.45 to 1.95	1.68	1.36 to 1.84	1.01	0.70 to 1.27	1.02	0.89 to 1.14	0.45	0.38 to 0.51	1.38	1.21 to 1.5
IQR to median			0.35	0.29 to 0.39	0.41	0.31 to 0.46	0.95	0.74 to 1.19	2.08	2.08 to 2.08	0.25	0.24 to 0.24	−1.52	−2.24 to 1.1

Minimum excise tax FM cigarettes is expressed in € per 1000 FM cigarettes.
Minimum excise tax RYO tobacco is expressed in € per 1000 g of fine cut tobacco.
WAP FM cigarettes is expressed in € per 20 FM cigarettes.
WAP RYO tobacco is expressed in € per 20 sticks equivalent of fine cut tobacco (ie, 14 g).
AT (Austria), BE (Belgium), BG (Bulgaria), CZ (Czeck Republic), DE (Germany), DK (Denmark), EE (Estonia), EL (Greece), ES (Spain), FI (Finland), FR (France), HR (Croatia), HU (Hungary), IE (Ireland), IT (Italy), LT (Lithuania), LV (Latvia), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), UK (United Kingdom)
CV, coefficient of variation; FM, factory-made; RYO, roll-your-own tobacco; WAP, weighted average price.

from 1000 g of RYO) have the freedom to increase RYO taxation further to compensate.

Another aspect of the reform that this paper does not address is its effects on public budgets. However, with tax-paid FM cigarettes sales price elasticities ranging between −0.47 and −0.35,[3] which imply that reductions in sales are less than proportional than increases in prices, the reform can be expected to produce substantial increases in tax revenues. Further tax revenue might also be generated if lower tax differentials between countries result in a reduction of illicit sales. A possibility worth considering in this sense would be to devote a tranche of the proposed tax to fund the EU's budget. This would seem a timely development after the European Council recent agreement to issue joint debt in order to finance pandemic recovery funds.[21] Besides contributing to a more equal level of health protection for its citizens, the reform proposed in this paper would thus advance the EU's integration process via the creation of common fiscal resources.

CONCLUSION

This study provides a blueprint for a reform of the EU tobacco tax directive that addresses two public health shortcomings about which the European Council has stated that 'action at the EU level is required'. The reform hinges on the use of minimum taxes on a per quantity basis to promote upwards price convergence across countries as well as a reduction of the gap between the prices of FM cigarettes and RYO tobacco. The ex-ante evaluation results presented herein suggest that such a reform would deliver on those desired outcomes and provide useful evidence for the process of reform of the EU tax directive.

What this paper adds

⇒ This paper proposes a blueprint for the reform of the European Union Tobacco Tax Directive affecting the two most important combustible tobacco products: factory-made cigarettes and fine-cut tobacco.

⇒ The reform aims to solve two public health shortcomings in the existing arrangements: the lack of price convergence across countries and the pervasive price gap between factory-made and roll-your-own cigarettes.

⇒ The study simulates the effect of such a reform and shows that it would significantly ameliorate these two public health problems.

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