

Cigarette tax avoidance and evasion: findings from the International Tobacco Control Policy Evaluation (ITC) Project

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ABSTRACT

Background Decades of research have produced overwhelming evidence that tobacco taxes reduce tobacco use and increase government tax revenue. The magnitude and effectiveness of taxes in reducing tobacco use provide an incentive for tobacco users, manufacturers and others, most notably criminal networks, to devise ways to avoid or evade tobacco taxes. Consequently, tobacco tax avoidance and tax evasion can reduce the public health and fiscal benefit of tobacco taxes.

Objectives First, this study aims to document, using data from the International Tobacco Control Policy Evaluation Project (ITC), levels and trends in cigarette users' tax avoidance and tax evasion behaviour in a sample of 16 low-, middle- and high-income countries. Second, this study explores factors associated with cigarette tax avoidance and evasion.

Methods We used data from ITC surveys conducted in 16 countries to estimate the extent and type of cigarette tax avoidance/evasion between countries and across time. We used self-reported information about the source of a smoker's last purchase of cigarettes or self-reported packaging information, or similar information gathered by the interviewers during face-to-face interviews to measure tax avoidance/evasion behaviours. We used generalised estimating equations to explore individual-level factors that may affect the likelihood of cigarette tax avoidance or evasion in Canada, the USA, the UK and France.

Findings We found prevalence estimates of cigarette tax avoidance/evasion vary substantially between countries and across time. In Canada, France and the UK, more than 10% of smokers reported last purchasing cigarettes from low or untaxed sources, while in Malaysia some prevalence estimates suggested substantial cigarette tax avoidance/evasion. We also found important associations between household income and education and the likelihood to engage in tax avoidance/evasion. These associations, however, varied both in direction and magnitude across countries.

INTRODUCTION

There is overwhelming evidence that tobacco taxes reduce tobacco use, save lives and increase government tax revenue.^{1–3} The magnitude and effectiveness of taxes at reducing tobacco use provide an incentive for tobacco users, manufacturers and others, most notably criminal networks, to devise ways to avoid or evade tobacco taxes. Tax avoidance by tobacco users involves legal purchasing behaviour in order to pay less or no taxes. Examples include cross-border shopping, duty-free

shopping and internet purchases. Tobacco manufacturers can also engage in tax avoidance by changing their products and prices with the objective of reducing their tax liability. Tax evasion involves illegal methods of avoiding tobacco taxes. Such illegal activities include illicit trade or production of genuine¹ or counterfeit tobacco products.⁴

Tobacco tax avoidance and evasion pose an array of challenges. Relatively inexpensive, licit or illicit, tobacco products undermine public policies that seek to render tobacco products less affordable. Moreover, tax evaded cigarettes may be sold in packs or plastic bags which do not provide the information which is required by regulations, such as health warnings and information on toxic emissions, as is the case in Canada.⁵ In turn, weak tax administration can undermine the public health objectives of tobacco control measures. Tobacco tax avoidance and evasion also decrease government revenue available for health and social programmes, can result in increased criminal justice expenditures, and can provide unmonitored access to cigarettes for the youth.⁶ Although the magnitude of the tobacco tax avoidance and evasion problem is challenging to quantify, it remains an intractable issue which merits attention due to the many implications for policy design, government revenues and public health.

The magnitude of cigarette tax avoidance and evasion can be estimated by contrasting estimates of legal cigarettes sales based on production, trade or tax revenue data with consumption estimates based on survey data while taking into account under-reporting.^{7–8} The tax authorities of the UK have used this method extensively to estimate the extent of cigarette tax avoidance/evasion.^{9–10} This method is also being used in Canada in an attempt to identify trends in cigarette contraband.^{11–12} Additionally, Stehr¹³ used a variant of this approach to examine the tax avoidance response to tax changes in the USA.

Self-reported information obtained from survey data can also be used to measure the level of cigarette tax avoidance/evasion. In many countries, information about the source of a smoker's last or usual purchase of cigarettes can provide key tax avoidance/evasion information (eg, First Nations reserves in Canada, out of state in the USA and out of country in the European Union (EU)). This

¹The production of genuine brands may be illegal if legal manufacturers declare only a fraction of their production to the tax authorities.⁴

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approach has been used extensively in Canada^{14–17} and also in the USA^{18–20} and the UK.²¹ Self-reported packaging information, or similar information gathered by the interviewers during face-to-face interviews or mail-in pack surveys can also provide key insights into tax avoidance/evasion behaviours. Examples include non-standard or missing health warnings, tax stamps or authenticity labels. For example, in Thailand, an examination of the health warnings (ie, the absence of warnings or warnings in a language other than Thai) during face-to-face interviews revealed if the cigarettes were likely to have been legally purchased or not.²² A similar approach was used in Taiwan relying on self-reports from telephone interviews, using cigarette packs not bearing the tax seal as an indicator of tax evasion.²³ An inspection of discarded cigarette packs can also be used to determine whether all taxes have been paid.ⁱⁱ This approach has been recently used in France,²⁴ Canada,²⁵ the USA^{26–27} and the UK.²⁸

Our first objective is to document for a large number of countries, using novel data from the International Tobacco Control Policy Evaluation Project (ITC), levels and trends in cigarette users' tax avoidance and tax evasion behaviour. Our second objective is to explore factors associated with cigarette tax avoidance/evasion.

DATA AND METHODS

We used data from ITC surveys conducted in high-, mid- and low-income countries between 2002 and 2011; ITC surveys are longitudinal cohort surveys of tobacco use that are designed to assist policy makers in the implementation of strong evidence-based tobacco control policies. First, we used data from the first eight waves of the ITC Four Country survey (Australia, Canada, USA and UK) conducted in 2002, 2003, 2004, 2005/2006, 2006/2007, 2007/2008, 2008/2009 and 2010/2011. Second, we used data from ITC surveys conducted in four European countries: France (2006/2007, 2008), Ireland (2003/2004, 2004/2005, 2006), Scotland (2006) and the Netherlands (2008, 2010, 2011). Third, we used data from ITC surveys conducted in seven low- and middle-income countries: Bangladesh (2009, 2010), China (2006, 2007/2008, 2009/2010), Malaysia and Thailand (2005, 2006/2007, 2008, 2009), Mexico (2006, 2007, 2008/2009, 2010, 2011), Uruguay (2006, 2008/2009, 2010/2011) and Mauritius (2009, 2010, 2011).ⁱⁱⁱ In all ITC countries (with the exception of China and Mexico^{iv}), probabilistic sampling methods were employed to obtain nationally representative samples of smokers. Stratified sampling designs were employed in high-income countries where landline telephone penetration is high. Multi-stage cluster designs were employed

in low- and middle-income countries. Sampling strata were defined by geographic regions within each country. In some countries, mixed survey modes were used: in the Netherlands and in the most recent wave of data collected in the ITC Four Country survey, both telephone interviewing and web-based interviewing were employed; in Malaysia, face-to-face and telephone interviewing methods were used. Sampling weights were computed for each wave of each survey within all ITC countries so that results are nationally representative of smokers. Sampling weights account for survey non-response. More details on ITC's conceptual framework and methodology are provided by Fong *et al*²⁹ and Thompson *et al*.³⁰

We present prevalence estimates of cigarette tax avoidance/evasion using two approaches. First, we followed Hyland *et al*³¹ and used responses to the question: 'where did you last buy cigarettes for yourself?' to identify low or untaxed sources of cigarettes that may represent tax avoidance/evasion behaviour. We present data for individuals who responded that their last source for cigarettes was either a First Nations/Indian reserve, out of state/province/country, a duty-free outlet, a direct purchase (mail, telephone or internet), 'someone else' such as an independent seller or a military commissary. For comprehensiveness, we also present data, when relevant, for individuals who reported that their last source for cigarettes was from a friend or a relative, or who reported not knowing or refused to answer. With the exception of ITC-Netherlands, all ITC surveys include a follow-up open-ended question for individuals who responded 'other' to the question that pertains to the source of their last cigarette purchase. All open-ended responses were manually examined and recoded when possible. We were unable to recode only a negligible number of responses; such responses were coded as 'other'. Second, we present estimates based on self-reported packaging information or similar information gathered by the interviewers during face-to-face interviews. We used responses to the question (or a variant of the question): 'do you have an empty pack handy? I need to get some information about the cigarettes you smoke? If not, can you tell me if your cigarette pack has: a standard warning label, a tax stamp, security ink' Data are presented per source of information (ie, self-reported or interviewers). All tax avoidance/evasion prevalence estimates presented were weighted using sampling weights. The two approaches described above were not practicable in all countries; hence, we present estimates from a subset of the surveys. For each country or groups of countries, we present all available data that may represent cigarette tax avoidance/evasion. For high-income countries (Australia, Canada, France, Ireland, the Netherlands, Scotland, the UK and the USA) and for Mexico and Uruguay, we present estimates that are based on the source of a smoker's last purchase of cigarettes. For Bangladesh, China, Malaysia, Mauritius, Thailand and Uruguay, we present estimates that are based on self-reported packaging information or similar information gathered by the interviewers during face-to-face interviews.

In addition to presenting prevalence estimates, we used generalised estimation equations (GEE) to explore factors that may affect the likelihood of cigarette tax avoidance or evasion. We used a binary indicator of potential cigarette tax avoidance/evasion defined as follows: 1 if individuals reported that their last source for cigarettes was either a First Nations/Indian reserve, out of state/province/country, a duty-free store, a military commissary, someone else or a direct purchase (mail, telephone or internet); 0 otherwise. We excluded individuals who reported that their last source for cigarettes was from a friend or a relative or who reported not knowing or refused to answer. We did not

ⁱⁱIt is worth noting that the littered pack approach will likely overstate the extent of tax avoidance/evasion given that it picks up commuting, tourism, etc. that have nothing to do with tax avoidance. Moreover, smokers who litter may be more likely to engage in tax avoidance/evasion.

ⁱⁱⁱITC surveys were also conducted in Germany (2007, 2009, 2011), New Zealand (2007/2008, 2008/2009) and in the Republic of Korea (2005, 2008, 2010): ITC-Germany omitted the most useful response categories to identify low or untaxed sources of cigarettes in all its waves; ITC-New Zealand omitted the most useful question in wave 2 while nearly 90% of respondents failed to answer in wave 1; and, estimates of tax avoidance/evasion in the Republic of Korea were not distinguishable from zero. Consequently, we do not present or use any of ITC-Germany, ITC-New Zealand and ITC-Korea data in our analyses.

^{iv}ITC-China was conducted in six cities (Beijing, Changsha, Guangzhou, Shanghai, Shenyang and Yinchuan); ITC-Mexico was conducted in four cities (Mexico City, Guadalajara, Tijuana and Ciudad Juárez).

use data obtained from self-reported packaging information or similar information gathered by the interviewers during face-to-face interviews.^v We performed this analysis using data from the following countries: Canada, the USA, the UK and France. We focus on these countries because the prevalence of tax avoidance/evasion appears to be important.^{vi} We examined associations between cigarette tax avoidance or evasion and the following individual-level factors: socioeconomic status using country-specific categorical measures of household income (low, moderate, high, refused/don't know) and education (low, moderate, high, refused/don't know); categorical measures of sex, daily cigarette smoking intensity (1–10, 11–20, 21–30, >30 cigarettes/day, refused/don't know), time to first cigarette (measured in minutes, >60, 31–60, 6–30, <5, refused/don't know) and quit intention (yes, no, don't know), and a continuous measure of age and age squared (measured in units of 10 years).

We used GEE with a logit link, a binomial family, an unstructured working correlation structure (ie, no constraints are placed on correlations between repeated observations on individuals over time) and robust SEs. The above specification did not converge for the USA; we instead used an exchangeable working correlation structure (ie, all correlations within a cluster (ie, an individual) were constrained to be identical). All models are estimated using Stata/MP V.12.1 for Macintosh.

RESULTS

Tables 1–3 present estimates of tax avoidance or evasion based on respondents' self-reported source of their last purchase of cigarettes. Table 1 presents data for Canada, the USA, the UK and Australia for eight survey waves conducted between 2002 and 2010/2011. It is important to note that it is difficult to disentangle tax avoidance from tax evasion. For example, the estimates presented in table 1 are more likely to represent tax avoidance than tax evasion, with the exception of Canada where cigarettes are likely purchased illegally from First Nations reserves. In the USA, purchases from Indian reservations and from out of state are, more often than not, legally permitted; similarly, out of country and duty-free purchases are generally legal in the UK. Estimates vary substantially between countries and across time within countries. Tax avoidance/evasion appears highest in the UK: about 12.5%–17% of respondents, between 2002 and 2010/2011, reported having last purchased cigarettes from a low or untaxed source.^{vii} These data suggest a downward trend between May–September 2003 and 2010/2011.

A decade ago, cigarette tax avoidance/evasion appeared to be relatively unimportant in Canada as only about 3% of respondents reported having last purchased cigarettes from a low or untaxed source. Our estimates, however, suggest a large increase—more than fourfold—between 2002 and 2008/2009 followed by a small decrease between 2008/2009 and 2010/2011. Cigarette tax avoidance/evasion in the USA appears to

have remained fairly stable during the last decade, oscillating between 5.3% and 7.6%. Unsurprisingly, because of its geographic situation and limited price differentials between states, cigarette tax avoidance/evasion appears negligible in Australia. As with levels and trends in cigarette tax avoidance/evasion, the type of cigarette tax avoidance/evasion is quite heterogeneous between countries. In Canada and the USA, low/untaxed sources of cigarettes are primarily First Nations/Indian reserve purchases while in the UK, they are primarily out of country and duty-free purchases.

Table 2 presents data for France, the Netherlands, Ireland and Scotland; table 3 presents data for Mexico and Uruguay. Out of country (but inside the EU) cigarette purchases are substantial in France and appear to be growing: 12.8% of smokers in 2006/2007 and 16.7% in 2008. In the Netherlands, Ireland and Scotland, cigarette purchases from low or untaxed sources are low but not negligible (between about 1% and 3.8% from a source outside the country). In both Netherlands and Ireland, there appears to be an upward trend in out of country purchases. Duty-free purchases are not substantial but are as high as 1.5%–3.2% in France, Ireland and Scotland. Out of country, duty-free and internet purchases appear to be negligible in Mexico between 2006 and 2011, and Uruguay between late 2006 and early 2011 (table 3).

Tables 4 and 5 present prevalence estimates of tax avoidance/evasion based on self-reported packaging information or similar information gathered by the interviewers during face-to-face interviews. Table 4 presents descriptive data for Malaysia and Thailand. The estimates suggest little evidence of tax avoidance/evasion in Thailand but substantial and increasing tax avoidance/evasion in Malaysia. Estimates for waves 2 and 3 of ITC-Malaysia also suggest self-reported information may not be reliable: estimates based on self-reports are substantially different than estimates based on pack inspection. Table 5 presents data for Mauritius, Uruguay, China and Bangladesh. The estimates suggest an important decrease in cigarette tax avoidance/evasion between early 2005 and the first half of 2008 in Mauritius and, on the whole, an increase in Uruguay. As was the case with data from Malaysia, these estimates suggest self-reported information may not be reliable. For example, the estimates based on self-reports are appreciably higher in waves 1 and 2 but lower in wave 3 in Mauritius. Estimates for China suggest substantial cigarette tax avoidance/evasion. These estimates, however, should be treated with caution. The high number of respondents and more importantly interviewers who reported or recorded not knowing suggests potentially important difficulties during the data collection process. Estimates from Bangladesh, based on a small subsample (about 16%) of respondents who provided a cigarette pack to the interviewers, suggest low but perhaps increasing cigarette tax avoidance or evasion.

Table 6 presents the results of the GEE models. In Canada, we find a statistically significant negative association between household income and the odds of engaging in cigarette tax avoidance/evasion (middle- and high-income are jointly significant; Wald test: $\chi^2=7.6$ and $p=0.020$) while in the UK we find a statistically significant positive association (Wald test: $\chi^2=41.4$ and $p<0.001$). In the USA, we find that individuals with higher education have higher odds of engaging in cigarette tax avoidance/evasion (middle- and high-education are jointly significant; Wald test: $\chi^2=16.2$ and $p<0.001$). More specifically, in the USA the odds of engaging in cigarette tax avoidance/evasion for individuals with moderate and high levels of education are 1.6 and 1.5 times higher than those of individuals with low levels of

^vAlthough the prevalence of tax avoidance/evasion appears to be important in China, Malaysia, Mauritius, Thailand and Uruguay, we do not use data from these countries because of the differences we observed between estimates based on self-reports and estimates based on pack inspections.

^{vi}Data on last purchased cigarettes from a low or untaxed source are also available from Australia, Ireland, the Netherlands, Mexico and Uruguay; in these countries, the prevalence of cigarette tax avoidance/evasion is small to negligible.

^{vii}Estimates for the UK more likely represent tax avoidance rather than tax evasion as most of the sources of last cigarette purchases are out of state/province/country and duty free.

Table 1 Percentage of respondents reporting the source of their last purchase of cigarettes: Canada, the USA, the UK and Australia

Four Country survey	Wave 1 (November–December 2002) %	Wave 2 (May–September 2003) %	Wave 3 (June–December 2004) %	Wave 4 (October 2005–January 2006) %	Wave 5 (October 2006–February 2007) %	Wave 6 (September 2007–February 2008) %	Wave 7 (October 2008–July 2009) %	Wave 8 (July 2010–June 2011) %
Canada								
First Nations reserve	2.0	2.6	3.5	6.0***	7.8*	10.3*	10.4	9.5
Out of state/province/country	0.3	0.3	0.3	0.3	0.1	0.1	0.0	0.4
Duty free	0.6	0.7	0.7	0.4	0.7	0.7	0.7	0.7
Any direct purchase (mail, phone or internet)	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2
Someone else (eg, independent seller)	0.2	0.1	0.5	0.7	0.6	1.1	0.5	0.4
Military	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Friends/relatives	0.1	0.3	1.2**	0.5	0.7	0.7	1.1	0.3*
Refused/don't know/other	0.0	0.3*	0.0*	0.1	0.0	0.1	0.4	0.2
n	2199	2014	1889	1774	1757	1727	1507	1245
USA								
Indian reservation	2.6	3.0	2.6	2.6	3.0	3.0	4.4	4.4
Out of state/province/country	0.7	0.4	0.8	0.2**	0.4	0.2	1.3**	0.8*
Duty free	0.4	0.2	0.2	0.4	0.3	0.0	0.1	0.4
Any direct purchase (mail, phone or internet)	0.8	1.4	1.9	1.0	0.6	0.9	1.0	0.9
Someone else (eg, independent seller)	0.0	0.0	0.2	0.2	0.6	0.4	0.1	0.0
Military	0.7	1.0	1.0	1.0	0.5	0.6	0.3	0.5
Friends/relatives	0.1	0.1	0.4	0.4	0.2	0.1	0.2	0.3
Refused/don't know/other	0.1	0.3	0.1	0.0	0.1	0.0	0.1	0.0
n	2123	1909	1924	1792	1820	1766	1516	1267
UK								
Out of state/province/country	8.6	10.4	9.7	7.8*	7.1	9.2	5.1***	5.4
Duty free	4.4	5.5	5.1	6.3	6.0	3.4	6.8***	5.8
Any direct purchase (mail, phone or internet)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Someone else (eg, independent seller)	0.6	1.2	1.6	1.2	1.0	1.0	2.5	1.2
Friends/relatives	2.2	2.0	1.8	2.5	2.6	2.2	3.5	3.8
Refused/don't know/other	0.1	0.2	0.3	0.0	0.1	0.0	0.0	0.0
n	2400	1933	1839	1738	1721	1665	1486	975
Australia								
Out of state/province/country	0.1	0.2	0.1	0.1	0.2	0.2	0.0	0.5
Duty free	0.7	0.5	0.6	1.2	0.5	0.9	1.4	1.5
Any direct purchase (mail, phone or internet)	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0
Someone else (eg, independent seller)	0.2	0.1	0.4*	0.2	0.6	0.3	0.2	0.4
Friends/relatives	0.1	0.4	0.2	0.3	0.1	0.2	0.4	0.3
Refused/don't know/other	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
n	2304	1975	1851	1714	1823	1805	1371	1116

n Represents the total number of valid responses (ie, the denominator). *, ** and ***: significant difference at 5%, 1% and 0.1% with previous time period. These should be interpreted with great caution as the number of comparisons is absurdly high.

Table 2 Percentage of respondents reporting the source of their last purchase of cigarettes: France, the Netherland, Ireland and Scotland

	France		The Netherlands			Ireland			Scotland
	Wave 1 (December 2006– January 2007)	Wave 2 (September– November 2008)	Wave 1 (March–April 2008)	Wave 4 (May– June 2010)	Wave 5 (May–June 2011)	Wave 1 (December 2003– January 2004)	Wave 2 (December 2004– January 2005)	Wave 3 (February– March 2006)	Wave 3 (February– March 2006)
	%	%	%	%	%	%	%	%	%
Out of country (inside EU)	12.8	16.7***	1.4	2.7**	2.9	0.8	1.3	2.8	3.7
Out of country (outside EU)	1.0	1.6	0.1	0.5	0.9				
Duty free	1.5	1.5	0.7	0.3	0.8	1.7	3.2**	1.8	2.2
Any direct purchase (mail, phone or internet)	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.5	0.2
Someone else (eg, independent seller)	0.5	0.7	0.4	0.6	0.5	0.4	0.3	1.0	1.0
Refused/don't know/other†	0.1	0.0	1.3	2.4**	3.6	0.3	0.1	0.2	0.2
n	1735	1540	2224	1723	1672	1071	912	578	507

†Unlike other ITC surveys, the Netherland surveys do not contain a follow-up open-ended question for individuals who responded 'other' as the source of their last purchase of cigarettes. See text for more details; n represents the total number of valid responses (ie, the denominator). *, ** and ***: significant difference at 5%, 1% and 0.1% with previous time period. These should be interpreted with great caution as the number of comparisons is absurdly high. EU, European Union; ITC, International Tobacco Control.

Table 3 Percentage of respondents reporting the source of their last purchase of cigarettes: Mexico and Uruguay

	Mexico					Uruguay		
	Wave 1 (September– November 2006)	Wave 2 (October– November 2007)	Wave 3 (October 2008–January 2009)	Wave 4 (January– February 2010)	Wave 5 (April– May 2011)	Wave 1 (October– December 2006)	Wave 2 (October 2008–February 2009)	Wave 3 (October 2010–January 2011)
	%	%	%	%	%	%	%	%
Out of country	0.6	0.7	0.2	1.3	0.4	0.0	0.2	0.6
Duty free	1.0	0.2*	0.1	1.3	0.3	0.2	0.7	0.3
Internet	0.0	0.0	0.0	0.9	0.0	0.2	0.0	0.0
Refused/don't know	0.1	0.4	0.7	0.7	0.0	0.0	0.1	0.1
n	1077	941	1854	394	821	887	1294	1224

n Represents the total number of valid responses (ie, the denominator). *, ** and ***: significant difference at 5%, 1% and 0.1% with previous time period. These should be interpreted with great caution as the number of comparisons is absurdly high.

Table 4 Percentage of smokers' cigarette packs showing evidence of possible tax avoidance or evasion in Malaysia and Thailand

Source of information	Malaysia						Thailand							
	Wave 1 (January–March 2005)		Wave 2 (August 2006–June 2007)		Wave 3 (January–August 2008)		Wave 1 (January–March 2005)		Wave 2 (August 2006–June 2007)		Wave 3 (January–August 2008)		Wave 4 (April–November 2009)	
	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %
Health warnings														
Non-standard warning labels	3.5	3.4	7.6	3.7	8.1	1.0*	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
No warning labels	3.8	3.1	8.4*	7.1	2.3*	3.1	0.0	0.5	0.0	0.0	0.9	0.2	0.9	0.0
Refused/don't know	NA	NA	7.8	2.9	0.4***	2.5	0.0	0.0	0.0	0.3	0.0	0.4	0.0	0.0
n	633	1048	379	871	957	498	260	754	31	829	211	784	299	618
Tax stamps														
No tax stamps or security ink	9.2	9.2	13.7*	10.0	39.7**	14.3*	0.0	0.0	0.0	0.0	NA	NA	NA	NA
Refused/don't know	NA	NA	10.8	3.6	2.0	22.9***	NA	NA	0.0	0.7	NA	NA	NA	NA
n	617	1035	376	880	374	248	260	754	31	828	NA	NA	NA	NA

n Represents the total number of valid responses per item (ie, the denominator). *, **, and ***: significant difference at 5%, 1% and 0.1% with previous time period. These should be interpreted with great caution as the number of comparisons is absurdly high.
NA, not applicable.

education. We do not find statistically significant associations between socioeconomic status (measured by income or education) and the odds of engaging in cigarette tax avoidance/evasion in France. On the whole, the results suggest, that if anything, in France there are positive associations between household income and education and cigarette tax avoidance/evasion.

Age is found to increase (at a decreasing rate) the odds of engaging in cigarette tax avoidance/evasion in Canada, the USA and the UK but not in France. In France, age appears to decrease (at a decreasing rate) the odds of engaging in cigarette tax avoidance/evasion; this association between age and cigarette tax avoidance/evasion is, however, not statistically significant. More specifically, in Canada, the odds of a 40-year-old are 1.33 times higher than those of a 30-year-old, while the odds of a 50-year-old are 1.20 times higher than those of a 40-year-old. We do not find that men have statistically significant higher odds to engage in cigarette tax avoidance/evasion than women in Canada, the UK and France. We do find, however, that women in the USA have statistically significant higher odds than men. On the whole, we find that heavier smokers tend to have higher odds of engaging in cigarette tax avoidance/evasion. These associations, however, are only statistically significant in Canada and the USA. We find that time to first cigarettes is likely associated with cigarette tax avoidance/evasion (the shorter the time to first cigarettes, the higher the odds). Finally, we find statistically significant associations between quit intentions and cigarette tax avoidance/evasion in the USA, the UK and France; smokers who intend to quit have lower odds of engaging in cigarette tax avoidance/evasion.

DISCUSSION

Principal findings

We find the prevalence of cigarette tax avoidance/evasion varies substantially between countries, and across time within countries. In Canada, France and the UK, more than 10% of smokers report last purchasing cigarettes from low or untaxed sources while in Malaysia, some estimates suggest substantial cigarette tax avoidance/evasion between 2005 and 2008. In Canada, the percentage of smokers reporting buying cigarettes from low or untaxed sources increased more than fourfold between late 2002 and late 2007, early 2008 but seems to have levelled off or decreased since. We find that the sources of low or untaxed cigarettes are very much country-specific. In Canada, and to a lesser extent in the USA, the main source of low or untaxed cigarettes are First Nations/Indian reserves; in the UK, it is out of country and duty-free purchases; while in France, it is out of country, but within the EU, purchases. It is important to note that our estimates of the prevalence of cigarette tax avoidance/evasion likely underestimates the proportion of total cigarettes that are purchased from low or untaxed sources as smokers who buy cigarettes from low or untaxed sources tend to be heavier smokers.^{viii}

As expected we find that, on the whole, heavier and more addicted smokers are more likely to engage in tax avoidance/evasion while smokers who intend to quit are less likely. We find important associations between household income and education and the likelihood of engaging in tax avoidance/evasion. These associations, however, vary both in direction and magnitude across countries. These results highlight the importance of taking into consideration country-specific contextual factors.

^{viii}This will be the case inasmuch as heavier smokers purchase a large proportion of their cigarettes from low or untaxed sources.

Table 5 Percentage of smokers' cigarette packs showing evidence of possible tax avoidance or evasion: Mauritius, Uruguay, China and Bangladesh

Source of information	Mauritius					
	Wave 1 (January–March 2005)		Wave 2 (August 2006–June 2007)		Wave 3 (January–August 2008)	
	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %
No tax stamps or authenticity labels	11.0	16.6	7.6	10.2	3.1	1.7
Don't know	0.8	10.6	0.2	17.2	0.1	17.8
n	210	388	335	218	305	230
	Uruguay					
	Wave 1 (October–December 2006)		Wave 2 (October 2008–February 2009)		Wave 3 (October 2010–January 2011)	
	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %
Non-standard warning labels	6.4	4.2	3.1	5.1	12.0***	5.1
No warning labels	4.6	0.6	3.6	1.8	8.5***	5.6
Don't know	0.2	0.0	0.7	0.8	3.4***	3.7***
n	305	426	361	137	765	459
	China					
	Wave 1 (March–December 2006)		Wave 2 (October 2007–February 2008)		Wave 3 (May 2009–March 2010)	
	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %
No authenticity labels	10.7	8.5	13.4*	7.2	6.3***	7.2
Don't know	10.3	0.2	5.8***	0.2	2.5***	8.9***
n	2308	1089	2455	817	2553	1191
	Bangladesh					
	Wave 1 (February–May 2009)		Wave 2 (March–June 2010)			
	Pack %	Self-report %	Pack %	Self-report %	Pack %	Self-report %
No tax stamps	0.4	NA	3.7**	NA		
n	368	NA	401	NA		

n Represents the total number of valid responses per item (ie, the denominator). *, ** and ***: significant difference at 5%, 1% and 0.1% with previous time period. These should be interpreted with great caution as the number of comparisons is absurdly high. NA, not applicable.

For example, the differentials in cigarette taxes or prices between neighbouring jurisdictions are often assumed to be the key driver of cigarette tax avoidance/evasion. Although theoretically sound, such assertions ignore an array of other factors that may be equally or more important. For example, in Canada, a province-level examination of the data reveals that cigarette tax avoidance/evasion is substantial in only two provinces, Ontario and Québec, the two provinces with the lowest cigarette taxes in Canada.³² Such findings suggest that the proximity to opportunities for tax avoidance/evasion may be one of the key factors. Other important country-level factors may include the tax effectiveness of governments' law enforcement, geographic situation (eg, long and porous borders) and the extent to which the tobacco industry tolerates or actively encourages tax evasion.

Limitations

A number of limitations merit discussion. First, most prevalence estimates presented are based on self-reported responses and, consequently, social desirability bias (when respondents provide socially desirable answers) cannot be ruled out. Responses may represent true behaviours or perceptions about what respondents thought investigators wanted to hear or a combination of both. Cigarette tax evasion, an illegal activity, may be particularly affected.³³ Imperfect recall, especially with respect to pack information, may also introduce measurement error. It is not possible to disentangle the effects of social desirability bias and

imperfect recall. Both may, at least in part, explain the differences we observed between estimates based on self-reports and estimates based on pack inspections. Second, unequal spacing between waves and differences in the duration and timing of fieldwork suggest caution should be exercised when examining temporal differences. For example, as pointed out by Hyland *et al*,³¹ wave 2 of the Four Country survey took place in the UK's summer holiday season when respondents would have been more likely to visit neighbouring countries where low or untaxed cigarettes may be more readily available compared with wave 1, which took place late in the European autumn. Third, it is difficult to disentangle tax avoidance from tax evasion. For example, carrying cigarettes across state or international borders may or may not be illegal, depending on the allowance permitted. Similarly, purchasing cigarettes on First Nations/Indian reserves is not necessarily illegal. Additional limitations include the inability to capture industry evasion, sales of untaxed cigarettes that are made in legitimate stores, and counterfeit cigarettes or cigarette with counterfeit stamps.

Implications for policy and research

Article 6.2 of the Framework Convention on Tobacco Control (FCTC), an international treaty negotiated by the member states of WHO with objective to reduce the prevalence of tobacco use and exposure to tobacco smoke, calls upon each party to adopt or maintain measures that prohibit or restrict, sales to or

Table 6 GEE models: factors associated with the odds of engaging in cigarette tax avoidance or evasion

	Canada			USA			UK			France		
	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value	OR	95% CI	p Value
Income (ref. low)												
Mid	0.92	(0.73 to 1.16)	0.49	0.88	(0.70 to 1.10)	0.26	1.27	(1.05 to 1.54)	0.01	1.05	(0.80 to 1.38)	0.75
High	0.72	(0.56 to 0.92)	0.01	1.10	(0.85 to 1.42)	0.47	1.86	(1.53 to 2.25)	0.00	1.21	(0.87 to 1.68)	0.25
Don't know/refused	0.79	(0.56 to 1.11)	0.17	0.65	(0.40 to 1.05)	0.08	1.31	(1.02 to 1.68)	0.04	0.66	(0.32 to 1.38)	0.27
Education (ref. low)												
Mid	1.00	(0.80 to 1.24)	0.98	1.58	(1.26 to 1.99)	0.00	1.09	(0.92 to 1.30)	0.33	1.13	(0.87 to 1.47)	0.37
High	1.06	(0.79 to 1.44)	0.69	1.48	(1.10 to 1.99)	0.01	1.15	(0.91 to 1.44)	0.24	1.03	(0.75 to 1.42)	0.84
Don't know/refused	0.35	(0.02 to 5.03)	0.44	3.10	(0.35 to 27.74)	0.31	0.54	(0.25 to 1.19)	0.13	1.34	(0.28 to 6.41)	0.72
Sex (ref. men)	1.11	(0.91 to 1.35)	0.32	0.73	(0.59 to 0.90)	0.00	1.08	(0.93 to 1.25)	0.30	0.83	(0.66 to 1.05)	0.12
Age	1.95	(1.29 to 2.93)	0.00	2.18	(1.44 to 3.28)	0.00	1.69	(1.25 to 2.29)	0.00	0.66	(0.36 to 1.19)	0.17
Age squared	0.95	(0.91 to 0.99)	0.02	0.95	(0.91 to 0.99)	0.02	0.96	(0.93 to 0.99)	0.02	1.04	(0.96 to 1.12)	0.33
No. cigarettes per day (ref. 1–10 cigarettes)												
11–20 cigarettes	1.62	(1.35 to 1.95)	0.00	1.40	(1.09 to 1.80)	0.01	1.04	(0.90 to 1.19)	0.61	1.17	(0.89 to 1.53)	0.26
21–30 cigarettes	1.44	(1.13 to 1.85)	0.00	1.61	(1.19 to 2.16)	0.00	1.23	(1.02 to 1.50)	0.03	1.24	(0.75 to 2.08)	0.40
>30 cigarettes	1.91	(1.30 to 2.82)	0.00	1.69	(1.18 to 2.41)	0.00	1.18	(0.91 to 1.53)	0.21	1.34	(0.54 to 3.32)	0.53
Don't know/refused	1.70	(0.44 to 6.64)	0.44	1.05	(0.21 to 5.17)	0.96	1.22	(0.56 to 2.64)	0.62	–	–	–
Time to first cigarette (ref. >60 min)												
31–60 min	0.66	(0.50 to 0.88)	0.00	1.33	(0.98 to 1.79)	0.07	0.91	(0.75 to 1.11)	0.34	0.99	(0.74 to 1.33)	0.96
6–30 min	0.85	(0.66 to 1.09)	0.20	1.25	(0.93 to 1.69)	0.15	0.93	(0.77 to 1.11)	0.41	1.36	(1.02 to 1.81)	0.04
≤5 min	1.07	(0.80 to 1.42)	0.67	1.37	(0.99 to 1.90)	0.06	0.98	(0.80 to 1.21)	0.87	1.13	(0.73 to 1.75)	0.58
Don't know/refused	0.80	(0.52 to 1.21)	0.29	0.87	(0.36 to 2.09)	0.76	1.01	(0.64 to 1.59)	0.97	3.58	(2.71 to 4.73)	0.00
Intention to quit (ref. no)												
Yes	0.91	(0.76 to 1.09)	0.30	0.71	(0.59 to 0.85)	0.00	0.80	(0.71 to 0.89)	0.00	0.79	(0.64 to 0.97)	0.02
Don't know/refused	0.97	(0.63 to 1.48)	0.89	0.66	(0.40 to 1.09)	0.11	0.57	(0.37 to 0.89)	0.01	0.68	(0.15 to 3.12)	0.62
Wave (ref. wave 1)												
Wave 2	0.38	(0.26 to 0.55)	0.00	0.81	(0.55 to 1.21)	0.31	1.86	(1.36 to 2.56)	0.00	0.78	(0.56 to 1.08)	0.13
Wave 3	0.44	(0.31 to 0.62)	0.00	0.81	(0.56 to 1.18)	0.27	1.79	(1.31 to 2.45)	0.00	–	–	–
Wave 4	0.50	(0.36 to 0.68)	0.00	0.85	(0.59 to 1.21)	0.37	1.64	(1.23 to 2.19)	0.00	–	–	–
Wave 5	0.76	(0.57 to 1.01)	0.06	0.75	(0.53 to 1.07)	0.11	1.47	(1.11 to 1.95)	0.01	–	–	–
Wave 6	0.84	(0.65 to 1.09)	0.20	0.80	(0.57 to 1.12)	0.20	1.45	(1.11 to 1.88)	0.01	–	–	–
Wave 7	1.23	(0.97 to 1.56)	0.09	0.62	(0.45 to 0.86)	0.00	1.37	(1.05 to 1.78)	0.02	–	–	–
Wave 8	1.12	(0.89 to 1.39)	0.33	0.89	(0.66 to 1.21)	0.47	1.19	(0.92 to 1.54)	0.19	–	–	–
Time-in-sample (ref. 1)*												
2	1.18	(0.99 to 1.41)	0.06	1.16	(0.96 to 1.40)	0.12	1.35	(1.15 to 1.59)	0.00	1.08	(0.77 to 1.50)	0.67
3	1.45	(1.18 to 1.79)	0.00	1.02	(0.80 to 1.30)	0.89	1.50	(1.26 to 1.78)	0.00	–	–	–
4	1.33	(1.05 to 1.68)	0.02	0.94	(0.71 to 1.25)	0.67	1.57	(1.27 to 1.93)	0.00	–	–	–
5	1.65	(1.27 to 2.15)	0.00	1.04	(0.73 to 1.49)	0.81	1.66	(1.29 to 2.14)	0.00	–	–	–
6	1.48	(1.07 to 2.05)	0.02	1.15	(0.73 to 1.81)	0.56	1.50	(1.11 to 2.04)	0.01	–	–	–
7	1.69	(1.15 to 2.48)	0.01	0.81	(0.43 to 1.55)	0.53	1.88	(1.30 to 2.72)	0.00	–	–	–
8	2.35	(1.49 to 3.69)	0.00	0.82	(0.37 to 1.81)	0.63	2.21	(1.37 to 3.56)	0.00	–	–	–
Intercept	0.01	(0.01 to 0.04)	0.00	0.00	(0.00 to 0.01)	0.00	0.02	(0.01 to 0.03)	0.00	0.63	(0.19 to 2.11)	0.46

Age and age squared measured in units of 10 years; For Canada, the UK and France: GEE (link=logit, family=binomial, working correlation structure=unstructured), for the USA: GEE (link=logit, family=binomial, working correlation structure=exchangeable); * average time-in-sample: Canada=2.5, USA=2, UK=2.5, France=1.5. GEE, generalised estimating equation.

importations by international travellers of tax- and duty-free tobacco products.³⁴ The proportion of smokers who report obtaining duty-free cigarettes at last purchase is substantial only in the UK (between about 3.5% and 7% during the past decade). Duty-free cigarette purchases are appreciably lower in other high-income countries but by no means negligible. Moreover, even if the true prevalence of duty-free cigarette purchases is on average only 1% (or even lower), such prevalence estimate represent considerable tax revenue losses. Additionally, there is some evidence that the availability of duty-free cigarettes has enabled cigarette tax evasion.⁴ Duty-free cigarette allowances are limited in several countries; some countries such as Barbados, Singapore and Sri Lanka have gone further and no

longer permit any duty-free allowances for cigarettes.⁴ In November 2012, the Protocol to Eliminate Illicit Trade in Tobacco Products was adopted by the parties to the FCTC. The new protocol's aim is to combat illegal trade in tobacco products through control of the supply chain and international cooperation. A key measure of the protocol is the commitment of each party to establish a global tracking and tracing system.

Most of the prevalence estimates of cigarette tax avoidance/evasion presented are national averages (with the exception of China and Mexico, ITC surveys are nationally representative). National estimates may hide important and policy-relevant regional differences. For example, the fourfold increase between 2002 and 2008/2009 in Canada was due in great part to an

increase in purchasing on First Nations reserves within the province of Ontario. Similarly, an inspection of the pattern of tax avoidance in France shows that it was almost entirely due to smokers in border regions purchasing their cigarettes from the bordering countries.³⁵ Additional promising avenues for research include the examination of the effects of country-level factors on tax avoidance/evasion and the effects of tax avoidance/evasion on purchasing behaviour (eg, prices paid and quantities purchased) and on the pass-through rate for cigarettes.³⁶

What this paper adds

- ▶ The magnitude and effectiveness of taxes at reducing tobacco use provide an incentive for tobacco users, manufacturers and others, most notably criminal networks, to devise ways to avoid or evade tobacco taxes.
- ▶ The magnitude of cigarette tax avoidance/evasion is challenging to quantify.
- ▶ We find that the extent and the type of cigarette avoidance/evasion vary substantially between countries and across time. We also find important associations between household income and education and the likelihood of engaging in cigarette tax avoidance/evasion.

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approval and the contents of the Data Usage Agreement are described online (<http://www.itcproject.org>).

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