INSTITUT C.D. HOWE INSTITUTE

COMMENTARY
NO. 471

Smokes, Smugglers and Lost Tax Revenues: How Governments Should Respond

Between 2006 and 2014, cigarette smuggling in Ontario resulted in lost tax revenue of $816 million to $900 million. The province should follow the lead of Quebec and strengthen enforcement to counter the problem, rather than raise taxes.

Anindya Sen

About The Author

Anindya Sen
is Professor of Economics and Director of the Master of Public Service Program, University of Waterloo.

The Institute's Commitment to Quality

C.D. Howe Institute publications undergo rigorous external review by academics and independent experts drawn from the public and private sectors. The Institute's peer review ensures the quality, integrity and objectivity of its policy research. The Institute will not publish any study that, in its view, fails to meet these standards.

The Institute requires that its authors publicly disclose any actual or potential conflicts of interest of which they are aware.

In its mission to educate and foster debate on essential public policy issues, the C.D. Howe Institute provides nonpartisan policy advice to interested parties on a non-exclusive basis. The Institute will not endorse any political party, elected official, candidate for elected office, or interest group.

As a registered Canadian charity, the C.D. Howe Institute as a matter of course accepts donations from individuals, private and public organizations, charitable foundations and others, by way of general and project support. The Institute will not accept any donation that stipulates a predetermined result or policy stance or otherwise inhibits its independence, or that of its staff and authors, in pursuing scholarly activities or disseminating research results.

Commentary No. 471
February 2017
Fiscal and Tax Policy

Daniel Schwanen
Vice President, Research

$12.00
ISBN 978-1-987983-21-0
ISSN 0824-8001 (print);
ISSN 1703-0765 (online)

The Study In Brief

There is widespread consensus that higher cigarette taxes are the most effective policy tool in reducing population smoking rates and tobacco-induced mortality, but the efficacy of such taxes is tempered by the possibility of a rise in smuggling and the availability of contraband tobacco.

Understanding the extent to which stronger law enforcement affects the consumption of contraband tobacco is key given the significant tobacco tax increases recently implemented by the federal, Ontario and Quebec governments. Concerns have been raised about lost tax revenue and even the funnelling of black-market revenue to organized crime and terrorist activities. The study employs rigorous econometric methods in order to estimate the amount of smuggled cigarette cartons, along with associated lost tax revenues, in Quebec and Ontario from 2006 to 2014.

While the amount of contraband has been quite significant in both provinces, it has been particularly high for Ontario, with lost tax revenue of approximately $816 million to $900 million in 2014. But the amount of contraband has declined over time for both provinces and coincided with an increase in excise cigarette taxes.

The reduction in contraband since 2008 has been especially dramatic in Quebec. Lost tax revenue from current levels of contraband in Quebec is roughly a tenth of corresponding amounts in Ontario. The decline in illegal sales can be at least partially attributed to additional federal and provincial resources devoted to law enforcement. Given the magnitude of the decrease in estimated lost tax revenues as a likely consequence of stronger policing, and the risks to higher tobacco taxes undermining fruitful enforcement efforts, it appears that Ontario in particular would be better off by focusing on strengthening enforcement and regulation.

C.D. Howe Institute Commentary© is a periodic analysis of, and commentary on, current public policy issues. Guy Nicholson and Barry Norris and James Fleming edited the manuscript; Yang Zhao prepared it for publication. As with all Institute publications, the views expressed here are those of the author and do not necessarily reflect the opinions of the Institute's members or Board of Directors. Quotation with appropriate credit is permissible.

To order this publication please contact: the C.D. Howe Institute, 67 Yonge St., Suite 300, Toronto, Ontario M5E 1J8. The full text of this publication is also available on the Institute's website at www.cdhowe.org.

There is widespread consensus that higher cigarette taxes are the most effective policy tool in reducing population smoking rates and tobacco-induced mortality.[1]

Higher cigarette taxes are also attractive to policymakers, given the potential for increased government tax revenues.

The significant increase in Canadian tobacco taxes since the late 1990s has been credited with dramatic reductions in the number of smokers (by roughly half) over the same time period.[2] On the other hand, the efficacy of higher cigarette taxes is tempered by the possibility of a rise in smuggling and the availability of contraband tobacco, which is a natural corollary to higher taxes. Increases to tobacco taxes result in higher prices, which provides an incentive for the provision of products that have been illegally produced, distributed and/or smuggled into the country, thus evading taxation.

Understanding the extent to which higher taxes result in the consumption of contraband tobacco is of key importance given the significant increases to tobacco taxes that have been recently implemented by the federal government and the provinces of Ontario and Quebec. Specifically, in 2013, federal, Ontario, and Quebec excise tobacco taxes on a carton of 200 cigarettes were $17, $24.70, and $25.80, respectively. They are now currently $21.03, $31 and $33. Along with relevant sales taxes, total per-carton tobacco taxes are roughly $60 and $55 in Ontario and Quebec, respectively, constituting 63 to 65 percent of average prices.[3] There have been significant concerns raised that these tax hikes will support a flourishing black market.[4]

This is the conundrum facing Canadian policymakers. Unlike most previous studies, this Commentary employs econometric methods to estimate the amount of contraband tobacco in both provinces on an annual basis over a relatively long time period. This allows a better understanding of the magnitude of contraband tobacco supply over time. The estimations suggest a steep decrease in illegal sales of cigarettes in Quebec since 2008, and a significant decrease in Ontario over the same period. While the number of contraband carton sales in Ontario declined by roughly 41 percent over the 2006-2014 period, the corresponding reduction in Quebec has been much more dramatic, at almost 89 percent.

The decline in illegal sales in Quebec is all the more remarkable given the roughly 25-percent increase in federal and provincial excise taxes over the same time span. In contrast, the corresponding increase in federal and provincial cigarette taxes

The author thanks Alexandre Laurin, Daniel Schwanen, Richard Bird, Ian Irvine, Tom Wilson and anonymous reviewers for comments on an earlier draft. The author retains responsibility for any errors and the views expressed here.

1 See Jha and Peto (2014) for further details.

2 Please see Non-Smokers' Rights Association (2009) and Irvine and Sims (2012) for an excellent history of tobacco taxation and contraband tobacco in Canada. Contraband cigarettes can be purchased from smoke shacks on First Nations territory or through other, off-reserve illegal networks. NSRA (2009) note four major sources of illegal supply: (1) illicit manufacturing operations in First Nations territories in Canada and the United States; (2) illegal importation of counterfeit copies of Canadian cigarette brands manufactured overseas; (3) Canadian brand-name cigarettes intended for reserves but made generally available and sold without all applicable taxes paid; and finally, (4) cigarettes stolen from convenience stores and truck shipments.

3 This percentage was calculated based on 2016 average carton prices estimates by the Non-Smokers' Rights Association and available at https://www.nsra-adnf.ca/cms/file/files/160203_map_and_table.pdf.

4 For example see 'Ontario budget 2016: Tobacco tax will support black market, critics say,' available at http://www.cbc.ca/news/canada/windsor/ontario-tobacco-tax-1.3466301.

in Ontario was much lower, at 10 percent. From another perspective, in Ontario, estimated illegal supply as a proportion of all carton sales fell from about 35 to 38 percent in 2008 to roughly 20 to 23 percent in 2014. The corresponding drop for Quebec was even more pronounced, from a high of nearly 31 to 34 percent in 2008 to roughly 4 to 5 percent in 2014.

Assuming that illegal contraband could be sold at existing tax rates, the total amount of lost federal and provincial excise and sales taxes in Ontario reached a maximum of approximately $1.4 billion to $1.6 billion in 2008, but dropped to roughly $816 million to $900 million in 2014. These estimates are lower than comparable results obtained by recent studies. Quebec experienced a much sharper decline, with lost tax revenue equal to roughly $617 million to $679 million in 2008 and $85 million to $93 million in 2014. In other words, lost tax revenue in Quebec from contraband is roughly a tenth of corresponding levels in Ontario. While there has been a significant drop in illegal products, it is important to acknowledge that the amount of contraband was quite high in the past and resulted in considerable losses to government tax revenues.

Broadly speaking, the statistical findings are consistent with Irvine and Sims (2012), who predicted that the market share of illegal products could be considerably reduced by increasing legal enforcement pressures on illegal suppliers. While it is not possible to provide a precise causal link, the statistical estimates reveal more police officers to be robustly correlated with higher legal sales. The reduced incidence of illegal products in the presence of increased taxation is also quite consistent with increased success of enforcement measures. However, it would be incorrect to assume that either federal or provincial governments can unilaterally keep increasing cigarette taxes. Tobacco taxes and cigarette prices are very high, and it is possible that further tax hikes would reverse the declining trend in contraband tobacco.

Review of Recent Studies

Numerous studies based on data from the 1990s and 2000s have demonstrated that changes to tobacco taxes are inversely related to either smoking rates or smoking participation in Canada.[5] However, recent research suggests that tobacco tax hikes from the late 1990s have resulted in a booming contraband market, facilitated by the efforts of organized crime.[6] Gabler and Katz (2010) acknowledge that while higher tobacco taxes reduce legal cigarette sales, these benefits may be attenuated given their role in facilitating the contraband market. They also note the possibility that proceeds from illegal cigarettes may be funnelled toward terrorist organizations.

In an update to a 2012 report issued by the Canadian Taxpayers Foundation, Van Geyn (2016) finds that the overall contraband tobacco trade in Ontario resulted in an estimated $832.6 million to $1.22 billion in lost federal and provincial tax revenue in 2014-15.[7] Her methodology is based

5 The range of adult smoking participation elasticities range from -0.1 to -0.4, with higher elasticities for youth (Sen, Ariizumi and Driambe, 2010). More on the relationship between tobacco taxes and smoking rates can be found in Galbraith and Kaiserman (1997), Hamilton et al. (1997), Gallet and List (2003), Gruber, Sen and Stabile (2003), Zhang et al. (2006), Irvine and Gospodinov (2005, 2011), Sen and Wirjanto (2010) and Sen and Fatima (2011).

6 Press releases by the Royal Canadian Mounted Police (RCMP) also suggest the seizure of significant amounts of contraband tobacco entering through the Central St. Lawrence Valley Corridor. The RCMP has organized a Combined Forces Special Enforcement Unit-Contraband Tobacco Initiative aimed at co-ordinating federal, provincial and municipal law-enforcement agencies to target organized crime involved in contraband tobacco smuggling. Please see 'Significant Contraband Tobacco Seizure: CRTF' available at http://www.rcmp-grc.gc.ca/on/news-nouvelles/2016/16-06-16-cornwall-eng.htm and 'Illicit Tobacco' available at http://www.rcmp-grc.gc.ca/ce-da/tobac-tabac/index-eng.htm for more detail.

7 Fildebrandt (2012) contains estimates of lost tax revenue from contraband tobacco based on earlier years.

on estimating the amount of tax-exempt tobacco allocated on Ontario aboriginal reserves, but eventually sold illegally to people who were not status Indians.

A recent study released by the Macdonald Laurier Institute finds even higher losses in tax revenue in Ontario, ranging from $1.6 billion to $3 billion each year. It concludes that governments and law-enforcement agencies need to do more to stem the flow of smuggled tobacco. The paper also points to the possibility of a connection between revenue from illegal sales and financing of terrorist organizations.[8]

On the other hand, while Guindon et al. (2016) find a clear upward trend in cigarette contraband in Quebec and Ontario from the early 2000s, their results also suggest a downward trend from 2007 to 2009. Zhang and Schwartz (2015) also find evidence of declining sales of contraband cigarettes in Ontario from 2008 to 2012, based on self-reported data from population-based surveys. This research contributes to the policy debate by offering estimates not only of the amount of contraband cigarette sales in Quebec and Ontario during a period of alleged significant smuggling (2006 to 2014), but also of corresponding losses in federal and provincial excise and sales taxes.

Estimating the Amount of Smuggled Cigarettes in Quebec and Ontario

Following previous studies, I focus on estimating lost tax revenue for Quebec and Ontario.[9] A primary contribution of this research paper is premised in the use of rigorous econometric methods to estimate the incidence of the contraband market.[10] The idea is straightforward: Data for provinces that did not experience significant smuggling (Alberta, Manitoba and Saskatchewan) from 1996 to 2014 are pooled along with data for Ontario and Quebec for years when smuggling did not reach serious levels (1996 to 2005) in these provinces. I employ these data to estimate the effects of various determinants of legal sales of cigarettes.

The specific empirical approach is to use a regression model in which the dependent variable is legal cigarette sales per capita of population aged 15 and over. The explanatory variables are the consumer price index for cigarettes, the province-specific unemployment rate for individuals aged 15 and over, the percentage of economic families living below the province's low-income cut off (LICO), a trend variable, the number of police officers per 100,000 of population, and province-specific dummy variables. Each of these variables has a clear relationship with the number of per-capita legal sales.[11,12] Empirical estimates are presented in the appendix (Table A1).

Estimation results for years when smuggling was not at significant levels yield estimates that can be used to predict the sales of legal cigarettes

8 See also 'Canada's flourishing contraband tobacco market helps fund overseas terrorism: report,' available at http://globalnews.ca/news/2608297/canadas-flourishing-contraband-tobacco-market-helps-fund-overseas-terrorism-report/.

9 As noted by Guindon et al (2015), contraband cigarettes are typically sold on First Nations reserves bordering Ontario, Quebec and the state of New York, or through illegal networks operating outside reserves that evade taxes.

10 Although Guindon et al. (2016) do not use econometric methods, their study is based on a very careful comparison of estimates of tax-paid aggregate cigarette sales with consumption estimates based on survey data, as well as the use of data from several individual-level surveys. Based on comprehensive simulations, Irvine and Sims (2012, 2014) find that in the presence of illegal supply, smokers would only redirect purchases to legal products in response to very large tax reductions, which would then stimulate increases in overall tobacco purchases.

11 The cigarette price index represents changes in real prices for legal cigarettes and a higher index should be associated with lower legal sales. The unemployment rate and percentage of people living beneath low-income cutoffs are intended to proxy the effects of socio-economic status on smoking. The number of per-capita police officers reflects the effects of enforcement on legal sales. Finally, province-specific dummies and the trend variable are meant to capture the impacts of unobserved province specific attributes and an overall trend.

12 Data on legal cigarette sales are available from http://healthycanadians.gc.ca/publications/healthy-living-vie-saine/wholesale-sales-2013-cigarettes-ventes-en-gros/index-eng.php. The other data are from CANSIM.

Table 1: Estimates of Contraband Cigarettes for Ontario and Quebec (2006-2014)

		Predicted Per Capita Sales in absence of smuggling ($)	Actual Per Capita Legal Sales ($)	Difference between Per Capita Predicted and Actual Sales ($)	Number of Smuggled Cartons (millions)
		(1)	(2)	(3)	(4)
2006	Ontario	1,665	1,116	549	28.0
2007	Ontario	1,623	994	629	32.5
2008	Ontario	1,582	895	687	35.9
2009	Ontario	1,565	921	643	34.0
2010	Ontario	1,521	1,047	475	25.4
2011	Ontario	1,471	1,008	463	25.1
2012	Ontario	1,451	1,014	438	24.1
2013	Ontario	1,430	1,013	417	23.2
2014	Ontario	1,245	919	325	18.3
2006	Quebec	1,588	1,033	554	17.3
2007	Quebec	1,537	954	583	18.4
2008	Quebec	1,510	920	590	18.8
2009	Quebec	1,415	1,006	409	13.2
2010	Quebec	1,387	1,163	224	7.3
2011	Quebec	1,353	1,164	189	6.3
2012	Quebec	1,331	1,177	154	5.2
2013	Quebec	1,235	1,136	100	3.4
2014	Quebec	1,103	1,041	62	2.1

Source: Author's calculations.

that should occur for years in which the levels of smuggled cigarettes were high. Specifically, the model can be used to predict legal sales that should have happened in the absence of smuggling in Ontario and Quebec for 2006 to 2014. These predicted values are higher than actual legal sales recorded for these years because of the presence of smuggling. Subtracting actual legal sales from predicted sales then yields an estimate of the amount of smuggled cigarettes in Ontario and Quebec for each year from 2006 to 2014.

This methodology is consistent with Gruber, Sen and Stabile (2003), who estimate the relationship between cigarette taxes and legal sales by excluding provinces that experienced high levels of smoking for certain years. An appropriate caveat is that the

model may yield differences in legal sales that may not necessarily be attributable to provincial and time differences in smuggling.[13]

Using the model presented in Table A1, I predict per-capita legal sales that should have occurred, absent smuggling, in Ontario and Quebec for each year from 2006 to 2014.[14] Results are presented in Table 1. Column 1 contains the predicted number of per-capita legal sales, while column 2 contains the actual per-capita legal sales. The difference between the two yields the estimated number of cigarettes per capita that are smuggled into the provinces (column 3). Finally, column 4 converts the per-capita cigarettes numbers into the corresponding number of cartons (consisting of 200 cigarettes) smuggled into Ontario and Quebec, by multiplying the estimates in column (3) with the corresponding number of population aged 15 and over.

From a theoretical perspective, these estimates reflect the assumption that absent smuggling, consumers purchasing contraband would have switched all their consumption to legal supply. This would result in a rightward shift in the demand curve for legal cigarettes as consumers previously purchasing illegal cigarettes will still buy the same number of cigarettes, which are now legally supplied, but at a higher cost relative to illegal purchases.

In other words, these estimates do not acknowledge a possible reduction in the number of cigarettes purchased by former contraband users. This is plausible if the demand curve for cigarettes is somewhat inelastic and consumers do save on transport or transaction costs associated with locating illegal supply.

However, there is evidence that illegal cigarettes can be purchased at extremely low prices, and in some circumstances, locating illegal supply is not extremely difficult.[15] Luk et al. (2007) find that illegal contraband is sold at less than one-third the price of legal products inclusive of taxes. Others suggest even more significant price differentials between legal and illegal products.[16]

For these reasons, this study estimates the total number of illegal cartons assuming that the prices of legal cartons are 30 to 50 per cent higher than corresponding illegal supply. Reductions in legal purchases are a function of conventional aggregate price elasticities ranging from -0.3 and -0.5.[17] If consumers previously purchasing illegal cigarettes experience the cost of legal cigarettes to be 30 percent higher, then they will reduce their consumption by roughly 12 percent, assuming a cigarette price elasticity of -0.4 (0.3 x -0.4). Hence, revised estimates of the number of illegal cartons sold were constructed, assuming a 30-percent and 50-percent price differential between legal and illegal supply and corresponding to different price elasticities.

Table 2 contains estimates of the total number of estimated illegal per-capita cartons and illegal cartons as a proportion of total estimated (legal and illegal) sales. For the sake of brevity, the table consists of estimates obtained assuming an aggregate price

13 Use of reasonable covariates along with province dummies and the trend should minimize the chance of such bias.

14 Given the similarities between the levels and log-log models, coefficient estimates of the levels specification were used for the exercise.

15 For example, see 'Clearing the smoke surrounding First Nations cigarettes, available at http://www.durhamregion.com/news-story/5160899-clearing-the-smoke-surrounding-first-nations-cigarettes/.

16 Please see 'Pre-Budget Consultation Hearings Speaking Notes John Clayton, Vice President Corporate Affairs, Imperial Tobacco Canada, available at http://www.imperialtobaccocanada.com/groupca/sites/imp_7vsh6j.nsf/vwPagesWebLive/DO82GTV2/$FILE/medMD82GU3H.pdf?openelement.

17 Consistent with Irvine and Sims (2014), it must be emphasized that the aggregate price elasticity is a function of the own price elasticity of demand as well as the cross-price elasticity of demand between legal and illegal cigarettes. The disadvantage of the simple back-of-envelope calculations is that they do not shed insight on whether the own-price elasticity or cross-price elasticity is more significant. However, results from Irvine and Sims (2014) do suggest that the cross-price elasticity is quite large and the own-price elasticity is much smaller, which is consistent with basic intuition.

Table 2: Estimates of Illegal Cartons as a Percentage of Legal Sales

Difference between Legal & and Illegal Prices	Ontario 30%	30%	50%	50%	Quebec 30%	30%	50%	50%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Estimated Smuggled Cartons per Capita of Pop. Aged 15 and over	Smuggled Cartons as a Prop. of Predicted Sales	Estimated Smuggled Cartons per Capita of Pop. Aged 15 and over	Smuggled Cartons as a Prop. of Predicted Sales	Estimated Smuggled Cartons per Capita of Pop. Aged 15 and over	Smuggled Cartons as a Prop. of Predicted Sales	Estimated Smuggled Cartons per Capita of Pop. Aged 15 and over	Smuggled Cartons as a Prop. of Predicted Sales
2006	483	29%	439	26%	488	31%	444	28%
2007	554	34%	503	31%	513	33%	466	30%
2008	604	38%	549	35%	520	34%	472	31%
2009	566	36%	515	33%	360	36%	327	23%
2010	418	28%	380	25%	197	14%	179	13%
2011	407	28%	370	25%	167	12%	151	11%
2012	385	27%	350	24%	136	10%	124	9%
2013	367	26%	333	23%	88	7%	80	7%
2014	286	23%	260	21%	54	5%	49	4%
Percentage Reduction	41%				89%			

Source: Author's calculations.

elasticity of -0.4. Corresponding estimates with aggregate price elasticities of -0.3 and -0.5 are not dramatically different and are available on request. Columns (1)-(4) are with respect to Ontario and columns (5)-(8) contain results for Quebec.

Table 2 offers some striking trends. First, while the number of per-capita illegal cartons was lower in Quebec in 2006, it was slightly higher as a proportion of all sales relative to Ontario. Second, both provinces experienced a peak in 2008, with illegal supply constituting roughly 35 to 38 percent of all sales in Ontario and 31 to 34 percent in Quebec. Third, the reduction in illegal supply has been dramatic in Quebec but less so in Ontario. In 2014, the proportion of illegal supply was 21 to 23 percent in Ontario and 4 to 5 percent in Quebec. In terms of per-capita sales, the number of illegal cartons declined by almost 41 percent from 2006 to 2014 in Ontario and by roughly 89 percent in Quebec over the same period. These estimates are consistent with Guindon et al. (2016), who employ a different methodology and focus on smoking participation as opposed to legal sales. They also find a decreasing trend in contraband from 2007 onward and particularly low levels of smuggling from 2010 onward in Quebec.

Estimating Lost Tax Revenue

Following this approach, estimates of the number of illegal cartons are multiplied by specific federal and provincial excise and sales tax rates. The results

are reported below in Table 3. Columns 3 and 4 contain estimates of the number of smuggled cartons corresponding to a 30-percent and 50-percent legal-illegal price difference (and an aggregate price elasticity of -0.4). Column 5 contains total federal and provincial excise taxes, while estimated carton sales taxes are found in column 6.[18] Column 7 consists of lost tax revenue, based on illegal supply estimates in column 3, while column 8 reports lost tax revenue based on illegal supply estimates in column 4.

There are some similar trends in both provinces. Lost tax revenue reached a maximum in 2008 at roughly $1.4 billion to $1.6 billion in Ontario and roughly $617 million to $679 million in Quebec. However, there is a pronounced decline after 2008 in both provinces. By 2014, the amount of lost tax revenue had declined to approximately $816 million to $897 million in Ontario and $84 million to $93 million in Ontario and Quebec, respectively.

Policy Discussion

A possible reason for the decline in illegal sales over time for both provinces could be more efficient policing and focused enforcement strategies adopted by enforcement agencies, particularly in Quebec. Leuprecht (2016) notes the success of Project ACCES in Quebec, which facilitates partnerships between federal and provincial agencies; one objective is stopping the flow of contraband tobacco. This initiative has been linked to significant seizures of contraband.

In this respect, the recent establishment of a specific Ontario Provincial Police unit to contraband tobacco is definitely a step in the right direction.[19] It is also important to note that that the observed decline in contraband tobacco from 2008 onward coincides with the launch of the RCMP's Contraband Tobacco Enforcement Strategy. Further, in May of 2010, a Combined Forces Special Enforcement Unit-Contraband Tobacco Initiative was established to bring together federal, provincial and municipal law-enforcement agencies to target organized crime involved in contraband tobacco smuggling in the St. Lawrence Valley region.[20] This emphasis on an area near or in Quebec as well as the unique initiatives launched by the Quebec government are probably responsible for the significant drop in contraband tobacco estimates for that province.

A relevant question is whether the declining trend in illegal cigarettes would persist with further tax increases. It is likely that, at some point, increases in excise taxes would stimulate the contraband market. However, a tax reduction is probably not a good strategy to further reduce contraband, especially given the success apparently achieved on this front. Irvine and Sims (2012) note that decreases in cigarette taxes would have to be quite significant to induce contraband users to switch to legal cigarettes, and any corresponding increase in tax revenue would likely be offset by health costs from a potential increase in smoking induced by reduced cigarette taxes. They suggest an increased emphasis on enforcement measures, which is supported by the positive and statistical significance of the police covariate in the regressions (Table A1).

It is important to acknowledge that cigarette taxes are high and have pushed up prices. While it is true that recent drops in contraband tobacco have coincided with higher taxes, this is certainly not a

18 Federal and sales taxes per carton were calculated based on estimates of average provincial prices constructed by the Non-Smokers Rights Association and available at https://www.nsra-adnf.ca/cms/file/files/140605_map_and_table.pdf.

19 http://cornwallfreenews.com/2016/01/25/kathleen-wynne-creating-another-layer-of-tobacco-enforcement-in-ontario-jan-25-2016/. It is also important to acknowledge the existence of specific contraband measures adapted by the Royal Canadian Mounted Police and discussed by Leuprecht (2016).

20 See http://www.rcmp-grc.gc.ca/ce-da/tobac-tabac/index-eng.htm.

Table 3: Estimates of Lost Excise and Sales Tax Revenue

Year	Province	Smuggled Cartons Assuming a 30% Legal-Illegal Price Difference (millions)	Smuggled Cartons Assuming a 50% Legal-Illegal Price Difference (millions)	Total Federal and Provincial Excise Tax on a Carton ($)	Estimated Sales Taxes Based on Average Carton Prices Collected by NSRA ($)	Lost Tax Revenue = Column 3 x (Column 5 + Column 6) ($ millions)	Lost Tax Revenue = Column 4 x (Column 5 + Column 6) ($ millions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006	Ontario	24.6	22.4	41.1	7.8	1,206	1,096
2007	Ontario	28.6	26.0	41.1	8.6	1,420	1,290
2008	Ontario	31.6	28.7	41.7	8.6	1,587	1,443
2009	Ontario	29.9	27.2	41.7	8.6	1,504	1,368
2010	Ontario	22.4	20.3	41.7	8.6	1,124	1,022
2011	Ontario	22.1	20.1	41.7	9.2	1,125	1,023
2012	Ontario	21.2	19.3	41.7	9.3	1,079	981
2013	Ontario	20.4	18.6	41.7	9.3	1,041	946
2014	Ontario	16.1	14.7	45.9	9.8	898	816
2006	Quebec	15.2	13.8	37.0	3.0	608	553
2007	Quebec	16.2	14.7	37.0	3.3	653	593
2008	Quebec	16.6	15.1	37.6	3.3	679	617
2009	Quebec	11.6	10.6	37.6	3.3	477	433
2010	Quebec	6.5	5.9	37.6	3.3	265	241
2011	Quebec	5.5	5.0	38.2	3.4	230	209
2012	Quebec	4.6	4.1	38.8	3.5	192	175
2013	Quebec	3.0	2.7	42.8	3.7	138	125
2014	Quebec	1.8	1.7	46.8	3.9	93	85

Source: Author's calculations.

causal relationship. From a theoretical perspective, the effects of higher taxes will be defined by the cost-benefit calculations conducted by smokers and the distribution of smokers by income level.

For example, it is possible that further tax increases would not significantly affect tax revenues if most of the smokers who currently purchase legal cigarettes are middle or higher income and a

significant proportion of low-income smokers already buy contraband. In this case, any reduction in tax revenue would primarily be a result of reductions in smoking by purchasers of legal cigarettes rather than increased consumption of illegal supply.[21]

Ontario would be well advised to think beyond simple tobacco tax changes intended at eliciting demand-side responses. The existence of contraband tobacco is facilitated by the Ontario government's Cigarette Allocation System (CAS), through which a certain number of tobacco products are allocated to each reserve according to a specific formula.[22] According to provisions of Section 87 of the Indian Act, tobacco products are allowed to be sold to status Indians, exempt of the HST and provincial excise taxes, upon presentation of a Certificate of Indian Status (CIS) card. The CAS limits the amount of tax-exempt purchases that can be made by status Indians. However, research by Van Geyn (2016) suggests that a significant portion of tobacco products distributed through CAS ends up as contraband sold to persons who are not status Indians, through smoke shacks on reserves and other means.

For a variety of reasons, any action by the Ontario Provincial Police aimed at entering reserves and curbing contraband tobacco sales is, in many instances, not feasible.[23] As noted by Van Geyn (2016), one strategy would be to reduce the number of cigarettes allocated to reserves through the CAS. While this would result in a short-term reduction, it would not stem the flow of contraband flowing from across the border in the United States or other countries. The key is to supplement reductions in CAS cigarettes by designing supply-side policies that give aboriginal governments incentives to stop the sale of contraband tobacco within reserves. As suggested by Leuprecht (2016), a possible strategy would be to allow aboriginal governments to charge lower taxes than those implemented by the province. This would still maintain a price differential relative to off-reserve cigarettes, albeit a lower one. Retailers would collect the tax revenue and remit it directly to local reserve governments, which could then allocate the funds to community development, infrastructure and job creation.[24]

Conclusion

The effects of increased tobacco taxes have been the subject of recent and extensive policy debate, with concerns primarily focused on the possibility of a lucrative black market. Besides the obvious loss in tax revenue, some studies point to the funnelling of black-market revenue to organized crime and terrorist activities.

This study distinguishes itself from others by employing rigorous econometric methods in order to estimate the amount of smuggled cigarette cartons along with associated lost excise tax revenues in Quebec and Ontario from 2006 to 2014. No other study has attempted to estimate contraband and lost tax revenue for these provinces over these years.

The findings are: First, while the amount of contraband has been quite significant in both provinces, it has been particularly significant for Ontario, with lost tax revenue of approximately $816 million to $900 million in 2014. In this context, it is important to emphasize that these estimates of lost tax revenue are lower than comparable findings from other studies. Second, the amount of contraband has declined over time for both provinces and coincided with an increase in excise cigarette taxes. Third, the reduction in contraband has been especially dramatic in Quebec. I estimate that the

21 These issues have been discussed by Irvine and Gopsodinov (2009).

22 Please see Leuprecht (2016) and Van Geyn (2016) for detailed discussions.

23 Please see Leuprecht (2016) for further explanation.

24 There have been some variations of such schemes implemented in other provinces. Leuprecht (2016) contains an excellent summary. "Please rewrite as" There have been some variations of such schemes implemented in other provinces. Leuprecht (2016) contains an excellent summary. Matheson (2015) and DeCicca et al. (2014) discuss the implications of differential tobacco taxes on reserves.

magnitude of contraband tobacco in Quebec is currently at quite low levels.

The decline in illegal sales can be at least partially attributed to additional federal and provincial resources devoted to law enforcement. Given the magnitude of the decrease in estimated lost tax revenues as a likely consequence of stronger policing, and the risks to higher tobacco taxes undermining fruitful enforcement efforts, it appears that Ontario in particular would be better off by focusing on strengthening enforcement and regulation instead.

APPENDIX

Table A1: Estimates of Regression with Legal Sales as Per Capita of Population Aged Fifteen and over (data from 1996-2014 for Alberta, Manitoba, and Saskatchewan and from 1996-2005 for Ontario and Quebec)

	Levels Model		Ln ln Model	
Independent Variable	Coefficient Estimate	t Stat	Coefficient Estimate	t Stat
Intercept	609.71	1.100	3.82	2.66
Unemployment Rate	-11.19	-0.52	-0.19	-3.21
Elasticity	-0.0423			
Cigarette Price Index	-5.66	-6.39	-0.321	-11.3
Elasticity	-0.38			
Percent beneath LICO	23.13	1.79	0.09	1.46
Elasticity	0.16			
Per Capita Police	8.93	2.83	1.12	3.90
Elasticity	1.07			
Province dummies and trend	YES		YES	
Adjusted R Square	0.87		0.93	
Number of observations	77		77	

Source: Author's calculations.

Table A1 presents the regression estimates for the levels model and for the double log model. Results are broadly comparable across both specifications. For ease of comparison, coefficient estimates of the levels model are also reported, along with corresponding elasticities that can be directly compared with coefficient estimates from the double log model. The overall fit of both models are quite high, which implies that the predictions of per-capita legal sales in a non-smuggling scenario should be quite accurate. The cigarette price index possesses the expected negative sign and is statistically significant at the 1-percent level for both models. The percentage of economic families is positive and significant at 10 percent with respect to the levels model, implying that lower-income households are more likely to purchase legal cigarettes. Coefficient estimates of the number of per-capita police officers are positive and statistically significant at the 1-percent level in both specifications, implying that more police officers are associated with higher levels of legal sales.

References

DeCicca, Philip, Donald S. Kenkel, and Feng Liu. 2014. "Reservation Prices: An Economic Analysis of Cigarette Purchases on Indian Reservations." NBER Working Paper No. 20778. December.

Fildebrandt, Derek. 2012. "How Much is Contraband Tobacco Costing Taxpayers in Ontario? A Look at the Cigarette Allocation System on Reserves and the Overall Contraband Problem in Ontario." Canadian Taxpayers Federation. Available at https://www.taxpayer.com/media/How%20Much%20is%20Contraband%20Tobacco%20Costing%20Taxpayers%20in%20Ontario%20-%20December%202012.pdf.

Galbraith, J.W., M. Kaiserman. 1997. "Taxation, smuggling and demand for cigarettes in Canada: evidence from time-series data." *Journal of Health Economics* 16:287–301.

Gallet, C.A., and J.A. List.2003. "Cigarette demand: a meta-analysis of elasticities. *Health Economics* 12:821–35.

Gruber J., A. Sen, M. Stabile. 2003. "Estimating price elasticities when there is smuggling: the sensitivity of smoking to price in Canada." *Journal of Health Economics* 22:821–42.

Guindon, G. Emmanuel, Robin Burkhalter, and K. Stephen Brown. 2016. "Levels and trends in cigarette contraband in Canada" Tobacco Control Published Online First: 6 September.

Hamilton, V.H., C. Levinton, Y. St-Pierre Y, et al. 1997. « The effect of tobacco tax cuts on cigarette smoking in Canada." *CMAJ* 1997;156:187–91.

Irvine, Ian, and William Sims. 2014. "The simple analytics of tobacco taxation with illegal supply." Canadian Journal of Economics/Revue canadienne d'économique, 47: 1153–1172.

_____. 2012. *A Taxing Dilemma: Assessing the Impact of Tax and Price Changes on the Tobacco Market.* Commentary350. Toronto: C.D. Howe Institute.

Irvine, Ian, and Nikolay Gospodinov. 2009. "Tobacco Taxes and Regressivity." *Journal of Health Economics* 28:375–384.

_____. 2005. "A 'Long March' Perspective on Tobacco Use in Canada." *Canadian Journal of Economics*, 38: 2.

Jha, Prabhat, and Richard Peto. 2014. "Global Effects of Smoking, of Quitting, and of Taxing Tobacco." *New England Journal of Medicine* 370:60-68. January.

Leuprecht, Christian. "Smoking Gun: Strategic containment of contraband tobacco and cigarette trafficking in Canada," report released by the MacDonald Laurier Institute, available at http://www.macdonaldlaurier.ca/files/pdf/MLILeuprechtContrabandPaper-03-16-WebReady.pdf.

Luk, Rita, Joanna E. Cohen, and Roberta Ferrence. 2007. "Contraband Cigarettes in Ontario." November. Available at http://otru.org/wp-content/uploads/2012/06/special_nov_2007.pdf.

Matheson, Jesse A. 2015. "Prices and social behaviour: Evidence from adult smoking in Canadian Aboriginal communities." *Canadian Journal of Economics* (48) 5: 1661–1693. December.

Sen, Anindya, and N. Fatima. 2011. "Do Lower Cigarette Taxes Increase Smoking? Evidence from the Canadian National Experiment." *Canadian Tax Journal* 59: 221–238.

Sen, Anindya, Hideki Ariizumi, and Daciana Driambe. 2010. "Do Changes In Cigarette Taxes Impact Youth Smoking? Evidence from Canadian Provinces." *Forum for Health Economics & Policy*. 13: 2. August.

Sen, Anindya, and Tony Wirjanto. 2010. "Estimating the impacts of cigarette taxes on youth smoking participation, initiation, and persistence: empirical evidence from Canada.," *Health Economics*, John Wiley & Sons, Ltd., vol. 19(11):1264-1280.

Van Geyn, Christine. 2016. 'How much is contraband tobacco costing taxpayers in Ontario?" Report released by the Canadian Taxpayers Federation and available at http://www.taxpayer.com/media/CTF-ChristineVanGeyn-ContrabandTobaccoReport.pdf.

Zhang B., J. Cohen, R. Ferrence et al. 2006. "The impact of tobacco tax cuts on smoking initiation among Canadian young adults." *American Journal of Preventive Medicine* 30:474–9.

Zhang, B., and R. Schwartz. "What Effect Does Tobacco Taxation Have on Contraband? Debunking the Taxation – Contraband Tobacco Myth." Toronto: Ontario Tobacco Research Unit, Special Report, February 2015.

Recent C.D. Howe Institute Publications

February 2017	Robson, William B. P., Alexandre Laurin, and Rosalie Wyonch. *Getting Real: A Shadow Federal Budget for 2017.* C.D. Howe Institute Commentary 470.
February 2017	Robson, William B. P., and Alexandre Laurin. *Hidden Spending: The Fiscal Impact of Federal Tax Concessions.* C.D. Howe Institute Commentary 469.
February 2017	Ciuriak, Dan, and Jingliang Xiao. *Aftershocks: Quantifying the Economic Impacts of a US Border Adjustment Tax.* C.D. Howe Institute Working Paper.
February 2017	Robins, Steven. "A Better Flight Path: How Ottawa can Cash In on Airports and Benefit Travellers." C.D. Howe Institute E-Brief.
February 2017	Koeppl, Thorsten, and Jeremy Kronick. *Blockchain Technology – What's in Store for Canada's Economy and Financial Markets?.* C.D. Howe Institute Commentary 468.
January 2017	Robson, William B.P. *Enduring Virtues: Saving and Investing as National Priorities for Canada in 2017.* C.D. Howe Institute Commentary 467.
January 2017	Ciuriak, Dan, and Jingliang Xiao. *Protectionism and Retaliation.* C.D. Howe Institute Working Paper.
January 2017	Rémillard, Richard. *Government Intervention in Venture Capital in Canada: Toward Greater Transparency and Accountability.* C.D. Howe Institute Commentary 466.
January 2017	Hicks, Peter. *Toward a New Balance in Social Policy: The Future Role of Guaranteed Annual Income within the Safety Net.* C.D. Howe Institute Commentary 465.
January 2017	Johnson, Jon R. *The Art of Breaking the Deal: What President Trump Can and Can't Do About NAFTA.* C.D. Howe Institute Commentary 464.
January 2017	Sutherland, Jason M., and Erik Hellsten. *Integrated Funding: Connecting the Silos for the Healthcare We Need.* C.D. Howe Institute Commentary 463.
January 2017	Guo, Huijie, and David R. Johnson. "Unfair Advantage? School Fundraising Capabilities and Student Results." C.D. Howe Institute E-Brief.
December 2016	Found, Adam, and Peter Tomlinson. "Business Tax Burdens in Canada's Major Cities: The 2016 Report Card." C.D. Howe Institute E-Brief.

Support the Institute

For more information on supporting the C.D. Howe Institute's vital policy work, through charitable giving or membership, please go to www.cdhowe.org or call 416-865-1904. Learn more about the Institute's activities and how to make a donation at the same time. You will receive a tax receipt for your gift.

A Reputation for Independent, Nonpartisan Research

The C.D. Howe Institute's reputation for independent, reasoned and relevant public policy research of the highest quality is its chief asset, and underpins the credibility and effectiveness of its work. Independence and nonpartisanship are core Institute values that inform its approach to research, guide the actions of its professional staff and limit the types of financial contributions that the Institute will accept.

For our full Independence and Nonpartisanship Policy go to www.cdhowe.org.

C.D. HOWE
INSTITUTE

67 Yonge Street, Suite 300,
Toronto, Ontario
M5E 1J8

Canadian Publication Mail Sales
Product Agreement #40008848