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A Taxing Dilemma: Assessing the Impact of Tax and Price Changes on the Tobacco Market

By analyzing the impact of tax and price changes on the cigarette market, the authors determine how policymakers can best reduce the sales of illegal tobacco products in Canada.

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THE STUDY IN BRIEF

Sales of contraband cigarettes in Canada constitute a sizable component of the tobacco market. This illegal trade is associated with a loss in tax revenue and an array of illicit activities that involve gangs and organized crime. Various policy responses have been called for to counter this state of affairs. Increased policing and controls have resulted in the market share of the illegal product declining significantly to about 20 percent in 2010 from about one-third two years earlier.

In addition to allocating more resources in order to control the problem, governments have been urged to lower tobacco taxes in the belief that lower relative prices for the legal product will induce smokers to switch in significant numbers away from the illegal supply source, perhaps also increasing tax revenues. This *Commentary* analyzes the impact of tax and price changes on the composition of the cigarette market in the context of a demand-driven analytical model, in which smokers shift between legal and illegal products to a significant degree.

We find that tax reductions would have only a modest impact on the share of the illegal product, cause a decline in tax revenues and result in a small increase in total consumption. However, if the price of the illegal product could be raised further by increasing the legal or enforcement pressures on suppliers, then the market share of the illegal product could decline even further.

We emphasize that tax policy should be based not only on its impact on the total quantity of cigarettes purchased, but also on the social, legal and enforcement costs associated with the illegal supply.

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Smoking is associated with a number of health disorders and shortens the expected lifespan of smokers. As a consequence, governments seek to limit the habit through both price and quantity-based measures.

Price measures take the form of taxes that are designed primarily to reduce tobacco consumption and, secondarily, to increase tax revenue. Quantity, or restrictions-based, measures have taken the form of health warnings on cigarette packages, smoking bans in public places such as bars, restaurants and the workplace, limitations on sponsorship of public events by tobacco manufacturers, limitations on displays in retail outlets and so forth.

Implementing these measures involves a trade-off between the benefits of reduced consumption and the cost of implementing the restrictions. Potential benefits include better health, reduced hospital costs in a publicly funded health system and cleaner air. Costs come in the form of reduced satisfaction to smokers, who pay more for their habit, as well as the administrative and unintended social costs that accompany assertive anti-tobacco measures. The most disconcerting consequence of current high tobacco taxes in Canada has been the increase in illegal supply from First Nations sources that is not legally available to individuals living off-reservation and, more recently, an increase in counterfeit tobacco products from Asia.¹

This *Commentary* focuses on the effect of tax policy on tobacco use and, in particular, the

impact of taxation on prices and consumer choice between illegal and legal cigarettes. By modelling consumer choices, we find that tax reductions on legal purchases would modestly reduce the share of the illegal product, cause a decline in tax revenues and result in a small increase in total cigarette consumption. For tax policy to drive out the illegal market, tax reductions would have to be substantial. But such tax reductions would reduce tax revenues dramatically and increase overall consumption.

Ultimately, tax policy decisions should be based not only on their impact on the total quantity of cigarettes purchased, but also on the social, legal and enforcement costs associated with the illegal supply. Sound policymaking needs to find the appropriate balance of taxes, restrictions and controls on the illegal market. However, if the price of the illegal product could be raised by increasing the legal or enforcement pressure on its suppliers, then the market share of the illegal product could decline without increases in overall consumption.

The Growing Illegal Supply of Cigarettes

The share of the Canadian tobacco market attributable to illegal supply has varied considerably

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- 1 Status Indians are obligated to pay only federal excise duty and excise tax on cigarettes, but do not have to pay federal goods and service tax, nor provincial sales tax, nor provincial tobacco taxes for tobacco products sold on the reserve. As a result, these products are not meant to be sold to those living off reserve. This is the major source of the illegal supply of cigarettes. An overview of the recent history of the tobacco market in Canada and its illegal component, in particular, is provided by Gabler and Katz (2010).

in recent years. Police and security reports indicate that it grew from essentially zero in the early years of the millennium to perhaps one-third of the national market by 2008, with most of this being concentrated in the provinces of Quebec and Ontario (Gendarmerie Royale du Canada 2009 and Non-Smokers Rights Association 2009). Other evidence suggests that the share has since declined to perhaps 20 percent or less in 2010 (Withington 2010 and Info-Tabac 2011). This decline appears to be due largely to concerted police efforts (Ministère de la Sécurité publique 2011).

Apart from the fact that illegal tobacco sales limit the effectiveness of some of the quantity or restrictions-based measures enumerated above,² they also evade taxes and have been associated with gangsterism,³ an increased ability to trade in other illegal products, higher police and law enforcement costs and a decline in social capital (RCMP 2005). Furthermore, there is evidence that illegal tobacco products are even more toxic than legal tobacco (Health Canada 2009).

This state of affairs has led to calls for stronger enforcement against the illegal trade on the one hand and for reduced taxes on the legal products on the other. Indeed, stronger enforcement has been the norm in both Ontario and Quebec since 2008. Ministries and police forces at local, provincial and national levels have stepped up patrols and surveillance in the Valleyfield, Que., and Cornwall, Ont., areas, where much of the illegal product originates, having been smuggled from the US side of the Akwesasne Reserve (Ministère de la Sécurité publique 2011).

In addition, Quebec and Ontario have instituted higher penalties and more explicit police-search rights in their war against illegal tobacco sales. For example, Ontario's Bill 186, enacted last year, permits seizure of illegal product if it is "in plain view."

Despite the growth in awareness, the presence of higher penalties, the introduction of new markings on the legal product and increased checks on retailers to ensure they are not distributing illegal or counterfeit goods, the fact remains that the illegal sector still appears to account for a sizable share of the tobacco market. This suggests that increased policing has led smokers and distributors to be more cautious in their activity, rather than to quit the activity altogether.

Furthermore, it is not clear that police have the power to search vehicles in the neighbourhood of smoke shacks, where tobacco is sold on native reserves. Nor has there been any move to close down smoke shacks or illegal manufacturers located on reserves, either by First Nations or non-First Nations authorities.

In the present political climate, it would be both difficult and of limited value for provincial or federal authorities to attempt a move against illegal production on First Nations lands within Canada. The memory of the 1990 Oka Crisis, pitting the Mohawks and Quebec authorities in a potentially explosive confrontation, remains vivid. Furthermore, even if illegal production facilities were closed or reduced in number, the major source of supply from the US side of the border would remain beyond federal or provincial control if it passed through reserves that straddle both countries.

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- 2 Of particular concern are the lack of health warnings since the illegal product comes mainly in the form of rolled cigarettes in 200-unit Ziploc bags (MSP 2011) and of regulations limiting youth access. For example, a study by the Convenience Store Association of Canada (2009), studying the origin of cigarette butts at selected schools, revealed that the incidence of illegal cigarette use by teens in Ontario schools in selected areas was 30 percent and as high as 45 percent in selected jurisdictions in Quebec.
- 3 According to the 2008 Criminal Intelligence Service Canada Threat Assessment, 100 of the 924 organized crime groups identified nationally were involved in the trade of illicit tobacco. Of note, 78 of these tobacco crime groups were also active in other forms of criminality (Task Force on Illicit Tobacco Products 2009).

Given the likelihood of declining incremental benefits from enforcement, even though such measures would likely further reduce supply, it is reasonable to ask if policies aimed at changing prices might be more effective. In particular, could a tax reduction on legal products effect a positive rebalancing of the market?

How Did We Get Here?

Throughout the 1980s, taxes on tobacco products increased gradually, primarily with a view to reducing the consumption of tobacco. A groundbreaking 1964 report from the US Surgeon General had stressed that cigarettes shortened smokers’ life expectancy through their impact on the development of lung cancer and myocardial infarctions. In Canada, this higher tax policy was accompanied by a decline in the percentage of the population that smoked. Taxes were further increased in the early nineties. But this gave rise to a type of smuggling facilitated by Canada’s cigarette manufacturers: Canadian-made cigarettes were exported to the United States – since the cigarettes were exported, they were tax-exempt – then smuggled back into the country and sold under the counter on such a scale that they accounted for half of all sales in Quebec and Ontario.

As a result two measures were taken to stem this tide. In 1994, the federal and provincial governments forged agreements that resulted in lower tobacco taxes in several provinces.

Subsequently, they introduced measures that made it more difficult for manufacturers to export cigarettes without paying taxes. By the late nineties, pressures were again mounting from health groups for higher tobacco taxes. The 2000–2005 period saw a very substantial increase in such taxes. Consequently, illegal supply resurfaced, but this time it came in the form of tax-exempt cigarettes from First Nations reserves,⁴ which were illegally sold to off-reserve consumers.

A further critical development took place in the middle of this most recent decade: Canada’s big-three manufacturers began to market a discount product – one that sold for less than the traditional premium or regular product. It bears the same excise taxes as the premium product, yet bridges the price gap between the premium product and the illegal product supplied by First Nations producers. It currently accounts for approximately the same market share as the premium product.

Figure 1 illustrates the trend in the combined federal and provincial tobacco taxes levied in Ontario and Quebec from 1996 to 2008.⁵ While describing tobacco tax history is relatively straightforward, describing cigarette price history⁶ for the most recent decade is more problematic. The available official price indices should be used with caution because of the dramatic change in product composition in the legal market on the one hand and the exclusion from official indices of the illegal component on the other.

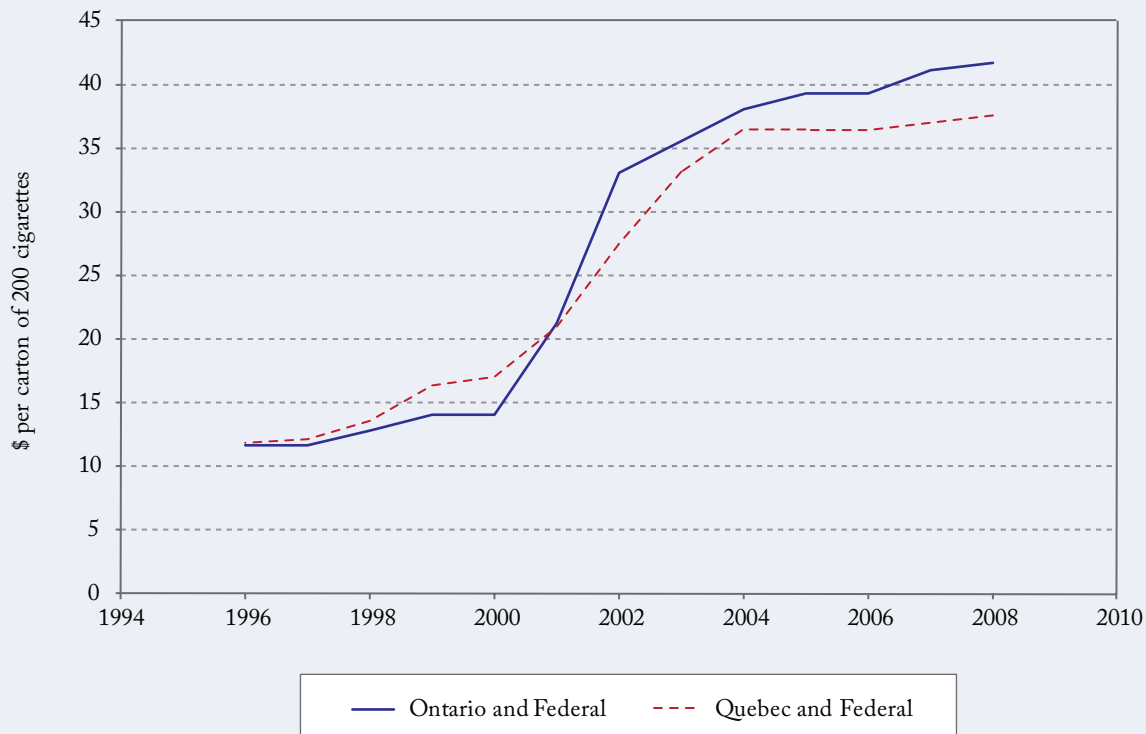
4 A very large proportion of this contraband is not manufactured in Canada (MSP, p. 4), but is smuggled across the US border, mainly near Cornwall, Ont. Furthermore, many of the manufacturing facilities operated on First Nations reserves in Canada are illegal. “The RCMP estimates that there are approximately 43 unlicensed manufacturers in Aboriginal territories in Canada and eight unlicensed manufacturers on the US side of the Akwesasne Mohawk territory that supply the Canadian market (Task Force on Illicit Tobacco Products, pp. 3-4).”

5 Thanks are due to Nachum Gabler for supplying these data.

6 The cigarette component of Canada’s CPI increased in nominal terms between 1999 and 2009 by more than a factor of two, with much of this increase coming between 2001 and 2005. The values of the index from CANSIM Series V41693515 are as follows (2002 = 100):

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
64.1	67.1	75.8	100.0	116.2	124.9	128.9	132.5	138.4	141.2	145.4

Figure 1: Federal and Provincial Cigarette Excise Taxes 1996-2008



Source: Authors' calculations.

A discussion of the methods used by Statistics Canada to integrate new products (in this case, the discount product) is beyond our scope. Nevertheless, since price indices are by definition averages of product components, the problem with interpreting a cigarette price index for recent years is that the cheaper components of the average cigarette price are new. An average cigarette today is much less expensive than an average cigarette was in 2004 because of the increasing supply of cheap illegal cigarettes and the emergence of the legal discount product.⁷

On the consumption side, smoking rates have declined considerably in the past decade. Health Canada data based on its annual Canadian Tobacco

Use and Monitoring (CTUM) surveys (Health Canada 2011) indicate that smoking participation fell from 21 percent in 2001 to 17 percent in 2009 for individuals aged 25 and above. Rates in the late nineties were in the region of 24 percent according to CTUM surveys. Production and sales data (Statistics Canada various years) suggest a 25 percent decline in domestic production and sales between the late nineties and 2005.

Thus, tobacco consumption has been on the decline for a decade, and appears to have fallen by about one-quarter from its level in the late nineties. Reductions in use have been particularly noticeable among youth, a clear public health benefit.

7 Another way of perceiving this problem is to recognize that the nature of the average cigarette itself has changed.

In addition to tax increases, the past decade was also characterized by large-scale smoking bans and numerous other supply-side measures designed to reduce consumption, such as the banning of sales displays in retail outlets and the introduction of health warnings on packages. If these measures lowered consumption, then tax-related price increases are responsible for only a portion of the reduced smoking rates we have witnessed. This suggests that the responsiveness of demand to tax increases may be smaller than these raw data suggest.

As well, in an era when a substantial part of the market is comprised of illegal products, respondents to government surveys on their smoking patterns may be more reluctant to offer truthful responses than when the market is composed totally of legal sales. However, even the resulting greater-than-normal underestimation,⁸ which universally characterizes such surveys, likely does not invalidate the general trends that emerge from CTUM surveys.

It is worth emphasizing that tax measures have different consequences for the illegal market than restrictions-based measures. Taxes provide an incentive for smokers to use the cheaper illegal product, whereas use-restrictions in particular are unlikely to create such an incentive.⁹

Illegal vs. Legal Product Prices: The Tax Reduction Proposal

Reducing tobacco taxes is highly controversial, as it would increase consumption. Broadly, health advocates would prefer to see high tobacco taxes and even stronger enforcement, while retailers would prefer to see lower taxes (and hence, prices), in addition to stronger enforcement. The Canadian Convenience Stores Association, an agency favouring reduced taxes, commissioned a report (Ouellet 2010) that claimed lower taxes in 1994 had a negligible impact on cigarette consumption. This met with contrary findings from reports commissioned by health groups (Guindon 2010, Pinheiro et al. 2010). A recent contribution using data from the eighties and nineties indicates that, while demand responses for cigarettes to tax-induced price changes are small, they are certainly not zero (Sen and Fatima 2011).

Supporters of reductions in tobacco taxes believe that such changes induce smokers to substitute the legal product for the illegal one, producing increased tax revenues while having a minimal impact on overall smoking rates.¹⁰ Our objective is to explore and analyze this belief, which depends

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- 8 It is universally recognized that respondents in smoking surveys understate their consumption to a considerable degree even when consumption is legal. But the down-side bias has possibly increased since the middle of the first decade of this century. If this is the case, then smoking participation is proving to be considerably more stubborn than policymakers envisaged a decade ago. The response rates that emerge from the Canadian Community Health Surveys (CCHS) suggest that smoking participation is a few points higher than reported in the CTUM surveys. The CCHS surveys typically interview about 130,000 individuals biennially on an enormous variety of health matters. In view of the fact that domestic sales data, historically, suggest consumption levels that are about 50 percent higher than reported in the CTUM surveys, the CCHS rates are probably closer to reality.
- 9 DeBartolome and Irvine (2010) propose that high-volume smokers should be more willing to use the illegal market than low-volume smokers, because the financial benefit of the lower price, relative to the risk of acting illegally, is less for the latter group. Hence if bans transform some high-volume smokers into low-volume smokers, such individuals may no longer deem the value of the lower priced illegal product to be sufficient to offset the risk associated with it, and hence may switch to the legal product. Evidence in support of this can be found in Irvine and Nguyen (2011).
- 10 The challenge for tax policy is that while overall purchases of cigarettes are inversely related to tax rates, the illegal component of cigarette sales varies directly with tax rates on the legal product. Consequently, if we could determine an “optimal” tax rate, that rate would balance the health benefits with the costs associated with illegal activity. Our objective here is not to search for such a value of the tax rate; instead, it is to examine the likely behaviour of smokers to changes in tax rates and prices.

on assumptions regarding the degree to which smokers would be willing to switch from the illegal to the legal product. Our approach is simply to be explicit about such assumptions and investigate their consequences. As part of this investigation, we have also searched the literature on consumer behaviour in an attempt to establish exactly how much switching would seem reasonable in this case.

This study is undertaken with an analytical model of cigarette demand. While we do not present the explicit mathematical details of this model,¹¹ its main elements are easily understood. The numerical results that emerge provide insight into the impact of policies designed to limit the demand for illegal cigarettes. In particular, the impact of excise tax reductions on cigarette demand is investigated.

Our objective is not to propose that tax reductions be substituted for controls of the type already in place; instead, we investigate these tax reductions as one possible policy among many. To this end, we simulate the effects of reducing tobacco taxes on consumption levels, on government tax revenues and on the size of the illegal cigarette market. Specifically, we deal with the likely effects of the following initiatives: i) tax reductions on the legal product; ii) even stronger legal and policing measures against illegal tobacco distribution; iii) a combination of these two policies; and iv)

a restructuring of the present tobacco tax system, which relies primarily upon a tax on quantity, in favour of one that envisages a stronger role for taxes based on value.

We find that no one policy stands out as an obvious choice for policymakers. At the same time, we believe that relative prices matter greatly – the present situation¹² arises precisely because of the radical difference in the prices of what are perceived to be similar products. Hence, even if tax reductions do not provide an easy fix, we emphasize that such a finding should not be used to justify further tax increases. Such increases would further increase the price spread between the legal and illegal products and, consequently, place more pressure on enforcement and exacerbate the problems that attend the illegal market.

MODELLING CONSUMER RESPONSES

The responses of smokers to tax changes, in terms of consumption and use of the illegal product, are simulated in a simple model described below.¹³ The model portrays “average” consumer behaviour when deciding among different cigarette products. It is also used to simulate the impact of an increase in supply-side restrictions and the resulting price increase on consumption of the illegal product.

11 This detail can be found in Irvine and Sims (2011).

12 Canada is not the only economy suffering from illegal tobacco supply problems. This sector accounts for more than 20 percent of the total UK market, with similar percentages for some other European economies (West et al. 2008). In those cases, the illegal supply arrives primarily from Eastern European countries. Indeed, even in the United States, where tobacco taxes have been very low historically, there is concern about the possible growth in supply from Indian reservations in the face of recent dramatic increases in state taxes. At the present time, a pack of cigarettes costs around \$10 in New York City and this has given rise to concerns and legal disputes over the treatment of reservation sales (Tobacco Free Kids 2010).

13 A more detailed presentation can be found in Irvine and Sims (2011). This model focuses upon the total amount of tobacco smoked rather than on the percentage of the population that smokes. The public debate on smoking is frequently framed in the latter context. But, under certain conditions, if the objective is to reduce the health costs of smoking, a superior outcome could be to induce heavy smokers to reduce the quantity they smoke, rather than getting low-volume smokers to quit. Irvine and Nguyen (2011b) suggest that the number of hospital days incurred by occasional smokers is not very different from days incurred by those who have never smoked.

The model assumes a price increase of the illegal product resulting from further limiting the availability of the illegal product through stronger enforcement and/or additional legal powers. Such pressures would make supply and consumption of the illegal product more difficult and risky and this, in turn, would place upward pressure on price. For example, the imposition of larger fines on those caught consuming or supplying the product, along with an increased probability of being caught, would result in a higher street price directly or as a result of the increased risk of consumption.¹⁴

In general, consumers are assumed to first allocate total planned expenditures among a group of desired commodities. This allocation is based on prices and the planned level of total expenditure. These broad categories of needs and wants are, for example, food, shelter, transport and, possibly, cigarettes.

In the case of cigarettes, the prices of premium, discounted and illegal cigarettes are considered. These prices also determine the overall price index for cigarettes, which influences the allocation of the consumer's budget between cigarettes and other aggregate commodities. The model parameters are initially chosen such that the quantity-demand predictions that emerge from the model mimic actual market shares of the various types of cigarettes at the initial prices.

The effects of changes in taxes or in the assumed price of illegal cigarettes are then simulated by finding the predicted shares at the new prices.¹⁵ Two parameters play a key role in the exercise: (i) the overall cigarette demand response to changes in its own price index – the demand elasticity;¹⁶ and (ii) the ease with which the three cigarette products can be substituted for one another.¹⁷ (See Box A for more detail on the assumptions.)

Base Case Assumptions

The model is run using initial prices of \$9.50 for a pack of 20 premium cigarettes, \$7 for the discount product and \$3 for the illegal product. These prices are based on the 2009 tax and price structure in Quebec and Ontario. The various provincial and federal taxes together amounted to almost \$40 per carton of 200 cigarettes. Hence, we suppose that the tax component in the price of the premium and discounted cigarettes amounts to \$4.50 per pack.

It is the relative prices here that are critical, not the units of measurement. For ease of interpretation, we set the initial value of the price index at 10¹⁸ and the initial value of the quantity-of-cigarettes aggregate also at 10. The assumed initial total expenditure is \$100. The model is calibrated initially to yield predicted (observed)

14 Sweeting, Johnson and Schwartz (2009) discusses various possible anti-contraband measures in considerable detail. One possibility involves an agreement to increase on-reserve prices through taxes, with an accompanying agreement to reroute the subsequent revenues back to the respective bands. Health benefits would accrue to reserve residents from such a policy. However, since a high proportion of the on-reserve illicit tobacco is smuggled from the United States (MSP 2011), this approach would not likely be effective in all cases.

15 It is assumed here that changes in taxes are fully reflected in the market prices of legal cigarettes.

16 Numerically, this is defined as the percentage change in the quantity of cigarettes demanded in response to a 1 percent change in its price. A small value (less than one in absolute value) implies that demand is not very responsive and hence is called inelastic. Research indicates that cigarettes, as an aggregate category, have such an inelastic value.

17 Economists refer to this as the elasticity of substitution. A higher value implies a greater ease of substitution among the three categories of cigarettes.

18 This could also be interpreted as a starting dollar value for this aggregate.

Box A: Consumer Responses to Prices

When a price or prices in the trio of cigarette products change, it impacts the overall cigarette price index. Research indicates that the responsiveness of cigarette demand to price changes is low. Our preferred numerical estimate of cigarettes demanded in response to a change in price is -0.3 ; that is, a 10 percent price increase results in a 3 percent reduction in consumption.^{a,b}

Therefore, in the case of a single product, such as cigarettes, where demand is not very responsive to price changes, tax revenues will fall as a consequence of any tax reduction. First, less tax revenue is generated on existing sales and, second, the increase in sales due to the tax decline is small. In other words, additional tax revenue on extra sales is insufficient to compensate for the decline in tax revenues on continuing existing sales.

In our model, the demand for cigarettes in the aggregate is relatively unresponsive to price changes. Yet it is still possible for tax revenues to increase as a result of a tax reduction, if a substantial shift takes place from the illegal toward the legal products. Hence, the substitution parameter is critical in determining the results. Thus, although tax reductions decrease prices and expenditures on cigarettes, the impact on tax revenues, a priori, is indeterminate.

The substitution parameter works through changes in prices within the cigarette group. A high substitution parameter means that consumers are willing to switch between different cigarette products as a result of relative price changes. This is the route through which taxes can be effective in our model, despite the relatively unresponsive nature of cigarette demand in the aggregate: tax measures can induce consumers to switch between the legal and illegal sectors.

From a policy standpoint it is clear that tobacco tax-reduction advocates believe implicitly that the cigarette components are very interchangeable: that consumers will substitute the legal for the illegal product as the price gap decreases. Advocates of high-tax policies, however, would argue that the price impact is small or insignificant, or that the resulting increase in overall cigarette consumption from tax reductions counterbalances the gain from reductions in the illegal product.

It is possible to simulate the model using a variety of assumptions on the degree of cigarette product substitutability.

^a We also experiment with values above and below this value – in the range of -0.1 to -0.5 . Sensitivity results are provided in Irvine and Sims (2011).

^b The literature on the tobacco demand elasticity in Canada is reviewed in Sen et al (2011). They find overall elasticities of daily participation in the neighbourhood of -0.15 for men and approximately zero for women, with some variation by age group. Fletcher, Deb and Sindelar (2009) also find very low estimates based on recent US data.

market shares, with assumptions for substitution products following changes in relative prices.¹⁹
that facilitate substantial switching between

19 Numerically, the value of the elasticity of substitution is set at 2.5. An obvious question arises: is the degree of assumed substitution consistent with available estimates of product substitution on the part of consumers? A search of the empirical literature indicates that our assumed substitution parameter is at the upper end of such empirical findings for other products. In the absence of estimates of this parameter for cigarettes, we have adopted a high value because (a) the three cigarette types appear to be close substitutes, (b) because the discount product has assumed a major role in the marketplace and (c) consumers have revealed themselves willing to purchase significant amounts of the illegal product instead of the legal alternative. Hence the findings we present could be interpreted as essentially representing an upper-end estimate of the possible efficacy of tax and price policies. This issue is discussed further in Irvine and Sims (2011).

Table 1: Simulating the Impact of a \$1-per-pack Tax Decline^a

	Base Case	After-Tax Change	
			<i>% change</i>
Expenditure on cigarettes	\$100.00	\$91.80	-8.2
Cigarette price index	10.0	8.9	-11.2
Cigarette aggregate	10.0	10.3	3.4
Share of cigarette expenditures on:			
	<i>Percent</i>		
• premium cigarettes	49	48	-2.0
• discount cigarettes	41	43	4.9
• illegal cigarettes	10	8	-16.0
Proportion of cigarettes^b comprised of:			
	<i>Percent</i>		
• premium cigarettes	36	36	0.0
• discount cigarettes	41	46	12.2
• illegal cigarettes	23	18	-21.7
Tax Revenues	\$49.60	\$41.40	-16.5
Tax revenue per \$ of cigarette expenditure	.496	.451	-9.1

Source: Authors' calculations.

^a Own price elasticity of demand for cigarettes = -0.3; substitution elasticity = 2.5; cigarette price and quantity indices equal 10 in the base period, prior to the tax change.

Base values: $p_1 = 9.5, p_2 = 7.0, p_3 = 3.0; t_1 = 4.5, t_2 = 4.5, t_3 = 0.$

Simulated values: $p_1 = 8.5, p_2 = 6.0, p_3 = 3.0; t_1 = 3.5, t_2 = 3.5, t_3 = 0.$

^b "Cigarettes" here refer to total number of cigarettes sold and not the cigarette aggregate.

THE RESULTS: CONSUMPTION AND SIZE OF THE ILLEGAL MARKET UNDER REFORMS

Given the foregoing, the base case results appear in the second column of Table 1. These base values are intended to mimic actual market conditions prior to the implementation of tax changes. The premium product accounts for 36 percent of all cigarettes sold; the discount product 41 percent and the illegal product 23 percent. These values correspond to estimates provided by industry analysts.

Scenario 1: A Decrease in Taxes on the Legal Product

The first experiment (see Table 1) is to reduce the cigarette tax component by one dollar from \$4.50 to \$3.50. The initial impact of this decline is to reduce the overall price by 11.2 percent—the price index declines from 10 to 8.88 (Table 1). The overall number of cigarettes consumed responds to this change in prices, producing a 3.36 percent demand increase (-11.2 x -0.3). Consequently, expenditure declines from \$100 to \$91.8 (8.88 x 10.336). This is the expenditure upon which the new predicted shares are based in the third column.

The major changes in the quantities demanded are reflected in the discount and illegal products: the discount product increases its market share by five percentage points and the illegal product declines by five percentage points. The premium product maintains its share.

From the government's perspective, the cost of the tax decline is the amount of tax revenue lost and, from a public policy standpoint, the increase in the quantity of cigarettes being consumed. Tax revenues decline by 16.5 percent in this simulation.

Meanwhile, the share of cigarette expenditure attributable to taxes declines from 49.6 percent to 45.1 percent. These numbers are based upon expenditures on all tobacco products, not just the legal products.

On the plus side, it should be noted that the decline in the share of the illegal product produces a decline in the negative social effects, referred to earlier, that are associated with smuggling.

The two results described above are this scenario's central finding: tax reductions do indeed reduce the share of the market assumed by the illegal product with a corresponding greater share in the legal sector. At the same time, however, total tax revenue declines. This is because, even though fewer illegal cigarettes are purchased and more legal cigarettes are purchased, the government has given up a tax margin of \$1 on a high volume of cigarettes in order to generate additional tax revenue on a relatively modest shift from illegal to legal purchases.

Scenario 2: Improved Enforcement and Regulation of the Illegal Product

The second scenario involves boosting the price of the illegal product by \$1 through an intensified crackdown on illegal suppliers (See Table 2). The tax on the legal products remains unchanged, as do the model's parameter values. This results in an overall rise in the price of cigarettes and a corresponding decline in overall consumption. The illegal product share declines considerably – by almost 44 percent,

and the illegal sector accounts for the entire market decline.

However, despite the decline in overall demand for cigarettes, government tobacco revenues rise as a result of the large shift from the illegal, non-taxed product to the legal, taxed product. Evidently, if the implicit price were to increase as a result of increased police or legal resources being directed to the problem, additional social costs would be incurred, but there would be an accompanying reduction in illegal activity.

Scenario 3: Combination of Policies

The third scenario (See Table 3) involves a simultaneous reduction in taxes on the legal products and a price increase of the illegal product – each changing by \$1. We assume the same degree of responsiveness to price and the same degree of substitutability between products. The results differ from Scenarios 1 and 2: the market share assumed by the illegal product drops considerably – by almost 59 percent. This is not unexpected since both policies incorporated in this scenario push illegal market share in the same direction. Since the overall price index declines (by 9.4 percent), the aggregate quantity increases (by 3.2 percent). Total expenditure declines by 6.6 percent and tax revenues decrease by 12.5 percent, less than in Scenario 1 where the decrease was 16.5 percent.

Scenario 4: Change the Mix of Taxes

A final scenario involves changing the tax system in such a way that the price of the discount product falls but the price of the premium product remains unchanged (See Table 4). The objective of such a strategy would be to provide a legal price point closer to the contraband price, without lowering the overall price of tobacco excessively. Using our model with the 2009 tax structure—involving principally specific (quantity-based) tax levies/duties—the price of discount and premium products would change by

Table 2: Simulating the Impact of a \$1-per-pack Increase Resulting from Tougher Regulation of Illegal Cigarettes^a

	Base Case	After Regulatory Change	
			<i>% change</i>
Expenditure on cigarettes	\$100.00	\$101.60	1.6
Cigarette price index	10.0	10.2	2.4
Cigarette aggregate	10.0	9.9	-0.8
Share of cigarette expenditures on:			
	<i>Percent</i>		
• premium cigarettes	49	51	3.7
• discount cigarettes	41	43	3.7
• illegal cigarettes	10	7	-33.0
Proportion of cigarettes^b comprised of:			
	<i>Percent</i>		
• premium cigarettes	36	41	13.3
• discount cigarettes	41	46	12.9
• illegal cigarettes	23	13	-43.9
Tax Revenues	\$49.60	\$52.20	5.2
Tax revenue per \$ of cigarette expenditure	.496	.514	3.6

Source: Authors' calculations.

^a Increased regulation modelled as a tax increase on the illegal product. Own price elasticity of demand for cigarettes = -0.3; substitution elasticity = 2.5; cigarette price and quantity indices equal 10 in the base period, prior to the tax change.

Base values: $p_1 = 9.5, p_2 = 7.0, p_3 = 3.0; t_1 = 4.5, t_2 = 4.5, t_3 = 0.$

Simulated values: $p_1 = 9.5, p_2 = 7.0, p_3 = 4.0; t_1 = 4.5, t_2 = 4.5, t_3 = 1.$

^b "Cigarettes" here refer to total number of cigarettes sold and not the cigarette aggregate.

approximately the same amount in response to a \$1 tax reduction. To the extent there exists a sales (or value-based) tax on top of the specific duties, the prices might change differentially.²⁰

In Canada, the federal goods and services (i.e., a value-based) tax is superimposed on the duties

in all provinces. In some provinces, there is an additional provincial sales tax (N.L., N.S., N.B., Sask., Man.). If, as an alternative, a higher sales tax (a larger value-based tax) were levied in addition to a reduced specific duty, then a larger price wedge could be created between the premium and

20 A \$1 quantity-based tax on premium and discount cigarettes increases the price of both commodities by \$1, whereas a 10 percent value-based tax on the price of cigarettes would create a lesser tax burden on the discount product than the more expensive premium product.

Table 3: Simulating the Combined Impact of a \$1 Increase from Tougher Regulation of Illegal Cigarettes^a and a \$1 Tax Reduction on Legal Products

	Base Case	After Regulatory and Tax Changes	
			<i>% change</i>
Expenditure on cigarettes	\$100.00	\$93.40	-6.6
Cigarette price index	10.0	9.1	-9.4
Cigarette aggregate	10.0	10.3	3.2
Share of cigarette expenditures on:			
	<i>Percent</i>		
• premium cigarettes	49	50	2.0
• discount cigarettes	41	45	8.5
• illegal cigarettes	10	6	-45.0
Proportion of cigarettes^b comprised of:			
	<i>Percent</i>		
• premium cigarettes	36	40	11.1
• discount cigarettes	41	51	23.2
• illegal cigarettes	23	10	-58.7
Tax Revenues	\$49.60	\$43.40	-12.5
Tax revenue per \$ of cigarette expenditure	.496	.465	-6.3

Source: Authors' calculations.

^a Increased regulation modelled as a tax increase on the illegal product. Own price elasticity of demand for cigarettes = -0.3; substitution elasticity = 2.5; cigarette price and quantity indices equal 10 in the base period, prior to the tax change.

Base values: $p_1 = 9.5, p_2 = 7.0, p_3 = 3.0; t_1 = 4.5, t_2 = 4.5, t_3 = 0$.

Simulated values: $p_1 = 8.5, p_2 = 6.0, p_3 = 4.0; t_1 = 3.5, t_2 = 3.5, t_3 = 1$.

^b "Cigarettes" here refer to total number of cigarettes sold and not the cigarette aggregate.

discount products.²¹ Accordingly, we suppose in this final scenario that such a tax structure is used to generate a one-dollar fall in the price of the discount product, while the tax on, and hence price of, the premium product remains unaffected.

The overall price of cigarettes falls less than in Scenario 1, as does expenditure. Quantity increases are more moderate and tax revenue declines are smaller. The share of the illegal product in total cigarettes consumed declines by 13 percent to

21 By increasing the value-based tax and reducing the quantity-based tax, one could retain the \$4.50 tax on the premium product while simultaneously reducing the tax burden on the discount product. Given the base case prices (which net of taxes are \$5 and \$2.50 for the premium and discount products, respectively), assuming a 40 percent value-based tax and a quantity-based (specific) tax of \$2.50 on both products would result in a constant \$4.50 tax on the premium product, but a decline in the tax on the discount product from \$4.50 to \$3.50.

Table 4: Simulating the Impact of a Move Toward Sales Tax: \$1-per-pack Tax Decline Only in the Legal Discount Product^a

Scenario:	Base Case	After-Tax Changes	
			<i>% change</i>
Expenditure on cigarettes	\$100.00	\$95.29	-4.7
Cigarette price index	10.0	9.3	-6.6
Cigarette aggregate	10.0	10.2	2.0
Share of cigarette expenditures on:			
	<i>Percent</i>		
• premium cigarettes	49	44	-10.2
• discount cigarettes	41	47	14.6
• illegal cigarettes	10	9	-10.0
Proportion of cigarettes^b comprised of:			
	<i>Percent</i>		
• premium cigarettes	36	30	-16.7
• discount cigarettes	41	50	21.9
• illegal cigarettes	23	20	-13.1
Tax Revenues	\$49.60	\$45.90	-7.5
Tax revenue per \$ of cigarette expenditure	.496	.482	-2.8

Source: Authors' calculations.

^a A shift in the mix of specific and ad valorem taxes such that the premium product price remains unchanged but the discount product price falls. Own price elasticity of demand for cigarettes = -0.3; substitution elasticity = 2.5; cigarette price and quantity indices equal 10 in the base period, prior to the tax change.

Base values: $p_1 = 9.5, p_2 = 7.0, p_3 = 3.0; t_1 = 4.5, t_2 = 4.5, t_3 = 0.$

Simulated values: $p_1 = 9.5, p_2 = 6.0, p_3 = 3.0; t_1 = 4.5, t_2 = 3.5, t_3 = 0.$

^b "Cigarettes" here refer to total number of cigarettes sold and not the cigarette aggregate.

20 percent of the total, with the share of the premium product also declining by 17 percent to 30 percent of the total. Tax revenue declines are also more moderate than in the first scenario where both legal products experience a price decline.

POLICY CONSIDERATIONS AND CONCLUSIONS

To date, there has been a lack of rigour in the

debate over appropriate tobacco policies to confront the serious illegal supply problem. Neither the proponents nor opponents of tax changes have been able to produce a numerical estimate of the likely impact of such changes. By specifying an explicit model of market behaviour, based on a relatively high degree of substitutability between cigarette products, we can predict how lower taxes on legal tobacco products and higher prices for the illegal product affect: (a) total purchases of cigarettes;

(b) tax revenues; and (c) the breakdown of the cigarette market between legal and illegal products.

The Individual Decision to Smoke and Well-Being

Public health advocates consider any increase in tobacco use to constitute a reduction in public well-being: not only do consumers make themselves worse off from a health standpoint, such increased smoking results in an increase in costs to the public health system (Irvine and Nguyen 2011). In this context, it is noteworthy that the illegal product has more toxins than the legal product, in some cases many more. Health Canada (2009) emphasizes that, other things being the same, the use of the illegal product is likely more damaging to health than the legal product.

The results that emerge from our model simulations can be interpreted accordingly. The 3.6 percent increase in overall consumption estimated in Scenario 1 is complemented by a five-point decline in the illegal product's market share in our main set of simulations (Table 1) – from 23 percent to 18 percent. Health Canada's warning suggests that the resulting health costs from the 3.6 percent increase would be less than expected due to the somewhat lower toxicity of the legal products.

But this interpretation needs to be qualified. There exists a significant body of literature that indicates consumers inhale different products more or less intensively (see for example, Adda and Cornaglia 2006, Benowitz et al. 2005, Evans and Farrelly 1998, Hammond et al. 2009, Harris 1980, Kozlowski et al. 1998, US Department of Health and Human Services 2000). In particular, smokers

of so-called light cigarettes are known to draw upon their cigarettes for a longer duration, with shorter time intervals between puffs, and to cup the more porous sleeve around the filter in order to get more of the inhaled air to arrive via the length of the cigarette.

Unfortunately, there is little evidence on the compensatory impact of smokers who choose the illegal product: these cigarettes' rougher taste and texture may induce smokers to inhale less intensively than they would were they smoking a legal product. Consequently, they may ingest a smaller percentage of the potentially higher toxic dose that is available in the illegal product.

Taxes and Tobacco Policy

Apart from simulating the impact of lower taxes²² on tax revenues and quantity demanded, our model can also be used to predict the impact of tax increases. Given our simulation results, it is clear that a small increase in taxes would increase tax revenue, other things the same. The overall low responsiveness of cigarette demand to price is a principal driver of this result. From a policy standpoint, however, such a tax increase would correspondingly increase the share of total cigarettes accounted for by the illegal product, and this should be a consideration in any decision to embark on further increases.

Perhaps the central finding of our work is that the illegal component declines by only a modest amount in response to a one-dollar decline in taxes. Hence, for tax policy to be truly effective, tax reductions would have to be greater. In other words, tax policy is not ineffective, but it has limits. Indeed,

22 Since, tobacco and sales taxation powers in Canada are shared by federal and provincial governments, different provinces have different tax rates on cigarettes. The rates implicit in the simulations above broadly reflect the rates that characterize Canada's two most populous provinces – Quebec and Ontario. It goes without saying that a reduction in taxes in a single jurisdiction would lead to cross-border purchases, which in turn would have sales and tax revenue implications for both the tax-reducing and non-tax-reducing province. Nonetheless, if we were to envisage a reduction of one dollar in the excise rate in both Quebec and Ontario, the cross-boundary fall out would likely be relatively minor.

if taxes on cigarettes were virtually eliminated, the illegal supply would quickly dry up. But such a policy would reduce tax revenues dramatically and increase overall consumption.

The gains from reducing taxes result from a reduction in illegal activity that has a high social cost. The illegal trade in cigarettes is criminal and leads to an increased ability to trade in other illegal products, as well as higher police and law enforcement costs and a decline in social capital.

A frequent objection to lower tobacco taxes is that, in addition to stimulating further smoking, such a policy would reduce government revenues. However, this reduction in tax revenue is not technically a cost to society; it represents redistribution from government to smokers. To the extent that smokers are more heavily concentrated in the lower parts of income distribution, this transfer is correspondingly a progressive redistribution.

Policy Reforms to Slow the Illegal Market for Tobacco

In a pricing framework, a higher price for illegal tobacco products resulting from tougher enforcement and regulation would lower their share of the total market while reducing total cigarette consumption and limiting losses in tax revenue. (See Scenario 2.) The feasibility of such a policy, however, remains uncertain: the use of increased tracking and searching policies may or may not be legal and would require a strong political will. Nonetheless, some progress should be made on this front to make the illegal product more difficult to access.

It has been suggested that tax agreements with First Nations band councils might facilitate a reduction in illegal supply. For example, increasing the on-reserve price, with an agreement to return most or all of the revenues to the bands, could have beneficial effects on the off-reserve market for cigarettes produced on reserve (Sweeting, Johnson and Schwartz 2009). While such a proposal may work in instances where one or two on-reserve

producers exist, it is unlikely to be fruitful in cases where there are many on-reserve producers whose livelihood would be compromised or where the majority of tobacco products are smuggled or produced in illegal facilities.

Even so, if enforcement could be increased, a combination of tax reductions and a higher effective price for the illegal product could reduce substantially the scale of the illegal market without generating a significant increase in overall demand.

The Financial and Health Costs of Tobacco Use

Finally, it is appropriate to emphasize who bears the health costs of tobacco use. The ongoing legal suits against tobacco manufacturers in Canada are driven by concerns about the additional costs borne not just by smokers themselves, but by the public healthcare system. The public debate about tobacco use frequently neglects the fact that it is individual smokers who bear the greater part of the costs.

It is accepted universally that tobacco use, and heavy use in particular, shortens the expected lifespan on account of the elevated risks of cancer and myocardial infarction. If we apply an annual dollar value to each year of life lost as a result of smoking (see, for example, Murphy and Topel 2006), such a valuation would substantially outweigh the ‘during-the-lifetime’ costs of poorer health – costs incurred both by the individual through lost work days and the public health system through additional medical care.

Furthermore, smokers’ shorter lifespans involve a substantial decline in state transfers to smokers – in the form of lower payments through the Canada and Quebec Pension Plan, Old Age Security and the Guaranteed Income Supplement, in particular. In sum, it is the individual smokers themselves who pay the bulk of the costs for their enjoyment of tobacco in the earlier years of their lives.

Although smokers, for the most part, are aware of the life-shortening consequences of their habit (Viscusi 1990), it is unlikely that the decision to

smoke is purely the result of a long-term rational deliberation. Indeed, young smokers are arguably less likely to consider the long-term consequences of their decision. It follows that government intervention in the tobacco market is predominantly an effort to protect individuals from themselves.

Conclusions

Unintended consequences frequently attend government policies. A recent example is Canada's tax policy designed to reduce the consumption of tobacco products. The unintended consequence of the steep tobacco tax increases in the early years of the millennium was the growth in illegal supply, accompanied by gang-related criminal activity. Despite increased policing and security efforts, illegal supply remains a serious problem.

In this *Commentary*, we addressed the possibility that tax reductions might induce smokers who now purchase cheaper illegal tobacco products to redirect their purchases to legal products. However, we found that very large tax reductions would be necessary to achieve this objective and such reductions would stimulate overall tobacco purchases. The consequence of this finding is that the illegal market is destined to remain operative unless more intensified legal measures are enacted. Consequently, governments would be well advised to consider the ramifications of further tax increases before embarking on them, as they will further spur illegal supply.

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