

De-marketing Tobacco Through Price Changes and Consumer Attempts Quit Smoking

*Michelle Inness
Julian Barling
Keith Rogers
Nick Turner*

ABSTRACT. Using panel data from three Canadian provinces, this article examines the relationship between the de-marketing of tobacco products through provincial-level price increases and consumers' attempts to quit smoking as measured by the uptake of tobacco replacement therapies. We ground our hypotheses in the rational addiction model and the theory of planned behavior. Our analyses suggest a positive, one-month lagged effect of a price increase of tobacco products on the uptake of tobacco replacement therapies. This effect dissipates 3 months later, suggesting that there is a critical period for aggressive de-marketing of tobacco products. We discuss the implications of these results for theory and future research into de-marketing harmful consumer products.

KEY WORDS: addiction, Canada, consumer behavior, de-marketing, marketing, motivation, panel data, smoking, theory of planned behavior, tobacco

Introduction

Smoking remains a major cause of mortality, morbidity, and reduced quality of life. Conservative estimates suggest that 25% of smokers will die from a smoking-related illness (Lewit, 1989), and smoking is a major contributor to fatal diseases such as cancer, cardiovascular, and respiratory disease (Kaplan et al., 2001). While 70% of non-smokers survive to the age of 80, only 40% of smokers do so, and two-thirds of non-smokers will survive without disability to the age of 65 compared to less than 50% of smokers (Statistics Canada, 2002). Smokers also generate higher than average health care costs, increasing their relative burden on the public health system.

Although these costs are attenuated to some extent by the premature death of smokers, they do not take account of the health problems and costs associated with non-smokers' exposure to second-hand smoke. Following early research (e.g., Burney, 1959; Levin, 1954) advising the United States Surgeon General on the health effects of tobacco consumption, governments initiated campaigns to de-market tobacco, that is, actively discourage the consumption of tobacco-containing products (Kinnear and Frey, 1979; Kotler and Levy, 1971). While a number of de-marketing strategies have been used, historically the most frequently used strategy has been imposition of increased taxes on tobacco products (Kenkel et al., 2002).

In the present study, we examine two issues. First, we directly examine the relationship between changes in the price of tobacco products and individuals' attempts to quit smoking, as operationalized by consumer demand for nicotine replacement therapies. In doing so, we draw both on the rational addiction model and the theory of planned behavior to help explain individuals' motivation to quit. Second, we examine the duration of any effect price changes may have on individuals' attempts to quit smoking.

Despite the fact that tobacco is addictive, research on the effects of the price of tobacco products on population rates of smoking has repeatedly suggested that there is an inverse relationship between the price and consumption of cigarettes (Frieden et al., 2005; Levy et al., 2005a, b, 2006; Niaura and Abrams, 2002). Further of all de-marketing strategies including anti-smoking advertising and legal restrictions on smoking, price increases on cigarettes have been found to bear the strongest relationship to

population rates of smoking (Levy et al., 2005b). However, these population data are of limited utility for understanding the behavior of the individual consumer, given that population-level cigarette sales may be influenced by several factors including consumers' rates of quitting, changes in rates of individuals who take up smoking, changes in the amount of tobacco consumed by smokers, or changes in the rates of the smuggling of tobacco products. The first goal of the present study is to directly examine the relationship between tobacco price changes and attempts to quit smoking.

To date, although there has been little rigorous examination focusing on the effects of changes in the price of tobacco on tobacco consumers' decisions to quit smoking, the few studies that do exist suggest that there may indeed be a relationship. For example, using an experimental manipulation, Johnson et al. (2004) asked cigarette-deprived smokers to work for cigarette puffs and nicotine-containing gum in a series of operant sessions; across each session, the price of cigarettes increased. Their findings showed that participants' use of nicotine-containing gum increased when the price of cigarettes increased. Another study (Levy et al., 2005b) used the U.S. Current Population Survey 1998–1999 Tobacco Use Supplement, along with information on state-level tobacco control policies, to examine the relationships between various socio-demographic, smoking, and policy variables related to consumers' self-reported attempts to quit smoking. Results showed that individuals who lived in states with relatively higher average cigarette prices were more likely to attempt to quit smoking. Finally, a two-wave study (Hyland et al., 2005) conducted across four countries compared quitting rates between individuals who had access to low-tax or untaxed cigarettes and those who did not, following an increase in tax rates. In all four countries, successful quitting was lower when consumers had access to low-taxed or untaxed cigarettes. Each of these studies suggests that there may indeed be a relationship between the price of cigarettes and tobacco consumers' attempts to quit smoking. We directly examine this in the present study using panel data across three provinces.

The second goal of this study is to examine the duration of time in which a price increase on

tobacco is likely to increase quit attempts. There are reasons to expect that any impact of price changes on individuals' motivation to quit will be temporary. One reason is that some smokers will successfully quit, especially given that nicotine replacements are one of the most effective methods of quitting (Tones and Tilford, 2002). Over time, the demand for nicotine replacement therapies should therefore decrease concomitantly. More specifically, given that the ideal regimens for the use of smoking cessation patches, pills, and gums extends for 2½–3 months for patches (although the patch can be used for up to 5 months), 1–3 months for gums, and 2½–3 months for pills (American Cancer Society, 2006), this is a time period after which there ought to be a drop in prescriptions. A second reason to expect that the effect of price change will be temporary is that those individuals who have used nicotine replacement therapies but have not successfully quit may begin to question the utility of these products, thus reducing their likelihood of continuing to use these products. Further, individuals who do not successfully quit smoking may habituate to the new price structure over time, perceiving it as less salient.

If there is indeed a time limitation on the effect of price changes on boosting individual's motivation to quit, this has implications for strategic de-marketing. Research has suggested that the combination of different de-marketing approaches may be more effective than any single strategy alone (Levy et al., 2005c). If there is a critical period during which de-marketing through price increase potentially has its greatest effect, this may also be a period of time in which the effectiveness of other de-marketing approaches might be heightened. Examining whether such a critical period exists and its duration is the second goal of the present study. It is our contention that gaining a better understanding of the utility of this widely used de-marketing strategy for encouraging individuals to quit smoking has important implications for population health.

Motivational theories as a framework for understanding smoking cessation

One way in which to understand smoking cessation is to conceptualize it as a process with at least two

separate aspects: the motivation to quit and successful quitting (Feng, 2005). This approach recognizes that each of these processes may be influenced by different psychological, individual, and environmental factors. An important implication of this differentiation is that prior research examining smoking cessation, which has mostly focused on successful quitting, has likely underestimated the number of people who have attempted to quit without success. In our study, we focus on the motivational aspect of quitting smoking. In doing so, we derive our hypotheses regarding the effects of price increases on quit attempts and the duration of these effects from two theories that have been commonly evoked in the literature on the motivation for tobacco consumers to quit smoking: the rational addiction model (Becker and Murphy 1988) and the theory of planned behavior (Ajzen, 1991). These theories offer insight into individuals' motivation to quit, and their decisions regarding the appropriate strategy for them to use to quit, respectively.

Traditionally, addictive behaviors were not thought to conform to the same rational, utility-maximizing model that is fundamental to standard economic analysis. However, Becker and Murphy (1988) noted that consumer demand for addictive products may be less influenced by price changes than non-addictive products. As such, they developed the 'rational addiction model', which suggests that consumers recognize the addictive nature of certain consumption choices such as smoking, but nevertheless continue to choose to consume these goods because the perceived present gains from consuming the good outweigh the costs of future addiction or illness (Becker et al., 1991; Becker and Murphy, 1988; Gruber and Koszegi, 2001). In this way, a consumer's decision to quit or continue to consume the addictive product is made on the basis of a cost-benefit analysis of quitting, by weighing both the positive and negative aspects of continuing to consume the product. According to this model, then, as the direct financial costs of consuming tobacco products increase, they add to the cumulated costs of tobacco consumption, resulting in more smokers deciding that quitting is the rational choice.

In the present study, we deviate somewhat from the traditional model of rational addiction. In con-

trast to the economic assumptions inherent in the rational addiction model, Ajzen's (1991) theory of planned behavior describes the link between individuals' attitudes and behaviors. This theory holds that the most proximal antecedent of behavior is the intention to engage in that behavior, which itself is based on three factors: attitudes toward the behavior, subjective norms surrounding the behavior, and individuals' perception of control over the behavior. Individuals' decision to use nicotine replacement therapy as a means to quit smoking results from their consideration of each of these three factors. Specifically, this theory would predict that if consumers hold the attitude that smoking is undesirable and that nicotine replacement therapies may effectively help them quit, that the use of these products is socially sanctioned, and that nicotine replacement products may help to increase their control over smoking, they may then be more willing to use these products. In a previous study, the theory of planned behavior has been found to account for 41% of the variance in individuals' decision to use nicotine replacement products (Thomson et al., 2006).

Unlike the rational addiction model that views consumers' decision to quit smoking as being subject to a cost-benefit analysis, the theory of planned behavior may address more specifically consumers' intentions to use nicotine replacement as a method for helping them quit smoking. In the present study, rather than setting up the rational addiction model and the theory of planned behavior as competing theories, we suggest that they complement each other, each helping to explain different aspects of the smoking cessation process. It is possible, for instance, that once an individual decides that the benefits of cessation outweigh the costs of continued consumption of tobacco products, they would then decide to attempt to quit smoking. In subjectively evaluating different methods of quitting, individuals would then consider the utility of nicotine replacement therapy, and behavior change in the form of active attempts to quit smoking might be enacted.

In examining our findings in light of these two models, we adopt a consumer-oriented perspective of smoking cessation in which we recognize that consumers subjectively weigh the costs of smoking, and these costs are dynamic and can change over time, and that consumers weigh different cessation

strategies in light of which strategy is most likely to yield success.

The present study and hypotheses

In this study, we examine two issues. First, we examine consumer demand for a variety of nicotine replacement therapies (patches, pills, and gums) prior to, simultaneous with, and following changes in the consumer price index (CPI) of tobacco products in the three Canadian provinces of British Columbia, Ontario, and Quebec. In doing so, we present panel data that allows both between- (across provinces) and within-group (longitudinal) examinations of consumer demand for nicotine replacement therapies. We also use CPI as a proxy for price. This is important because when government-imposed tax increases are introduced, tobacco producers often tend to coordinate their own price increases to coincide with the tax increases. This often results in a price that exceeds the government-imposed tax increases (Lewit, 1989). As a result, the real price of tobacco products to consumers may be increasing over time by a multiplier of the tax increase (Lewit, 1989). As such, CPI represents the real price of tobacco and hence a more accurate reflection of the financial costs of smoking. Finally, our focus on sales of nicotine replacement therapies as the outcome avoids the problem of confounding the effects of price changes on smoking cessation attempts and actual quitting, potentially providing information of considerable conceptual and clinical value concerning the smoking cessation process.

If a relationship is found between the CPI of tobacco products and consumer demand for nicotine replacement therapies, the second goal of our study is to examine the duration of these effects. We expect that the subsequent decrease in consumer demand for nicotine replacement therapies will occur after approximately 2–3 months.

H₁: Any effects of prices increases will exert an immediate effect on the consumer demand for nicotine replacement products.

H₂: Following an increase in sales of nicotine replacement therapies, there will be a sub-

sequent decrease in consumer demand for nicotine replacement therapies 2–3 months following changes in the tobacco price.

Method

Measurement

Outcome variable: Prescriptions for nicotine replacement products

Consumer demand for nicotine replacement products was operationalized as the total number of prescriptions sold monthly for various nicotine replacement therapies. The prescription drugs included in the present study included all nicotine replacement therapies that are available by prescriptions including pills, patches, and gums. Consumer demand for these products is examined across the three Canadian provinces of British Columbia, Ontario, and Quebec. These data were obtained from IMS Health Canada, which compiles province-level prescription sales data for an array of pharmaceutical products on a monthly basis. No data were available for any of the provinces between January 1995 and December 1997. With the exception of this time period, data were available for British Columbia between January 1992 and January 2004. For Ontario and Quebec, data were also available between these time periods, but the first 15 months of data from Ontario and the last 40 months of data from Quebec were dropped from the analyses as a result of the presence of very large spikes in the prescription data that were inconsistent with the rest of the time period. The decision to obtain data for this time period was dictated by the fact that different provinces had different changes in tobacco CPI at different times and by different rates during this period.

This operationalization provides a behavioral index of quitting attempts, as data are obtained from pharmacies. Hence, individuals must first see their physicians, and afterwards visit a pharmacy for the data to appear in this data set.

Predictor variable: Tobacco CPI

Data on Tobacco CPI were obtained from Statistics Canada (2006) (CANSIM Table 326–0001),

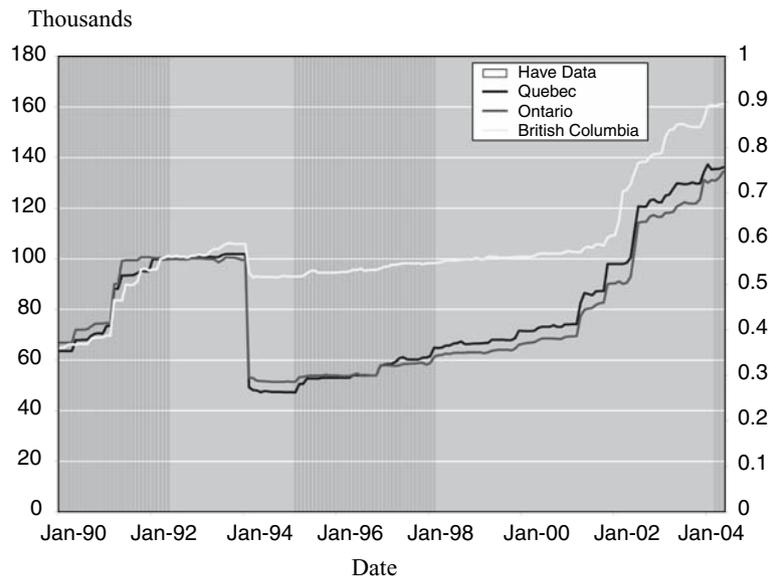


Fig. 1 Tobacco CPI by Province (from page 11)

a national data source for information on a wide variety of indicators regarding the economy, people, and government of Canada. Like the data for prescriptions, these data were compiled monthly. The time span examined in the present study was limited by the availability of data on prescriptions for nicotine replacement products (see Figure 1).

Results

Analytical strategy and model development

Our goal is to analyze the relationship between tobacco price levels and the use of nicotine replacements therapies. To do so, several statistical and geographical concerns of our data need to be confronted. First, prior research (e.g., Chandra and Chaloupka, 2003) has identified a seasonality effect on consumer attempts to quit smoking (i.e., the result of New Year's resolutions). To address this issue, we test for seasonality on the levels of cessation drug sales by allowing for a dummy variable for the months of January, February, and March. The results showed that cessation rates for the months in the first quarter of the year were 60% higher than the cessation rates for the latter three quarters of the year

($p < 0.00001$), as a result of which we controlled for seasonal effects in all subsequent analyses.

Second, since our data reside at the province-month level, it is important to recognize that smokers in each province are exposed to different factors that might influence smoking cessation beyond price changes (e.g., legal restrictions on where smoking can take place, government campaigns, social pressures). Given that the theory of planned behavior would predict an increase in cessation as smoking behaviors are perceived as illegitimate in a wider range of social situations, these factors could influence both the level of nicotine replacement usage as well as the response to price changes. As such, we also included a dummy variable for each province on both the level and response terms in subsequent analysis. As a result of including three provincial dummy variables, we cannot include an intercept term.

With these considerations, we consider a model using the levels of smoking cessation product sales (SaleCess) as a dependent variable.

$$\text{SaleCess} = \beta_0 T - \text{CPI} + \beta_1 \text{Time} * \text{Province} \\ \text{dummies} + \beta_2 \text{Season} + \beta_3 \text{Province} \\ \text{dummies} \quad 1 \quad \quad \quad (\text{M1})$$

Third, time series data such as the CPI of tobacco are often non-stationary due to the presence of a unit root. This is a potentially significant aspect of the data since the use of standard regression techniques on non-stationary time series can result in invalid and inaccurate results (Davidson and MacKinnon, 2004). To test for non-stationarity, we conducted an Augmented Dickey Fuller test for a unit root on both T-CPI and SaleCess, rendering the results meaningless. To address this problem, we used a ‘differenced’ model developed below in our main analysis:

$$\text{SaleCess} = \gamma_0 \text{Province} + \gamma_1 \Delta T - \text{CPI} + \gamma_2 \Delta \text{Season} \quad (\text{M2})$$

This ‘differenced’ version of (M1) is constructed by subtracting a lagged version (M1) from both the left and right hand side:

$$\begin{aligned} \text{SaleCess}_t - \text{SaleCess}_{t-1} = & \beta_0 (\text{T} - \text{CPI}_t \\ & - \text{T} - \text{CPI}_{t-1}) + \beta_1 (\text{Time}_t - \text{Time}_{t-1}) * \\ & \text{Province} + \beta_2 (\text{Season}_t - \text{Season}_{t-1}) \\ & + \beta_3 (\text{Province}_t - \text{Province}_{t-1}) \end{aligned} \quad (\text{M3})$$

Differenced versions of Sales and T-CPI become respective changes in these variables. The other changes deserve some explanation. Since the province dummies are constant, they have no impact on the change over time and consequently do not appear in (M2). Since $\text{Time}_t - \text{Time}_{t-1}$ is always 1, the coefficient on the change over time becomes the new collection of dummy variables capturing province-specific intercept effects. Finally, since the Season variable reflected a period of a high volume of nicotine replacement prescriptions, its complement in (M2) is now the change in season (ΔSeason). ΔSeason is $a + 1$ for observations that are entering the high season and $a - 1$ for periods exiting the high season. This captures the expectation that cessation usage will increase at the beginning of the high season, and return to normal when the high season ends.

To account for the cumulative effect of missing observations for each province, we added a dummy variable, ‘Miss’, which was set to 1 for each

province’s observation after the period of missed observations. This results in the basic model:

$$\begin{aligned} \Delta \text{SaleCess} = & \gamma_0 \text{Province} + \gamma_1 \Delta T - \text{CPI} \\ & + \gamma_2 \Delta \text{Season} + \gamma_3 \text{Miss} \end{aligned} \quad (\text{M4})$$

Main analysis

Because our data are based on provinces that are significantly different in size, heteroskedasticity may be an issue. To allow for this, a robust regression was conducted using HCCME (Davidson and MacKinnon, 2004) in both regressions.

Our first hypothesis was tested by computing a regression on model M3. Consistent with Hypothesis 1, our findings show that an increase in the tobacco CPI is associated significantly ($p = 0.015$) with an increase in consumers’ use of nicotine replacement therapies in the month following the price increase (see Table I).

To test Hypothesis 2, we needed to determine whether or not a price change has an impact on sales of nicotine replacement therapies 1 or 2 months later. We do this by augmenting M3 with lagged values of changes in tobacco CPI. The results demonstrate that consistent with Hypothesis 2, the CPI of tobacco has a non-significant impact on cessation in the second month ($p > 0.05$), but has a significant negative impact in the third month ($p < 0.001$), indicating a significant decrease in consumer demand for nicotine replacement therapies (see Table II).

Discussion

There were two main purposes of the present study: first, to examine the impact of price changes on tobacco on consumer demand for nicotine replacement therapies; and, second, to examine the duration of these effects. In support of our hypotheses, the results of the present study suggest that de-marketing cigarettes through price changes yields the desired result of increasing consumer motivation to quit smoking, as indicated by an increase in the sales of nicotine replacement therapies. However,

TABLE I
Base model

Predictor variables	Coefficient	Standard Error	<i>t</i> -Test	<i>p</i>
Season – New Year	0.0027	0.0003	7.55	0.000
Tobacco-CPI	0.0023	0.0009	2.46	0.015
Quebec	0.0004	0.0004	1.03	0.303
Ontario	-0.0001	0.0001	-0.80	0.422
British Columbia	0.0000	0.0002	-0.23	0.818
Quebec – ‘Miss’ term	0.0020	0.0005	3.92	0.000
Ontario – ‘Miss’ term	0.0017	0.0003	4.66	0.000
British Columbia – ‘Miss’ term	0.0012	0.0004	2.86	0.005

Number of observations = 249.

$F(5, 241) = 12.8$.

Prob > $F = 0.000$.

$R^2 = 0.2102$.

this effect is temporary, peaking approximately one month after these changes take effect, but returning to baseline after 3 months.

Implications and advances of the present study

The findings that changes in the price of tobacco are positively associated with individual consumers’

attempts to quit smoking is consistent with the model of rational addiction which suggests that the increasing present financial cost of continuing consumption tends to encourage consumers to attempt to quit smoking. It is also in keeping with the suggestion of policy-makers that increases in taxation on cigarettes may effectively help to de-market tobacco products and reduce smoking rates. From a policy and a public health standpoint, motivating individuals to quit smoking may be particularly critical to

TABLE II
Model with lagged values

Predictor variables	Coefficient	Standard Error	<i>t</i> -test	<i>p</i>
Season – New Year	0.0028	0.0004	7.47	0.000
Tobacco-CPI	0.0024	0.0010	2.51	0.013
Quebec	0.0004	0.0004	1.00	0.318
Ontario	-0.0001	0.0001	-0.75	0.456
British Columbia	-0.0000	0.0002	-0.17	0.862
Quebec – ‘Miss’ term	-0.0014	0.0004	-3.15	0.002
Ontario – ‘Miss’ term	-0.0001	0.0001	-1.30	0.194
British Columbia – ‘Miss’ term	-0.0048	0.0002	-23.73	0.000
Lag 1 – Tobacco-CPI	0.0010	0.0012	0.84	0.402
Lag 2 – Tobacco-CPI	-0.0054	0.0015	-3.70	0.000

Number of observations = 237.

$F(7, 227) = 11.9$.

Prob > $F = 0.000$.

$R^2 = 0.2394$.

personal and public health given the difficulties associated with cessation of addictions, and the rates of health problems among long-term smokers. It may be more difficult to convince smokers to quit than to convince non-smokers to abstain from smoking, and the present study offers a strategy for encouraging quitting.

The finding that the immediate increase in smoking cessation attempts following a price increase lasts for one month, and dissipates by the second month, suggests that any change in consumers' smoking cessation attempts not seen immediately following a price increase are unlikely to occur as a result of this price change. There are a number of possible reasons for this. Individuals who have success quitting smoking with the aid of nicotine replacements would no longer need to use these products. It is also possible that consumers become habituated to the new price structure, and therefore the price change becomes a less salient factor in motivating quitting. This finding is also consistent with the theory of planned behavior. According to this theory, one of the main factors contributing to individuals' decisions to behave in a certain way is their perception of their control over the behavior. If using nicotine replacement therapies does not effectively help individuals to quit smoking, their perception of their personal control over quitting might be weakened, reducing their likelihood of using nicotine replacement therapies in future quit attempts. Together, these findings help explain the process of quitting smoking by addressing the motivation to quit in the first place, the motivation to use specific methods such as nicotine replacement therapy, and the motivation to continue with that course of action.

The finding that there is a temporary impact of price changes on individuals' motivation to quit also has implications for policy. If the perceived increase in the costs of smoking resulting from a price increase is particularly salient during the time period following a price increase on tobacco products, policy makers might promote the use of other de-marketing strategies during this time, such as increased anti-tobacco and anti-smoking advertising, increasing advertising of cessation aids such as nicotine replacement therapies, or both. This may be particularly important given the relative success of

using de-marketing strategies in tandem over any single strategy, as well as the relative impact of nicotine replacement therapies over other cessation strategies in successful quitting (Tones and Tilford, 2002).

It is important to note that we do not necessarily believe that increases in prices or taxation are a panacea for public health. Indeed, price increases may themselves lead to a number of negative outcomes in this and other contexts, such as smuggling, concomitant increases in crime, and increases to the relative financial burden to consumers occupying the poorest socio-economic groups, who tend to consume tobacco at the highest rates (Benjamin and Dougan, 1997; Saba et al., 1995; Sung et al., 1994; Tancer, 1997). Despite this, the question of whether price and/or tax increases might be used to pursue a social good is raised.

In addition, we recognize that the impact of changes in the price of tobacco product on the decision of consumers to quit smoking depends on consumers' framing of their decision to buy tobacco products. Research suggests that price changes are most likely to have an effect when the individual is either not expecting a price change, or not expecting a price change to be as dramatic as it is, and/or when the price change renders the product unaffordable (Puto, 1987). We encourage future research to examine whether there is a minimal price increase that may be required to make the added costs of smoking a deterrent.

There are a number of methodological advances of the present study that address limitations of prior research. First, some previous studies (e.g., Meier and Licari, 1997) have used cross-sectional designs to compare tobacco consumption rates across jurisdictions, while others have used longitudinal data, comparing rates of consumer demand for tobacco products within a given political jurisdiction before and after a tax increase (e.g., Hu et al., 1995; Peterson et al., 1992; Sung et al., 2005). Both these designs remain "non-interpretable" (Shadish et al., 2002), especially as some of these data were obtained in populations in which the demand for tobacco is already declining (Flewelling et al., 1992), thereby rendering any conclusions about the effects of tax or price increases tentative at best. In contrast, our panel data included data from three different jurisdictions that experienced

different levels of price increases at different points in time. The use of this panel data allows for a nuanced understanding of the effects of tobacco price increases on consumers' smoking cessation attempts. In examining longitudinal data, our focus is not simply to allow greater confidence in any causal inferences. Instead, each of the two goals of our study can only be assessed with longitudinal data, and therefore these data are of considerable conceptual and practical significance. Given the continuing debate in the behavioral sciences as to the timing of any effects following interventions, longitudinal data can help both identify when any effects emerge and when these effects stabilize and/or dissipate (Campbell et al., 1982).

Second, we use the CPI of tobacco as a proxy of price (and tax) changes. While CPI is commonly used in the economics literature, it is rarely used in the marketing literature, and it offers certain advantages. One advantage is that, by focusing on the overall price of tobacco to consumers, the CPI of tobacco may be the most effective measure of the real financial cost of smoking, and the benefit of quitting to existing smokers. A related advantage of the use of CPI is that it looks at pricing from a consumer-centered perspective (Lager, 2005), which is more consistent with a marketing approach (Skouras et al., 2005).

Third, by using sales of nicotine replacement prescriptions as the outcome, the present study was able to isolate changes in consumer motivation to quit smoking. While much previous research suggests that a change in the price of tobacco products can result in a decrease in the sale of tobacco products, why this effect occurs is less clear, and could in fact emerge in several ways. For example, with increases in the prices of tobacco products, the number of tobacco consumers who decide to quit smoking could increase, the number of people who choose to start smoking could decrease, existing smokers could consume less tobacco, or smuggling and illegal sales could mask the actual amount of tobacco consumed (Lewit, 1989). Our decision to focus on sales of prescription nicotine replacement therapies as the outcome avoids these potentially confounding explanations, and in doing so contributes to a more precise understanding of the motivation underlying the use of nicotine replacement

therapies, a proximal variable for actual smoking cessation. Using sales of nicotine replacement prescriptions as the outcome also provides naturalistic behavioral data. Finally, given that nicotine replacement therapies have the best record all cessation strategies in helping smokers to quit (Tones and Tilford, 2002), the use of nicotine replacements has implications for successful quitting.

Limitations of the present study

As with any study, there are also limitations of the present study that should be mentioned. First, we should note that the use of nicotine replacement products is only one method by which consumers can quit smoking. Given other possible (non-prescription) ways in which consumers may attempt to quit smoking following tobacco price increases (e.g., quitting without any aids, hypnosis, counseling), the present findings are likely a conservative estimate of the effect of price changes on consumer attempts to quit smoking, and price changes likely have an even greater effect on quit attempts than observed in the present study. Second, while panel data are used in the present study, some months of prescription data were unavailable, and the time period examined was relatively short compared to other longitudinal economic data. Nevertheless, hypothesis-consistent effects were found despite these limitations on data availability. Third, the present prescription data offers no way of tracking whether an individual was successful in quitting smoking. From a policy and health perspective, this is important information, if beyond the purview of the present study.

Finally, it is important to note that cigarettes are just one example of addictive goods. The question remains whether the current findings can be extended to the de-marketing of other addictive substances, such as alcohol. For instance, alcohol abuse might also be regulated through government pricing policies, but to date has not been subject to the same level of government intervention. Given that tobacco and nicotine-containing addictive substances are legal, they can be regulated and subject to policy decisions. Many other addictive products, such as most narcotics are illegal, and

therefore cannot be as easily controlled. Another unique feature of cigarettes compared to other addictive goods is that nicotine replacement therapies are available and fairly easily accessible. There are few other addictive goods for which pharmaceutical treatment options are as readily available. As such, cigarettes may be an addictive product for which government de-marketing may be most effective. However, by refining and gaining an understanding of the de-marketing of cigarettes, policy-makers may be better poised to apply these strategies to other addictive products.

Future research

We encourage future research on a number of issues raised, but not addressed by the present findings. First, it would be of interest to examine whether there is indeed a critical period following a price change on tobacco when other de-marketing strategies might exert a heightened effect on encouraging quitting. Second, we encourage future research to examine whether there is a minimal price increase that is required to encourage people to quit smoking. Finally, it would be of interest to examine the rates of successful quitting following a price increase on tobacco.

Conclusion

In conclusion, using panel data, our results show that a price increase in tobacco encourages individuals to attempt to quit smoking, highlights the immediate nature of this change, and isolates the duration of its effect. These findings have both conceptual and public policy implications. Conceptually, this study addresses the specific issue of the motivation to quit smoking. From a public policy perspective, these findings are consistent with the suggestions of policy makers that the price of cigarettes can be used as a tool to de-market tobacco products and motivate smoking cessation, and that the period of time following a price change may represent a small but distinct window of opportunity to increase consumers' attention to the negative effects of smoking and the opportunities available to assist quit attempts, such as nicotine replacement therapies.

Note

¹ To keep notation as simple as possible, we assume β_1 , β_3 and γ_0 to be a vector of parameters indexed by province. For example, $\beta_3 = \{\beta_{3BC}, \beta_{3QUE}, \beta_{3ONT}\}$.

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Michelle Inness
Strategic Management and Organization,
School of Business,
University of Alberta,
T6G 2R6, Edmonton, Alberta, Canada
E-mail: michelle.inness@ualberta.ca

Julian Barling and Keith Rogers
School of Business,
Queen's University,
K7L3N6, Kingston, Ontario, Canada

Nick Turner
Asper School of Business,
University of Manitoba,
R3T5V4, Winnipeg, Manitoba, Canada