Europe Economics

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ECONOMIC ANALYSIS OF RESTRICTIONS ON THE DISPLAY OF TOBACCO PRODUCTS – 2009 CANADIAN ANNUAL SMOKING DATA

I write this letter in order to provide an update to my previous reports in light of relevant additional data recently published in Canada.

Introduction

I am the author of the following reports prepared for Japan Tobacco International ("JTI") in which I review, amongst other things, whether there is credible statistical evidence from Canada, Iceland and Thailand that the introduction of display bans there has been associated with reduced smoking prevalence and/or a reduction in the average number of cigarettes smoked:[1]

- Economic Analysis of a display ban and/or a Plain Packs Requirement in the UK, dated 2 September 2008 ("the 2008 Report");[2]
- The Impacts of Restrictions on the Display of Tobacco Products - A Supplemental Report by Europe Economics", dated 8 October 2009 ("the 2009 Report"); and
- Economic Analysis of a Display Ban Requirement in England, dated 28 April 2010 ("the 2010 Report").[3]

I refer to these three documents below as "the Reports".

A key component of my analysis in the Reports has been in respect of the statistical evidence from Health Canada[4] as to whether the introduction of provincial display bans has been associated with reduced smoking prevalence and/or a reduction in the average number of cigarettes smoked.

The basis of my analysis is summarised below:

- In the 2008 Report, I considered (at paragraph 6.7 to 6.23) the relationships between the display bans in two Canadian provinces – Manitoba and Saskatchewan – and smoking prevalence and the average number of cigarettes smoked in these provinces.

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1 In particular amongst young people given that the display ban has as one of its key objectives to discourage or reduce youth smoking uptake.

2 The 2008 Report can be found at http://www.jti.com/cr_home/industry_regulation.

3 This report was submitted as part of judicial review proceedings brought by members of the JTI group in the English High Court in respect of the introduction of a display ban in England.

4 Health Canada's Canadian Tobacco Use Monitoring Surveys ("CTUMS").

- In the 2009 Report, I considered additional data published for 2008 on how many people smoke cigarettes and how many cigarettes are smoked per day in certain Canadian provinces which had been published following the 2008 Report.[5] Using more detailed and powerful statistical tests than were available in September 2008 (given the limited suitable data which existed at that point), I found that, although the presence of the display ban has no statistical correlation with the extent of smoking prevalence for the general population in Canada, the display ban is strongly and materially correlated with increased prevalence amongst 15 to 19 year olds.

- At the time of preparing the 2010 Report, the additional data that had become available since the 2009 Report were Canadian results collected between February and June 2009. For the reasons set out in more detail at paragraph 2.8 of the 2010 Report, these data did not allow any meaningful conclusions to be reached regarding whether the introduction of provincial display bans has been associated with reduced smoking prevalence and/or a reduction in the average number of cigarettes smoked.

Dataset used

In my 2009 Report, I employed a statistical model based on panel data which utilises two of the insights of the economic theory of consumer demand that would be most widely acknowledged by economists. I referred to this model as the standard economic factors model. Specifically, I considered the possibility that consumption of cigarettes (both in terms of prevalence and in terms of average number of cigarettes smoked) might be correlated with the price of cigarettes and the average incomes of smokers. The model used, in part, data from Health Canada's Canadian Tobacco Use Monitoring Surveys (hereafter "CTUMS").

New Canadian data

On 27 September 2010, Health Canada published additional annual CTUMS data for 2009 on how many people smoke cigarettes and how many cigarettes are smoked per day in Canadian provinces.[6]

I have been asked by JTI to consider whether the additional data change the conclusions I have previously reached as to whether the introduction of display bans in Canada have been associated with reduced smoking prevalence and/or a reduction in the average number of cigarettes smoked (particularly amongst 15-19 year olds).

Updating the Model

Consistent with the approach in the 2009 and 2010 Reports, I have now updated the standard economic factors models using four different panels:

- Smoking prevalence and average number of cigarettes smoked (per person per day for the general population and for those aged 15-19, as available from Health Canada);

- Cigarette prices (obtained by combining the Consumer Price Index of cigarettes with information on the price levels of cigarettes in each province);[7]

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[5] Link: http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/index-eng.php.

[6] Link: http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_prevalence/prevalence-eng.php#annual_09.

- Gross Domestic Product (GDP) per capita (obtained by combining historic data on GDP for each province available from Statistics Canada and population data available from the OECD);[8] and

- The display ban (for each province considered, the presence of the display ban was accounted for by using a dummy variable which takes value "one" if the display ban is in place and value "zero" otherwise).

A full list of the relevant data sources for this panel analysis is appended to this letter.

The estimation technique I have used to analyse the potential impact of the display ban is a first difference estimator with fixed effects. For simplicity, I refer herein to the standard economic factors model estimated using this technique as a "first difference fixed effects model". I have set out in the Appendix the rationale for choosing the "first difference fixed effects model". In addition, I have set out the general econometric methodology adopted for the quantitative analysis of the impact of the display ban in Canada, and the estimation results.

Summary of findings

The conclusions I reached in the 2009 Report, which are repeated in the 2010 Report, concerning the impact of the display ban in Canada on smoking prevalence and average number of cigarettes smoked have not changed in light of the data now available.

Indeed, this new data reaffirms my view that:

- there is, as yet, no credible statistical evidence that the introduction of display bans has been associated with reduced smoking prevalence, and in particular, no evidence of such an effect in respect of those aged 15-19;[9] and

- although the presence of the display ban has no statistical correlation with the extent of smoking prevalence for the general population in Canada, the display ban is strongly and materially correlated with increased prevalence amongst 15-19 year olds.[10]

Accordingly, I remain of the views stated in my 2009 Report and my 2010 Report.[11]

Dr Andrew Lilico

30 November 2010

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7 Link: http://www.statcan.gc.ca; http://www.nsra-adnf.ca/cms/file/pdf/cigarette_prices_Canada_17_April_2009.pdf and http://www.cctc.ca/cctc/EN/tcrc/multimedia/tcmultimedia.2008-05-09.4904552730.

8 Links: http://www.statcan.gc.ca and http://stats.oecd.org/OECDregionalstatistics.

9 Paragraph 2.46(c) of the 2009 Report, reported at paragraph 2.51(c) of the 2010 Report.

10 Paragraph 2.46(d) of the 2009 Report, reported at paragraph 2.51(d) of the 2010 Report.

11 However, I note that my observation in respect of cigarette pricing amongst the general population at paragraph 2.44(a) of the 2009 Report has changed following my analysis of the additional data. This can be seen in the tables in the Appendix to this letter.

APPENDIX

This Appendix presents the technical details of the empirical analysis underpinning the findings set out in the letter. The Appendix is structured as follows:

- Summary of data sources.
- Rationale for choosing the first difference fixed effect model.
- Econometric methodology and estimation results.

Summary of data sources

I provide below a brief description of the data sources on which the analysis of smoking prevalence and consumption in Canada has been based:

- Canadian Tobacco Use Monitoring Surveys (CTUMS), 1999-2009 (as available from Health Canada, and at http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/index-eng.php) which provides yearly data on:
    - Percentage of smokers by age group and by province for the period 1999-2009.
    - Average number of cigarettes smoked per person by age group and by province for the period 1999-2009.
- Statistics Canada (available at http://www.statcan.gc.ca/start-debut-eng.html) provides the following information:
    - Consumer Price Index (CPI) for cigarettes by province for the period 1999-2009.
    - GDP by province for the period 1999-2009.
    - Population by Canadian province for 2009.
- The OECD (http://stats.oecd.org/OECDregionalstatistics/) provides the following information:
    - Population by Canadian province for the period 1999-2008.
- The Smoking and Health Action Foundation provides:
    - Average price level of 200 cigarettes by province as of 2009 (http://www.nsra-adnf.ca/cms/file/pdf/cigarette_prices_Canada_17_April_2009.pdf)

Rationale for choosing the first difference fixed effect model

The first difference fixed effects model is an internationally recognised statistical technique and is widely used in order to assess the impact of regulatory interventions (such as the introduction of display bans in our context) upon a given outcome variable (in the case of our study, the outcome variables are smoking prevalence and cigarette consumption).

A key advantage of this model is that it is particularly effective in dealing with what in statistics is known as 'unobserved heterogeneity'. In this context this term refers to the fact that the ten different Canadian provinces in our sample have their own unique features such as cultural differences, differing age distributions, differing geographies, and so on. These province-specific factors are not observable — because we have no data — but might be statistically relevant in accounting for smoking behaviour. If this were the case, omitting these province-specific variables from the model would lead to biased results. In the context of this model the potentially omitted variables can be split into two groups:

- Omitted variables that are specific to each province and that might have an effect upon the absolute levels of smoking prevalence and the average number of cigarettes consumed.

- Omitted variables that are specific to each province and that might be important not only in explaining the absolute levels of smoking prevalence and cigarette consumption, but also the rate at which smoking prevalence and cigarette consumption change with time.

The first difference fixed effects model allows us to control for both province-specific omitted variables that affect the absolute levels of smoking prevalence and average number of cigarettes consumed, and also province-specific omitted variables that affect the rate at which these change in time.

Econometric methodology and estimation results

The variables

The empirical analysis is based on a panel with yearly data covering the period 1999-2009 for the following ten provinces (acronyms in brackets):

Alberta (ALB), British Columbia (BC), Manitoba (MAN), New Brunswick (NB), Newfoundland and Labrador (NFLD), Nova Scotia (NS), Ontario (ONT), Prince Edward Island (PEI), Québec (QUE), Saskatchewan (SASK).

The dependent variables used in the model are the following:

- *GPREV* = smoking prevalence of the general population (15+ years old)

- *YPREV* = smoking prevalence of the 15-19 year-old age group

- *GCONS* = average number of cigarettes smoked among the general population (15+ years old)

- *YCONS* = average number of cigarettes smoked among the general age group (15+ years old)

The explanatory variables are:

- *PRICE* = price of cigarettes

- *GDP* = GDP per capita

Since it is unclear over precisely what time period the display ban is intended to reach maturity in its effects, I have tested for:

- continuing effects produced by the presence of a display ban;
- immediate effects of a display ban; and
- effects that do not begin until one year after the introduction of the display ban.

The distinction between the continued presence of the display ban, the introduction of the display ban, and the presence of the display ban with a one year delay, is accounted for by measuring the display ban through the following variables:

- *BAN* = a dummy variable which takes value one if the display ban is in place and value zero otherwise
- *D(BAN)* = the first difference transformation of the variable BAN, i.e. a dummy variable which takes value one if the display the year of the introduction of the display ban, and value zero otherwise.
- *BAN_DELAY* = a dummy variable which takes value one if the display ban is in place for at least one year, and value zero otherwise

In general, *D(.)* denoted the first difference transformation of a given variable, and *C* denotes a constant.

The model specification

Formally, the first difference fixed effect model is represented by the following equation:

$$D(YPREV)_{i,t} = \gamma_i + \beta_1 D(PRICE)_{i,t} + \beta_2 D(GDP)_{i,t} + \beta_3 BAN_{i,t} + \varepsilon_{i,t}$$

where:

- $i = \{ALB,...,SASK\}$ indicates the province
- $t = \{1999,...,2009\}$ indicates the year
- γ_i are the province-specific fixed effects, $\beta_1, \beta_2, \beta_3$ are the coefficients to be estimated, and $\varepsilon_{i,t}$ is the error term.

The estimation results

I report below the estimation results concerning the impact of the display ban on the average number of cigarettes smoked by the general population and those 15-19 years old (C denotes the common co-efficient, and for notational simplicity province specific fixed-effects are not reported). The tables indicate that the *presence* of the display ban is not associated with changes in the average number of cigarettes smoked by the general population and those 15-19 years old. I have re-estimated the models replacing the variable *BAN* with *BAN_DELAY* (i.e. a ban with delay) and I obtained similar results. On the other hand, as in the 2009 Report, when I replaced *BAN* with *D(BAN)* I found that the *introduction* of the display ban was correlated with a reduction in cigarette consumption for the 15+ population.

The impact of the presence of a display ban on the average number of cigarettes smoked (15+)

Dependent Variable: **D(GCONS)**
Method: Panel EGLS (Cross-section weights)

Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BAN	**-0.248113**	**0.257998**	**-0.961685**	**0.3389**
D(PRICE)	-0.017648	0.022997	-0.767403	0.4449
D(GDP)	-3.54E-05	0.000112	-0.315111	0.7534
C	-0.077850	0.188070	-0.413944	0.6799
R-squared (weighted)	0.019024			
Adjusted R-squared (weighted)	-0.116283			
Observations	100			

The impact of the presence of a display ban on the average number of cigarettes smoked (15+)

Dependent Variable: **D(YCONS)**
Method: Panel EGLS (Cross-section weights)
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BAN	**0.177179**	**0.350042**	**0.506166**	**0.6140**
D(PRICE)	-0.039015	0.031774	-1.227874	0.2228
D(GDP)	0.000179	0.000138	1.291514	0.1999
C	-0.069876	0.253296	-0.275868	0.7833
R-squared (weighted)	0.051975			
Adjusted R-squared (weighted)	-0.078787			
Observations	100			

The tables below provide the results concerning the impact of the presence of a display ban on smoking prevalence among the general population (15+) and among those 15-19 years old. The tables indicate that, although the presence of the display ban has no statistical correlation with the extent of smoking prevalence for the general population, the display ban is strongly and materially correlated (at the 95 per cent confidence level) with increased prevalence amongst 15-19 year olds.

The impact of the presence of a display ban on smoking prevalence (15+)

Dependent Variable: **D(GPREV)**
Method: Panel EGLS (Cross-section weights)
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BAN	**-0.225319**	**0.398108**	**-0.565974**	**0.5729**
D(PRICE)	-0.119703	0.037064	-3.229633	0.0017
D(GDP)	-0.000184	0.000145	-1.272369	0.2066
C	0.025370	0.275044	0.092239	0.9267
R-squared (weighted)	0.145130			
Adjusted R-squared (weighted)	0.027217			
Observations	100			

The impact of the presence of a display ban on smoking prevalence (15-19)

Dependent Variable: **D(YPREV)**
Method: Panel EGLS (Cross-section weights)
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.

BAN	**1.731139**	**0.769054**	**2.250998**	**0.0269**
D(PRICE)	0.077234	0.071721	1.076866	0.2845
D(GDP)	-5.11E-05	0.000304	-0.168205	0.8668
C	-2.123851	0.544057	-3.903727	0.0002
R-squared (weighted)	0.075728			
Adjusted R-squared (weighted)	-0.051758			
Observations	100			

I have re-estimated the model for those aged 15-19 by replacing *BAN* with *BAN_DELAY* and the presence of the display ban ceases to be significant. However, if I replace *BAN* with *D(BAN)* (that is to say, I assess the impact of the introduction of the display ban rather than the presence of the display ban) the significance (at the 95 per cent level) is restored (see the table below).

The impact of the *introduction* of the display ban on smoking prevalence (15-19)

Dependent Variable: **D(YPREV)**
Method: Panel EGLS (Cross-section weights)
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BAN)	**2.570948**	**1.008785**	**2.548559**	**0.0126**
D(PRICE)	0.049954	0.068084	0.733714	0.4651
D(GDP)	-0.000256	0.000283	-0.903941	0.3685
C	-1.686144	0.442130	-3.813682	0.0003
R-squared (weighted)	0.091977			
Adjusted R-squared (weighted)	-0.033268			
Observations	100			

It is worth noting the following remarks:

- Because of the potential presence of cross-section heteroskedasticity, I used a Generalised Least Square (GLS) with cross section weights estimator, and I have employed Panel Corrected Standard Error (PCSE) methodology in order to estimate errors and covariance that are robust to cross-section heteroskedasticity. However, my results concerning the impact of the display ban on smoking prevalence and average number of cigarettes smoked are robust to other estimation and error correction techniques.

- In all of the above tables the R-squared and the adjusted R-squared are extremely low. This is partially due to the fact that the model is in first differences (which generally leads to much lower goodness of fit compared to the models where the variables are expressed in absolute levels). In fact, I have estimated the model in which all variables are expressed at their absolute levels and I have obtained the same results with a much higher goodness of fit. However, for the reasons explained earlier in the Appendix, I prefer to rely only on the results of a first difference model, even if this comes at the cost of a lower goodness of fit.