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Cross-Sectional Relations Between Slim Cigarettes and Smoking Prevalence *

by

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SUMMARY

Slim cigarettes were defined in the 2012 draft European Union-Tobacco Product Directive (EU-TPD) as cigarettes with a diameter of less than 7.5mm. Allegations that slim cigarettes may negatively impact tobacco control efforts led the European Commission to propose a ban on them in 2012, which was ultimately rejected. This study investigated whether there is any association between slim cigarettes and smoking prevalence rates, in order to see if these allegations are justified. Data was compiled on the market share of slim cigarettes and smoking prevalence rates from the years 2012, 2006 and 1996. The core 2012 sample (once data limitations were accounted for) consisted of 95 countries. Raw correlations between market shares of slim cigarettes and smoking prevalence rates were first examined, followed by multivariate cross-country regressions where various factors were controlled for. This was done for overall smoking prevalence, as well as for male and female prevalence separately.

Although raw correlations between the slim cigarette market share and smoking prevalence were sometimes positive and statistically significant, this result disappeared in all cases except for one when potential confounding factors were fully controlled for. The correlation between slim cigarette market share and smoking prevalence remained significant only for males in 2012 at levels of statistical significance of 10% or above when cultural and socio-economic factors were fully controlled for. Importantly, for females no positive statistically significant correlations between the slim cigarette market share and smoking prevalence were found for any year. The cross-country variation in smoking prevalence was substantially explained by a number of regional and cultural dummies, as well as socio-economic factors.

This study has found no indication that a higher market share of slim cigarettes was associated with greater smoking prevalence among females, and has failed to find a strong indication among males, once confounding factors were controlled for. [Beitr. Tabakforsch. Int. 27 (2016) 75–99]

ZUSAMMENFASSUNG

Slim-Zigaretten wurden im Entwurf der EU-Tabakproduktrichtlinie von 2012 (EU-TPD) als Zigaretten mit einem Durchmesser von weniger als 7,5 mm definiert. Behauptungen, dass Slim-Zigaretten einen negativen Einfluss auf Tabakkontrollmaßnahmen haben könnten, hat die Europäische Kommission in 2012 dazu veranlasst, ein Verbot von Slim-Zigaretten vorzuschlagen. Dieses wurde jedoch letztendlich verworfen. Um zu untersuchen, ob jene Behauptungen gerechtfertigt sind, wird in dieser Studie der Zusammenhang zwischen Slim-Zigaretten und dem Raucheranteil in verschiedenen Ländern untersucht.

Es wurden Daten vom Marktanteil für Slim-Zigaretten und dem Raucheranteil für die Jahre 2012, 2006 und 1996 zusammengestellt. Für das Jahr 2012 wurden Daten aus 95 Ländern für die statistische Auswertung verwendet. Zunächst wurden diese Daten mittels Standardkorrelationen und anschliessend mittels multivariater Regressionen unter-

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sucht. Dies wurde für den Gesamt-Raucheranteil der Bevölkerung wie auch getrennt nach Geschlecht durchgeführt.
Während die Standardkorrelationen zwischen dem Marktanteil für Slim-Zigaretten und dem Raucheranteil teilweise positiv und statistisch signifikant waren, ging die Signifikanz nach Berücksichtigung weiterer Faktoren in der multivariaten Regression jedoch in allen bis auf einem Fall verloren. Nur bei Männern im Jahr 2012 blieb die Korrelation nach Berücksichtigung kultureller und sozio-ökonomischer Faktoren statistisch signifikant zum 10%- Niveau. Anzumerken ist, dass bei Frauen für alle untersuchten Jahre keine positive statistisch signifikante Korrelation zwischen dem Marktanteil für Slim-Zigaretten und dem Raucheranteil gefunden wurde. Länderübergreifende Unterschiede im Raucheranteil konnten hauptsächlich durch regionale und kulturelle Dummy-Variablen sowieso sozio-ökonomische Faktoren erklärt werden.
In dieser Studie wurde nach Berücksichtigung aller Faktoren bei Frauen kein und bei Männern kein deutlicher Hinweis darauf gefunden, dass in Ländern mit höherem Marktanteil von Slim-Zigaretten der Raucheranteil größer war. [Beitr. Tabakforsch. Int. 27 (2016) 75–99]

RESUME

La proposition de révision de la directive européenne sur les produits du tabac définissait les cigarettes « slim » (cigarettes fines) comme des cigarettes d'un diamètre inférieur à 7,5 mm. En 2012, la Commission européenne a proposé d'interdire les cigarettes slim alléguant que celles-ci auraient un impact négatif sur la lutte anti-tabac. Cette proposition fut finalement rejetée. Nous avons étudié s'il existe une association entre les cigarettes slim et la prévalence du tabagisme afin d'évaluer si ces allégations sont justifiées.
Nous avons compilé des données de parts de marché des cigarettes slim et de prévalence du tabagisme pour les années 2012, 2006 et 1996. Notre échantillon de base (2012) comprenait 95 pays. Dans un premier temps, nous avons examiné les corrélations brutes entre les parts de marché des cigarettes slim et les taux de prévalence du tabagisme. Ensuite, nous avons procédé à des régressions multiples en coupes instantanées, contrôlant pour différents facteurs, et ce pour les taux de tabagisme globaux ainsi que pour ceux des hommes et des femmes séparément.
Dans certains cas, les corrélations brutes entre les parts de marché des cigarettes slim et les taux de tabagisme étaient positives et statistiquement significatives. Néanmoins, ces corrélations ont disparu dans tous les cas sauf un après contrôle des facteurs confondants potentiels : seule la corrélation entre la part de marché des cigarettes slim et le taux de tabagisme des hommes en 2012 restait significative à 10% ou plus après contrôle des facteurs culturels et socio-économiques. En particulier, aucune corrélation statistiquement significative n'a été trouvée chez les femmes, quelle que soit l'année. La variation de la prévalence du tabagisme entre les pays s'expliquait en grande partie par un certain nombre de variables « muettes » régionales et culturelles, ainsi que par des facteurs socio-économiques.
Cette étude, après contrôle de facteurs confondants, n'a pas trouvé d'indication qu'une part de marché plus élevée de cigarettes slim soit associée à une prévalence du tabagisme plus élevée chez les femmes ni de forte indication que ce soit le cas chez les hommes. [Beitr. Tabakforsch. Int. 27 (2016) 75–99]

INTRODUCTION

Slim cigarettes were defined in the 2012 draft European Union Tobacco Product Directive as cigarettes with a diameter of less than 7.5 mm (1). Slim cigarettes are marketed in various countries around the world, and have been growing as a share of the global cigarette market even as overall cigarette sales volumes have been falling in most markets. The data set utilised in this study showed a large cross-country difference in preference for slim cigarettes. In 2012 high market shares for slim cigarettes were reported in Eastern Europe and Russia (ranging generally between 20% and 40%), South Korea (39%), and Indonesia (37%). In contrast, many other countries, such as Germany (1.1%), Finland (0.3%), and the United Kingdom (0.4%) had a very low slim cigarettes market share. Allegations that slim cigarettes may negatively impact tobacco control efforts by softening perceptions of cigarette smoking led the European Commission to propose a ban on them in 2012. After considerable debate among legislators and EU Member States, the proposed ban on slim cigarettes was ultimately excluded from the final version of the EU-TPD of April 2014. However, the existing state of knowledge on the relationship between slim cigarettes and smoking behaviour is very limited.
There is an existing literature studying the effects of slim cigarette design on perceptions of cigarettes and smoking which have a very diverse spectrum of findings. On the one hand of the spectrum, a number of focus group and interview studies have found that young people consider slim cigarettes to be more attractive and appealing than cigarettes of regular diameter (2, 3), with multiple positive connotations (4). Other studies note that slim cigarettes tend to be marketed towards young women (5). A few studies have also found that slim cigarettes tend to be judged as less harmful than regular cigarettes (3, 6, 7) as well as easier to quit (6). On the other hand of the spectrum, one study found that standard diameter cigarettes had more positive perceptions than slim cigarettes, especially amongst men (8). Another survey found that cigarette diameter was a minor factor in determining perceptions relative to other factors (9).
However, many of these perception studies are qualitative in nature, and so the statistical generalisation of their outcomes to a wider population is hampered. In addition, the geographical and temporal focus of these studies tends to be limited and they are often marred by small, unrepresentative and non-random samples. By far the biggest limitation of the existing literature is the focus on perception rather than actual smoking behaviour. Studies have drawn attention to the frequent disconnect between positive psychological orientation towards a behaviour and actual engagement in that behaviour (10). To the knowledge of this author, there is no previous literature studying the impact of slim cigarettes on actual smoking behaviour.

There are a number of ways in which slim cigarettes may affect smoking behaviour and consequently, public health. Slim cigarettes may serve as an entry point into tobacco consumption ("adoption"), a complement to traditional diameter cigarettes (whereby both are consumed), a substitute (whereby existing smokers switch to slim cigarettes) and as a retention mechanism for keeping existing smokers, who would have otherwise quit smoking had it not been for the availability of slim cigarettes, in the tobacco market. Both the adoption and retention mechanisms have a negative impact on public health by influencing smoking prevalence rates. This study investigates the cross-sectional relationships between smoking prevalence rates and slim cigarette market share, paying particular attention to the gender dimension of any association. As changes in smoking prevalence rates will only capture the adoption and retention mechanisms, the scope of this paper is confined to examining whether slim cigarettes affect the number of regular smokers. The adoption mechanism is the most widely discussed mechanism by which slim cigarettes might influence smoking behaviour, with many studies focussed on the issue of whether slim cigarettes encourage young females to adopt smoking (3).

METHODS

Sample

The main dependent variable of this study was the age-standardised adult smoking prevalence rate. This is defined as the number of people aged 15 years and older who are daily smokers of any tobacco product as a percentage of the total population aged 15 years and older, adjusted for the different age structures of different countries so as to increase international comparability. In addition to the overall smoking prevalence rate, this study also used gender-specific smoking prevalence rates which just consider smoking prevalence amongst the male or female population.

The smoking prevalence data were obtained from an academic study by NG *et al.* (11) which sourced raw prevalence data from various multi-country surveys and used statistical adjustment methods to make the numbers internationally comparable. This database had smoking prevalence data for 187 countries for the years 2012, 2006, 1996 and 1980. However, due to limitations on data availability (described below) for the main covariate of interest, the market share of slim cigarettes, this was cut down to a sample of 95 countries, where data from the years 2012, 2006 and 1996 was considered.

The main covariate of interest was the market share of slim cigarettes, defined as the number of slim cigarette sticks sold as a percentage of total cigarettes sales volume in each national market. Estimates of the market share of slim cigarettes were obtained from Philip Morris International, which were constructed using data from A.C. Nielsen and other in-market sales data. The dataset covered 177 countries for the years from 1996 to 2013. In this dataset there were missing values for many country-year combinations.[1]

In addition, countries with a market share of precisely zero were interpreted as null values (due to doubts about the accuracy of these data points) and removed from the dataset accordingly.[2] It is important to state that no country has ever banned the sale of slim cigarettes, so a zero market share data point does not correspond with a slim cigarette ban. For the year 2012 (the last year for which smoking prevalence data was available), this approach provided market share data for 95 countries. These countries were therefore selected as the core sample. For the year 2006 there were market share data for 75 countries; for the year 1996 this fell further to 28 countries. As there was no data on the slim cigarette market share for the year 1980, this year was excluded from the study.

Of the control variables considered, the most important were the various regional and cultural dummy variables, which were introduced in order to attempt to control for confounding factors – dummies for the Sub-Saharan Africa, Latin America, Asia, and Central and Eastern Europe (CEE) regions were experimented with in order to control for the specific cultural factors related to smoking in these countries. These took the value 1 if the country was in the relevant region and zero otherwise (further detail is provided in the Appendix). A dummy variable indicating whether a country is majority Muslim (12) was also considered in order to control for the specific cultural factors related to smoking in these countries (given that smoking is widely interpreted to be forbidden by Islam).

This study also experimented with: measures of income (14) GDP (Gross Domestic Product) per capita at PPP (Purchasing Power Parity) exchange rates, calculated using IMF (International Monetary Fund) and Oxford Economics data); affordability (expressing the US$ price of 100 cigarette packets as a proportion of per capita GDP in US$, so as to normalise the cigarette price with respect to average income, calculated using Oxford Economics data); education (13) (secondary school enrolment ratio, from the World Bank); cigarette prices (15–17) (average real pack price and average pack price relative to income, calculated using data from PMI); and the policy environment (18, 21, 22) (a standard approach (23, 24) was followed, whereby an index of tobacco control policies was constructed using WHO data (23) ; see the Supplementary Tables for details on the construction of the index).[3]

Figures 1, 2 and 3 below provide a visual representation of the smoking prevalence and slim cigarette market share data for 2012, 2006 and 1996 respectively, and Table 1 provides the slim cigarette market share and smoking prevalence dataset. See also Tables Supp 1.1–1.5 (available on the Oxford Economics website https://www.oxfordeconomics.com/my-oxford/projects/324917) for a full set of data tables, data sources, and country sample list for each year.

[1] 30, 4 and 1 countries were excluded from the 1996, 2006 and 2012 samples respectively, due to a lack of smoking prevalence data.

[2] 107, 83 and 65 countries were excluded from the 1996, 2006 and 2012 samples respectively, as they had precisely zero market share data.

[3] The policy environment variable could be constructed for 93 of the 95 countries in our core sample for the year 2012.

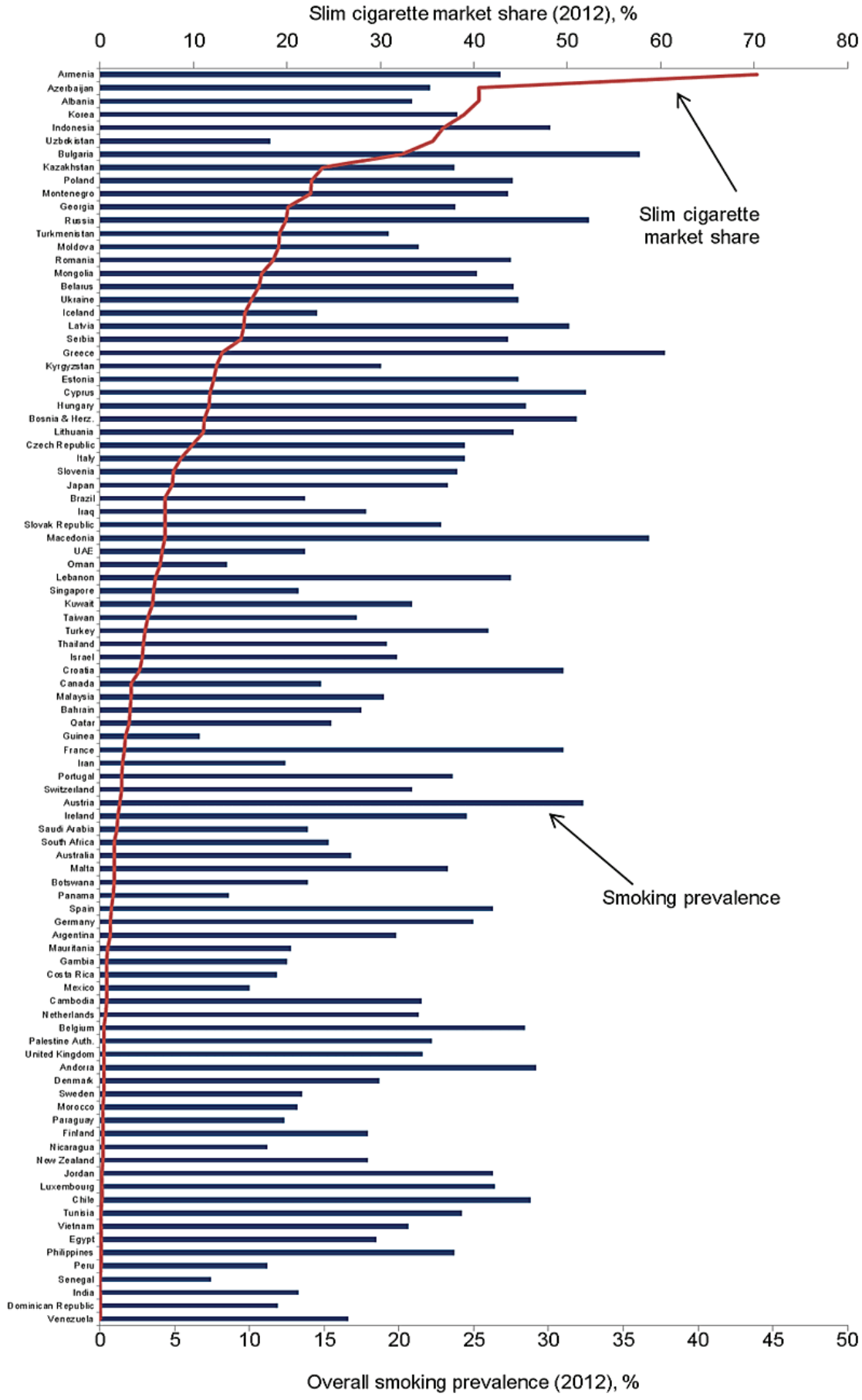

Figure 1. Slim cigarette market share and overall smoking prevalence (2012).

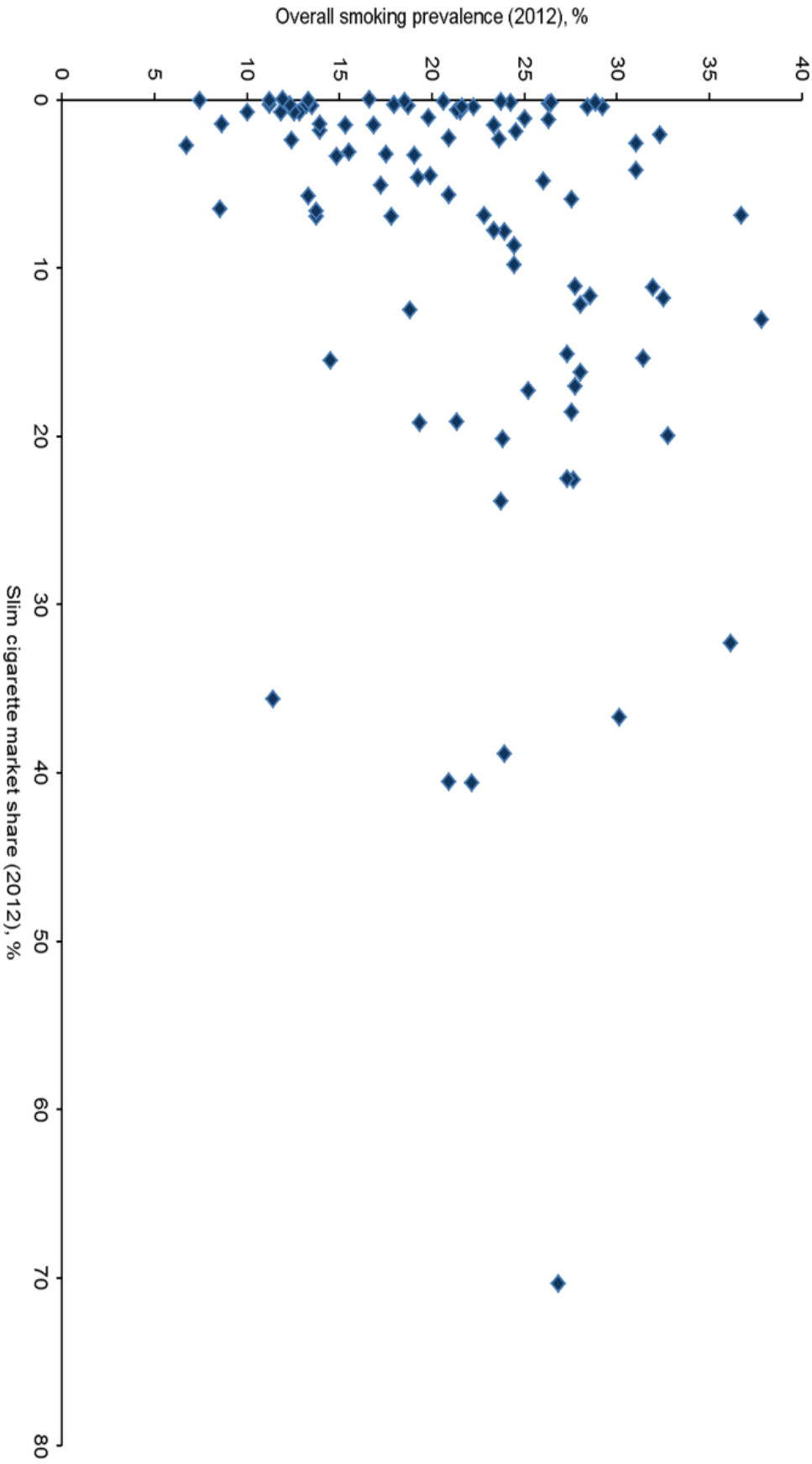

Figure 1.b. Slim cigarette market share and overall smoking prevalence (2012).

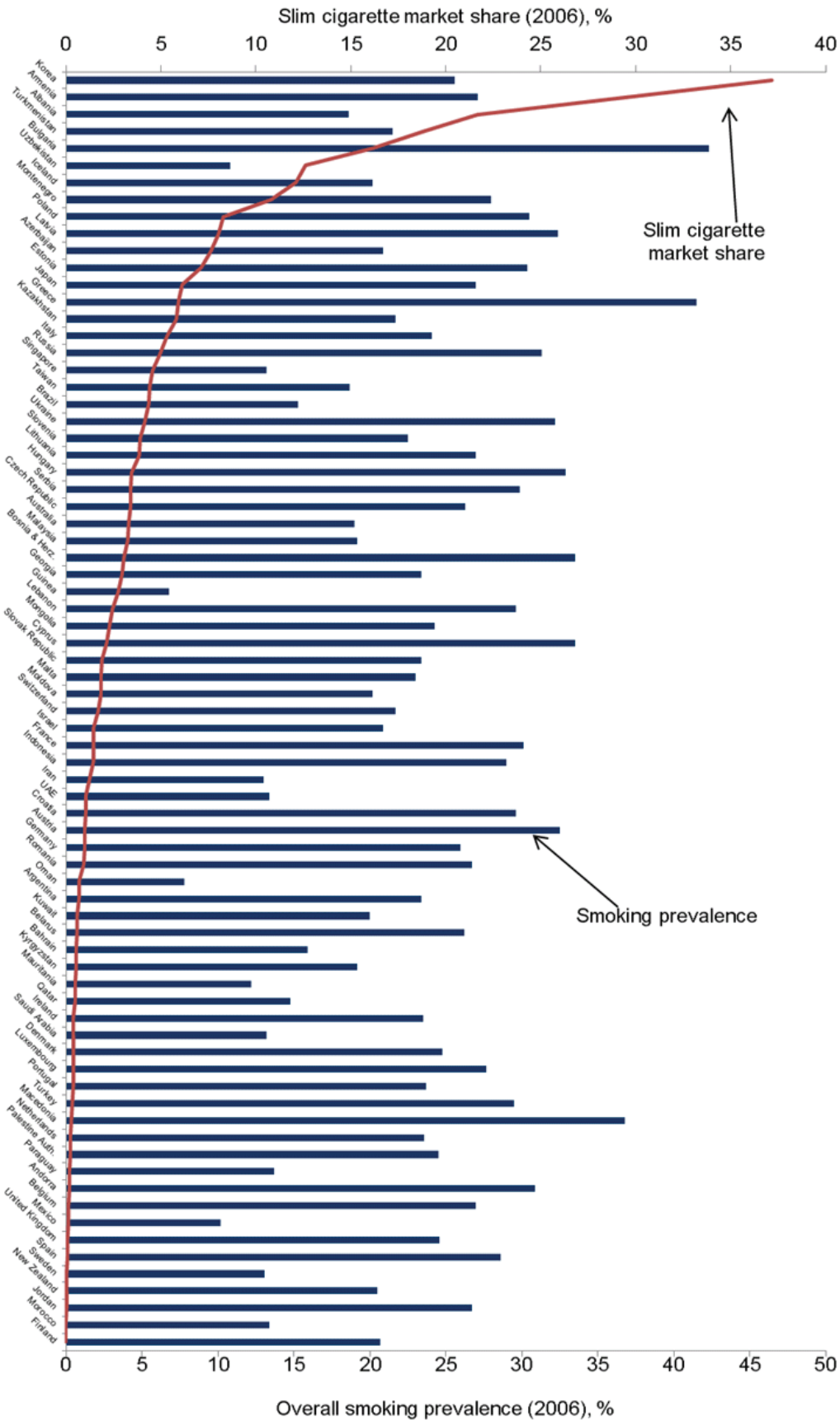

Figure 2. Slim cigarette market share and overall smoking prevalence (2006).

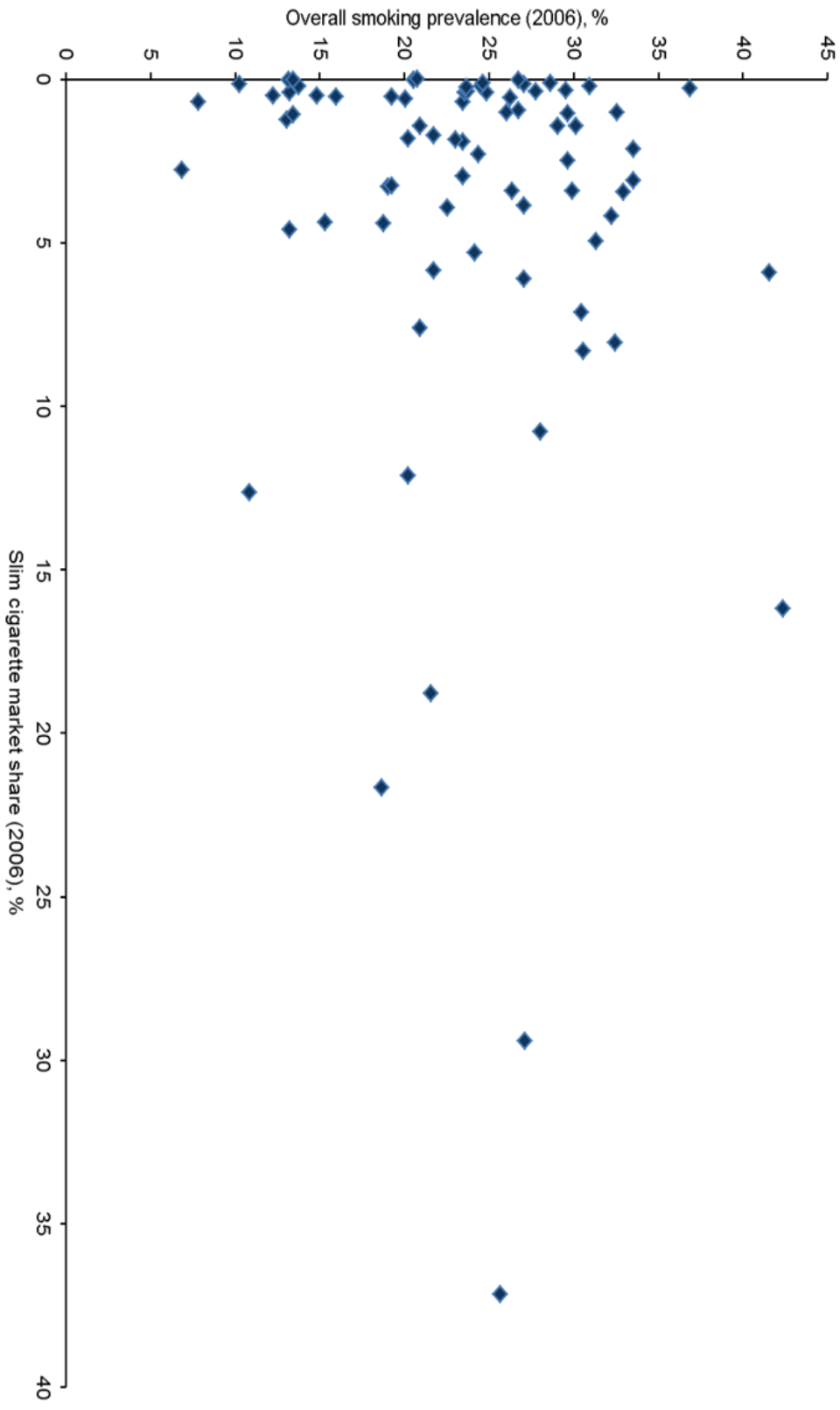

Figure 2.b. Slim cigarette market share and overall smoking prevalence (2006).

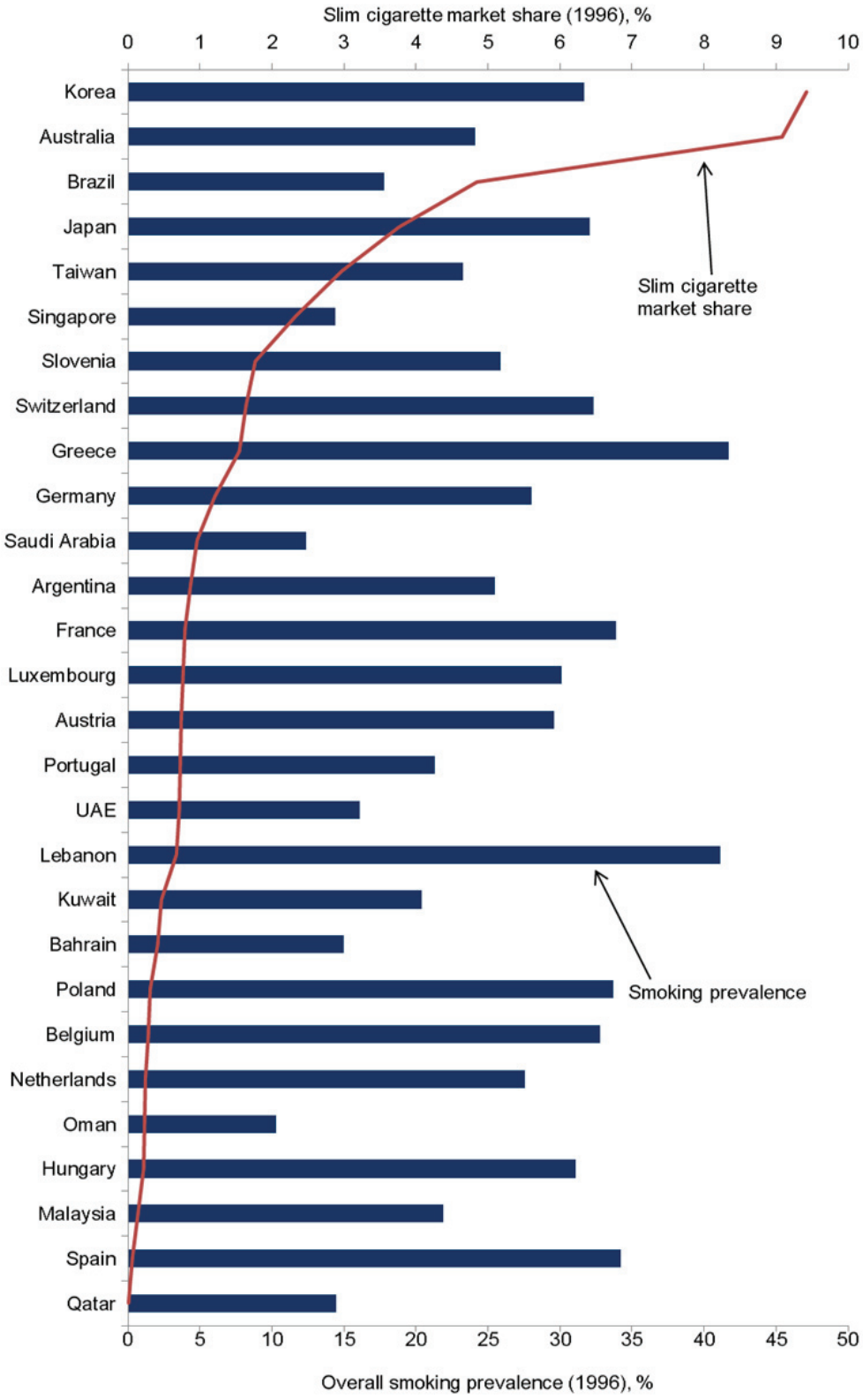

Figure 3. Slim cigarette market share and overall smoking prevalence (1996).

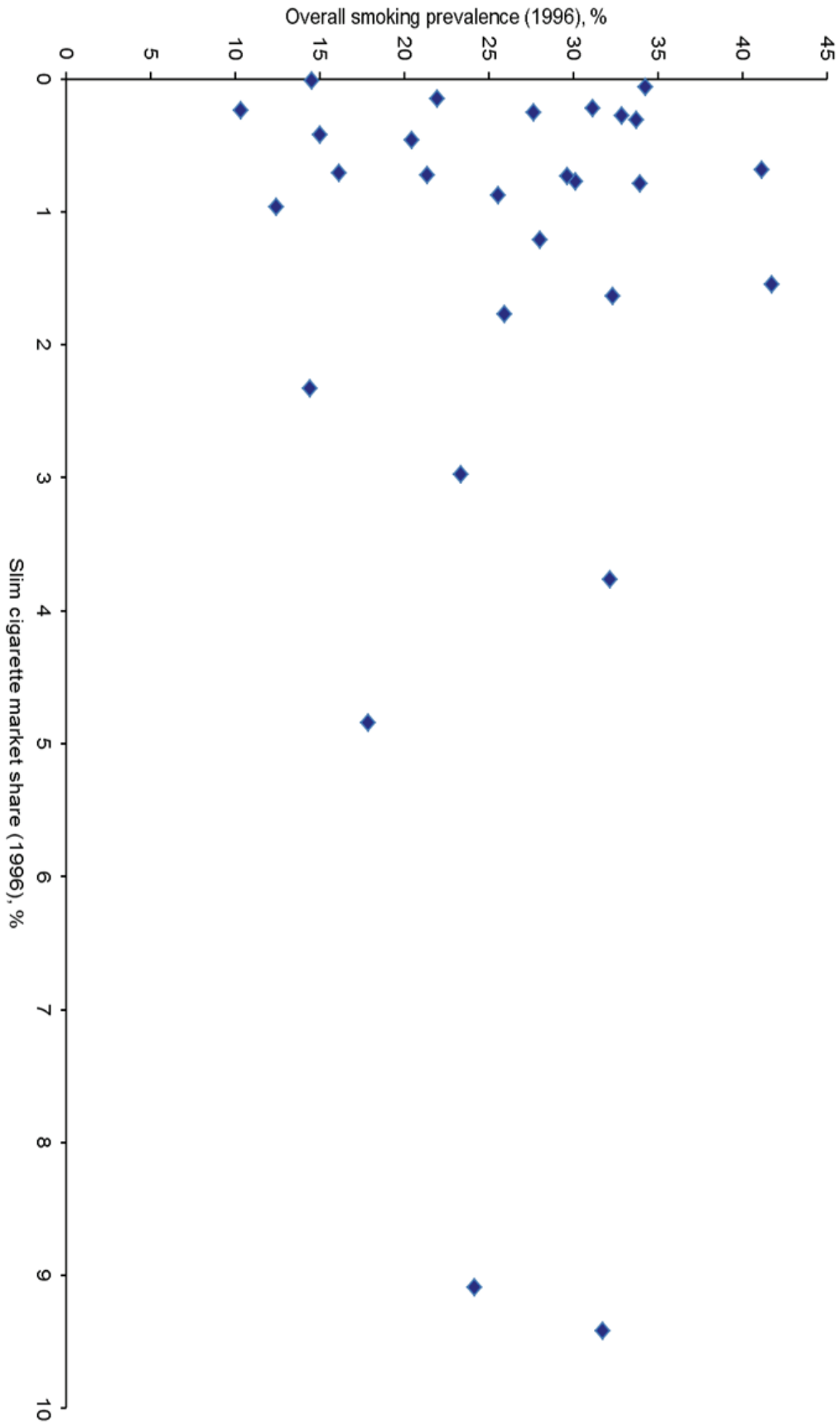

Figure 3.b. Slim cigarette market share and overall smoking prevalence (1996).

Table 1. Slim cigarette market share and overall smoking prevalence (2012).

	Smoking prevalence 2012 (Overall) (%)	Smoking prevalence 2012 (Male) (%)	Smoking prevalence 2012 (Female) (%)	Slim cigarette market share (2012) (%)
Albania	20.9	38.1	3.9	40.5
Andorra	29.2	33.3	25.2	0.4
Argentina	19.8	23.9	15.9	1.1
Armenia	26.8	51.7	1.7	70.4
Australia	16.8	18.3	15.4	1.5
Austria	32.3	36.4	28.3	2.1
Azerbaijan	22.1	44.9	0.9	40.6
Bahrain	17.5	23.9	5.9	3.3
Belarus	27.7	45.5	12.2	17.0
Belgium	28.4	30.7	26.1	0.4
Bosnia & Herz.	31.9	39.9	24.3	11.2
Botswana	13.9	21.5	6.2	1.5
Brazil	13.7	16.5	11.0	6.9
Bulgaria	36.1	40.9	31.5	32.3
Cambodia	21.5	42.1	4.0	0.7
Canada	14.8	16.7	12.8	3.4
Chile	28.8	31.9	26.0	0.2
Costa Rica	11.8	16.1	7.5	0.7
Croatia	31.0	37.8	24.5	4.2
Cyprus	32.5	48.0	18.1	11.8
Czech Republic	24.4	28.5	20.4	9.8
Denmark	18.7	19.7	17.8	0.4
Dominican Republic	11.9	14.5	9.5	0.0
Egypt	18.5	36.1	1.1	0.1
Estonia	28.0	38.4	18.6	12.2
Finland	17.9	20.4	15.3	0.3
France	31.0	34.4	27.7	2.6
Gambia	12.5	24.8	0.8	0.8
Georgia	23.8	45.4	4.4	20.2
Germany	25.0	28.0	22.1	1.1
Greece	37.8	40.8	34.7	13.1
Guinea	6.7	12.0	1.6	2.7
Hungary	28.5	31.5	25.8	11.7
Iceland	14.5	15.9	13.1	15.5
India	13.3	23.0	3.2	0.0
Indonesia	30.1	57.0	3.6	36.7
Iran	12.4	23.1	1.6	2.4
Iraq	17.8	33.0	3.0	6.9
Ireland	24.5	24.8	24.2	1.9
Israel	19.9	26.1	13.8	4.5
Italy	24.4	27.1	21.7	8.7
Japan	23.3	35.3	11.2	7.8
Jordan	26.3	43.4	8.5	0.2
Kazakhstan	23.7	43.1	6.3	23.9
Korea	23.9	41.8	5.9	38.9
Kuwait	20.9	31.3	3.5	5.7
Kyrgyzstan	18.8	35.8	3.4	12.5
Latvia	31.4	44.6	19.2	15.4
Lebanon	27.5	33.6	21.2	5.9
Lithuania	27.7	40.6	16.1	11.1
Luxembourg	26.4	30.1	22.7	0.2

Table 1. (cont.) Smoking prevalence and slim cigarette market share data (2012).

	Smoking prevalence 2012 (Overall) (%)	Smoking prevalence 2012 (Male) (%)	Smoking prevalence 2012 (Female) (%)	Slim cigarette market share (2012) (%)
Macedonia	36.7	46.5	26.7	6.9
Malaysia	19.0	37.9	1.3	3.3
Malta	23.3	27.7	18.9	1.5
Mauritania	12.8	21.7	3.8	0.8
Mexico	10.0	15.7	5.0	0.7
Moldova	21.3	39.3	5.0	19.1
Mongolia	25.2	45.0	6.3	17.3
Montenegro	27.3	34.6	20.2	22.5
Morocco	13.2	26.7	0.7	0.3
Netherlands	21.3	22.4	20.2	0.6
New Zealand	17.9	18.4	17.4	0.3
Nicaragua	11.2	17.3	5.6	0.3
Oman	8.5	12.9	0.9	6.5
Palestine Authority	22.2	41.3	3.1	0.4
Panama	8.6	13.8	3.3	1.5
Paraguay	12.3	19.2	5.3	0.3
Peru	11.2	17.9	4.5	0.1
Philippines	23.7	39.8	8.1	0.1
Poland	27.6	31.3	24.1	22.6
Portugal	23.6	31.7	15.9	2.4
Qatar	15.5	19.3	1.4	3.1
Romania	27.5	36.4	18.7	18.6
Russia	32.7	51.0	16.9	20.0
Saudi Arabia	13.9	22.1	2.2	1.8
Senegal	7.4	14.5	1.2	0.0
Serbia	27.3	31.9	22.8	15.1
Singapore	13.3	22.5	4.3	5.7
Slovak Republic	22.8	30.4	15.5	6.9
Slovenia	23.9	26.5	21.3	7.9
South Africa	15.3	22.0	9.1	1.5
Spain	26.3	29.5	23.2	1.2
Sweden	13.5	12.3	14.8	0.4
Switzerland	20.9	23.2	18.7	2.3
Taiwan	17.2	31.0	3.4	5.1
Thailand	19.2	37.2	2.2	4.6
Tunisia	24.2	44.8	4.5	0.2
Turkey	26.0	39.0	13.6	4.8
Turkmenistan	19.3	36.8	3.1	19.2
Ukraine	28.0	46.3	11.7	16.2
UAE	13.7	18.2	2.5	6.6
United Kingdom	21.6	23.0	20.1	0.4
Uzbekistan	11.4	21.6	1.6	35.6
Venezuela	16.6	21.7	11.7	0.0
Vietnam	20.6	40.9	1.5	0.1

Source: Smoking prevalence data (11), slim cigarette market share (Philip Morris International Management SA, based on A.C. Nielsen and other in-market sales data).

Table 2. Smoking prevalence and slim cigarette market share data (2006).

	Smoking prevalence 2006 (Overall) (%)	Smoking prevalence 2006 (Male) (%)	Smoking prevalence 2006 (Female) (%)	Slim cigarette market share 2006 (%)
Albania	18.6	34.5	3.1	21.7
Andorra	30.9	35.1	26.8	0.2
Argentina	23.4	27.1	19.8	0.7
Armenia	27.1	54.4	1.8	29.4
Australia	19.0	20.8	17.2	3.3
Austria	32.5	35.8	29.2	1.0
Azerbaijan	20.9	42.8	0.8	7.6
Bahrain	15.9	22.0	5.4	0.5
Belarus	26.2	43.0	11.5	0.6
Belgium	27.0	29.8	24.3	0.2
Bosnia & Herz.	33.5	42.1	25.6	3.1
Botswana	14.0	21.9	6.2	—
Brazil	15.3	18.8	12.0	4.4
Bulgaria	42.3	49.0	35.8	16.2
Cambodia	23.1	45.6	4.4	—
Canada	16.2	18.1	14.3	—
Chile	28.3	30.9	25.9	—
Costa Rica	11.4	15.9	6.8	—
Croatia	29.6	35.9	23.7	1.1
Cyprus	33.5	47.7	20.1	2.2
Czech Republic	26.3	30.6	22.2	3.4
Denmark	24.8	26.6	22.9	0.4
Dominican Republic	12.2	14.8	9.7	—
Egypt	16.3	32.0	0.9	—
Estonia	30.4	42.2	19.9	7.1
Finland	20.7	23.3	18.0	0.0
France	30.1	33.3	27.0	1.4
Gambia	13.0	25.6	0.8	—
Georgia	23.4	44.7	4.5	3.0
Germany	26.0	29.3	22.7	1.0
Greece	41.5	47.7	35.4	5.9
Guinea	6.8	12.0	1.6	2.8
Hungary	32.9	36.9	29.2	3.5
Iceland	20.2	21.6	18.7	12.1
India	15.5	27.1	3.3	—
Indonesia	29.0	54.3	4.1	1.4
Iran	13.0	23.1	2.2	1.2
Iraq	17.7	32.9	2.9	—
Ireland	23.5	23.9	23.2	0.4
Israel	20.9	27.3	14.8	1.5
Italy	24.1	28.5	19.8	5.3
Japan	27.0	40.9	13.1	6.1
Jordan	26.7	44.2	8.4	0.0
Kazakhstan	21.7	38.8	6.5	5.8
Korea	25.6	45.9	5.4	37.2
Kuwait	20.0	30.0	3.3	0.6
Kyrgyzstan	19.2	37.2	2.3	0.5
Latvia	32.4	46.7	19.3	8.1
Lebanon	29.6	35.0	23.9	2.5
Lithuania	27.0	40.0	15.3	3.9
Luxembourg	27.7	31.4	24.0	0.4

Table 2. (contd.) Smoking prevalence and slim cigarette market share data (2006).

	Smoking prevalence 2006 (Overall) (%)	Smoking prevalence 2006 (Male) (%)	Smoking prevalence 2006 (Female) (%)	Slim cigarette market share 2006 (%)
Macedonia	36.8	46.9	26.5	0.3
Malaysia	19.2	37.3	1.7	3.3
Malta	23.0	27.4	18.7	1.9
Mauritania	12.2	20.8	3.7	0.5
Mexico	10.2	16.3	4.9	0.1
Moldava	20.2	37.1	4.6	1.8
Mongolia	24.3	43.7	5.8	2.3
Montenegro	28.0	35.9	20.4	10.8
Morocco	13.4	27.1	0.7	0.0
Netherlands	23.6	25.0	22.2	0.3
New Zealand	20.5	21.2	19.8	0.0
Nicaragua	11.1	17.1	5.5	—
Oman	7.8	12.2	0.8	0.7
Palestine Authority	24.5	46.1	3.0	0.2
Panama	8.2	13.1	3.2	—
Paraguay	13.7	21.2	6.1	0.2
Peru	11.4	17.7	5.2	—
Philippines	24.3	40.7	8.2	—
Poland	30.5	32.7	28.4	8.3
Portugal	23.7	32.3	15.4	0.4
Qatar	14.8	19.4	1.4	0.5
Romania	26.7	35.0	18.6	1.0
Russia	31.3	48.8	16.3	5.0
Saudi Arabia	13.2	21.2	1.8	0.4
Senegal	8.5	16.5	1.4	—
Serbia	29.9	35.7	24.2	3.4
Singapore	13.2	22.5	4.2	4.6
Slovak Republic	23.4	31.2	15.9	1.9
Slovenia	22.5	25.0	20.0	3.9
South Africa	15.5	23.1	8.5	—
Spain	28.6	31.7	25.7	0.1
Sweden	13.1	11.1	15.1	0.0
Switzerland	21.7	24.7	18.9	1.7
Taiwan	18.7	33.5	3.6	4.4
Thailand	19.0	37.0	2.2	—
Tunisia	24.3	45.9	3.6	—
Turkey	29.5	44.4	15.6	0.3
Turkmenistan	21.5	40.9	3.4	18.8
Ukraine	32.2	51.9	15.0	4.2
UAE	13.4	17.6	2.1	1.1
United Kingdom	24.6	25.6	23.6	0.1
Uzbekistan	10.8	20.5	1.6	12.6
Venezuela	17.0	22.4	11.6	—
Vietnam	21.4	42.7	1.7	—

Source: Smoking prevalence data (11), slim cigarette market share (Philip Morris International Management SA, based on A.C. Nielsen and other in-market sales data).

Table 3. Smoking prevalence and slim cigarette market share data (1996).

	Smoking prevalence 1996 (Overall) (%)	Smoking prevalence 1996 (Male) (%)	Smoking prevalence 1996 (Female) (%)	Slim cigarette market share 1996 (%)
Albania	21.6	39.8	3.3	—
Andorra	33.4	38.8	28.2	—
Argentina	25.5	29.1	22.1	0.9
Armenia	27.8	57.1	2.9	—
Australia	24.1	25.6	22.6	9.1
Austria	29.6	34.5	24.9	0.7
Azerbaijan	20.8	42.9	0.8	—
Bahrain	15.0	19.5	8.1	0.4
Belarus	30.7	53.1	11.0	—
Belgium	32.8	37.3	28.5	0.3
Bosnia & Herz.	36.4	45.1	28.7	—
Botswana	14.7	23.5	6.3	—
Brazil	17.8	21.3	14.4	4.8
Bulgaria	32.7	42.4	23.3	—
Cambodia	25.8	49.7	5.8	—
Canada	26.0	27.4	24.6	—
Chile	36.6	39.0	34.4	—
Costa Rica	9.1	13.7	4.5	—
Croatia	28.2	32.6	24.2	—
Cyprus	35.9	48.6	23.8	—
Czech Republic	26.6	31.9	21.5	—
Denmark	35.0	35.2	34.9	—
Dominican Republic	17.6	21.2	13.9	—
Egypt	17.3	34.0	0.9	—
Estonia	31.4	44.4	20.0	—
Finland	23.1	26.7	19.7	—
France	33.9	37.9	30.1	0.8
Gambia	14.6	28.0	1.0	—
Georgia	23.2	42.7	5.6	—
Germany	28.0	32.8	23.2	1.2
Greece	41.7	53.8	30.2	1.5
Guinea	7.0	12.5	1.7	—
Hungary	31.1	38.4	24.1	0.2
Iceland	28.5	28.7	28.4	—
India	17.7	31.9	2.7	—
Indonesia	28.6	55.6	2.5	—
Iran	13.6	23.5	3.4	—
Iraq	19.1	36.5	2.3	—
Ireland	30.9	32.3	29.6	—
Israel	27.8	32.0	23.7	—
Italy	26.7	32.2	21.4	—
Japan	32.1	51.9	12.7	3.8
Jordan	29.0	46.6	9.1	—
Kazakhstan	19.9	25.2	15.1	—
Korea	31.7	58.8	5.2	9.4
Kuwait	20.4	30.6	3.4	0.5
Kyrgyzstan	19.4	38.2	1.7	—
Latvia	31.9	47.6	18.0	—
Lebanon	41.1	49.4	33.4	0.7
Lithuania	24.2	40.1	9.7	—
Luxembourg	30.1	33.2	27.1	0.8

Table 3. (contd.) Smoking prevalence and slim cigarette market share data (1996).

	Smoking prevalence 1996 (Overall) (%)	Smoking prevalence 1996 (Male) (%)	Smoking prevalence 1996 (Female) (%)	Slim cigarette market share 1996 (%)
Macedonia	37.3	47.7	27.0	—
Malaysia	21.9	41.3	2.1	0.1
Malta	27.9	34.0	22.0	—
Mauritania	10.4	17.7	3.3	—
Mexico	19.0	29.3	9.8	—
Moldova	22.6	42.2	5.0	—
Mongolia	23.2	41.5	5.6	—
Montenegro	28.1	36.5	20.1	—
Morocco	14.1	28.1	0.7	—
Netherlands	27.6	29.9	25.3	0.3
New Zealand	25.6	25.8	25.6	—
Nicaragua	11.9	18.6	5.5	—
Oman	10.3	15.0	1.2	0.2
Palestine Authority	28.8	53.6	3.9	—
Panama	10.3	16.5	4.1	—
Paraguay	16.8	25.5	8.0	—
Peru	10.7	15.8	5.7	—
Philippines	30.5	49.7	11.4	—
Poland	33.7	44.2	23.7	0.3
Portugal	21.3	33.3	10.0	0.7
Qatar	14.5	19.6	1.5	0.0
Romania	30.6	42.8	18.6	—
Russia	34.0	55.1	15.4	—
Saudi Arabia	12.4	20.0	1.0	1.0
Senegal	11.0	20.7	2.0	—
Serbia	29.0	34.2	24.1	—
Singapore	14.4	25.4	3.5	2.3
Slovak Republic	25.1	35.4	15.3	—
Slovenia	25.9	30.0	22.0	1.8
South Africa	23.4	38.5	9.6	—
Spain	34.2	41.0	27.7	0.1
Sweden	22.2	19.7	24.8	—
Switzerland	32.3	35.3	29.6	1.6
Taiwan	23.3	41.9	3.8	3.0
Thailand	25.2	47.4	4.1	—
Tunisia	22.7	43.6	1.9	—
Turkey	28.0	43.1	13.8	—
Turkmenistan	21.7	41.1	3.7	—
Ukraine	31.9	52.6	13.8	—
UAE	16.1	21.7	0.8	0.7
United Kingdom	30.0	30.4	29.5	—
Uzbekistan	11.7	22.4	1.3	—
Venezuela	19.3	25.9	12.7	—
Vietnam	30.3	58.2	4.4	—

Source: Smoking prevalence data (11), slim cigarette market share (Philip Morris International Management SA, based on A.C. Nielsen and other in-market sales data)

ANALYSIS

In order to investigate the cross-sectional relationship between the market share of slim cigarettes and smoking prevalence rates, a forward selection procedure was followed. Firstly, univariate simple correlations between the market share of slim cigarettes and smoking prevalence rates were examined, to see if there was a statistically significant raw association between the two (a relationship between two variables was considered to be 'statistically significant' if it was so at a 5% level of confidence). Next, potential confounding factors were controlled for, by adding our regional and cultural dummy variables to the basic univariate regression. Next, while leaving in the equation those dummy variables that proved to be statistically significant, additional control variables were tested to try to further account for the cross-country variation in smoking prevalence rates. The full list of variables considered is detailed in the Appendix. An illustrative example of an equation used is provided below, where:

Y represents smoking prevalence rates;

a is a constant;
b represents the main covariate of interest, slim cigarette market share; and
e is a random error.

$$Y = a + bx_1 + cx_2 + e$$

The discussion in the Methods section motivates the variables considered for inclusion in c. The control variables included in the final regression specifications were: CEE (Central and Eastern Europe dummy), LATAM (Latin America dummy), AFRICA (Sub-Saharan Africa dummy), ASIA (Asia dummy), MUSLIM (dummy capturing religious beliefs), LOG(GDPCAP) (Income per Capita variable) and LOG(GDPCAP) ^{2} (to account for non-linear effects of income per capita on smoking prevalence). See Tables 4–6 in the Results section for a comprehensive outline of which variables were included in each regression specification.

Ordinary least squares (OLS) regression with robust standard errors was used to estimate the models. The above procedure was followed for overall smoking prevalence, as well as male and female prevalence separately. This was conducted for each of the years 2012, 2006 and 1996.

The initial plan was to use the NG *et al.* data to also examine whether slim cigarettes influence trends over time in smoking prevalence, using the percentage point change in the smoking prevalence rate between 2006 and 2012 and between 1996 and 2012 as the dependent variables. However, it soon became clear that the data limitations faced were too severe to produce reliable results.

First, the time period from 2006 to 2012 is too short to adequately observe meaningful trends in smoking prevalence, given that the latter tends to evolve fairly slowly over time. This problem is compounded by the fact that any sampling or measurement error in the NG *et al.* data would render the data lacking in the precision required for meaningful longitudinal study. Looking at the NG *et al.* smoking prevalence observations for the years 2006 and 2012, the 95% confidence intervals around these data points overlap for the vast majority of countries (see Figure 4 below). This means that the uncertainty surrounding the smoking prevalence numbers is larger than the estimated size of the change over time in smoking prevalence. This could undermine the reliability of any attempt to use the percentage point change in smoking prevalence between 2006 and 2012 as a dependent variable. One might for example find no impact of the slim cigarette market share on the trend over time in smoking prevalence, but this would be simply due to the fact that the change in smoking prevalence over this time period is too small relative to the noise in the data, rendering it difficult to pick up the impact of slim cigarettes (or indeed any other variables that might affect smoking prevalence).

As to the 1996 to 2012 time period, data on our main independent variable of interest, the slim cigarette market share, was lacking for most countries in 1996. As a result, the sample size for any study of the 1996 to 2012 period would necessarily be cut down to only 28. Furthermore, not only would the sample be small, it would also be highly unrepresentative. Notably, slim cigarette market share data for the vast majority of countries was absent in the crucial CEE region (the region where preference for slim cigarettes is highest). Any results obtained on this time period would thus be potentially non-robust.

Given these serious data limitations, time-series analysis was not taken forward. In order to adequately investigate the relationship between slim cigarettes and trends over time in smoking prevalence, good data on both smoking prevalence rates and the slim cigarette market share over a sufficiently long time period (ideally around a decade) for a reasonably large sample of countries (ideally at least 40 countries) is required.

RESULTS

In the 2012 sample of 95 countries, the bivariate correlation between the overall smoking prevalence and the slim cigarette market share was positive and significant at the 1% level. When considering male smoking prevalence separately, the bivariate correlation was positive and highly statistically significant (at the 0.1% level). By contrast the correlation for female smoking prevalence was negative and far from standard levels of statistical significance.

The results of the multivariate regression analysis for the year 2012 are summarised in Table 4 (see Appendix for variable definitions and sources). The uppermost section shows the best-performing models for the overall smoking prevalence data in this year. Equation [1] in this section shows the results of the univariate regression.

As with the simple correlation, the slim cigarette market share was positive and significant at the 1% level. However, the R^2 of 0.10 means the slim cigarette market share by itself could only explain 1/10 of the total cross-country variation in smoking prevalence rates.

Equation [2] in this section shows the results of adding the regional and cultural dummy variables to the regression. The CEE, Latin America, Sub-Saharan Africa and Muslim dummies were all statistically significant. Furthermore, when these dummies were included, the coefficient on the

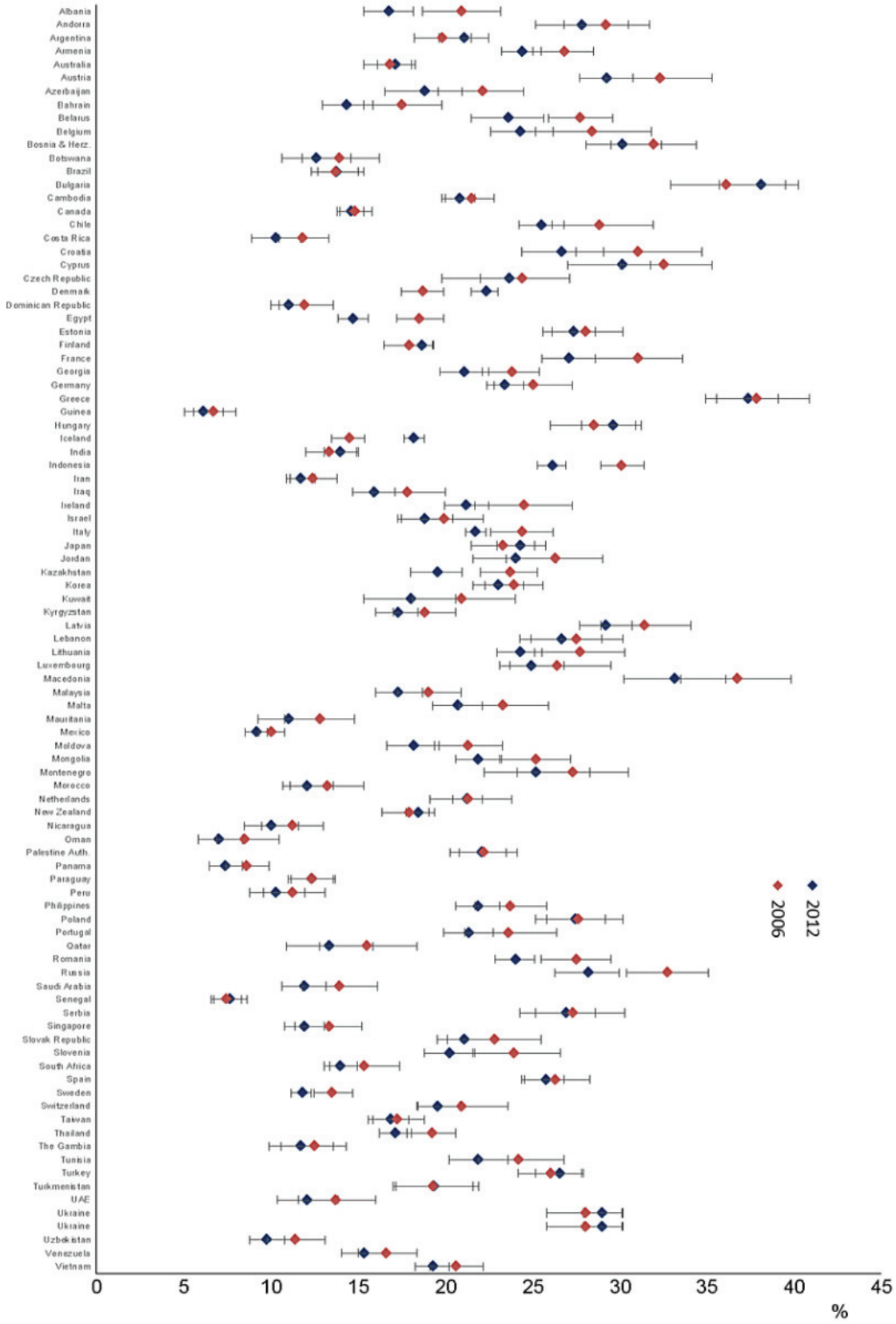

Figure 4. Overall smoking prevalence observations - 95% confidence intervals.

slim cigarette market share became small in magnitude and statistically insignificant. In addition, the R^2 and adjusted R^2 of the equation were 0.48 and 0.45 respectively, indicating that this equation could account for around half of the total cross-country variation in smoking prevalence.

Equation [3] in this section adds in additional control variables, namely terms capturing the impact of income levels on smoking prevalence. Both a linear and a non-linear term in income were included, both of which are significant at the 5% level, with the former having a positive sign and the latter a negative sign. Including income in the regression did not dramatically alter the R^2 or the adjusted R^2.

The other control variables did not perform particularly well, so the equations including them are not reported. Education was of the same sign as income but statistically insignificant. The tobacco control index and the price variables entered with a negative sign, but were statistically insignificant.

The middle section in Table 4 shows the results of repeating the above exercise for male smoking prevalence in 2012. Again, as with the simple correlation analysis, the slim cigarette market share entered into Equation [1] with a positive and highly statistically significant coefficient. Furthermore, the magnitude of the coefficient was more than twice that in the equivalent regression on the overall smoking prevalence, and the R^2 was also higher, with the slim cigarette market share by itself able to account for over one-quarter of the cross-country variation in smoking prevalence rates.

Equation [2] shows the results of adding the regional and cultural dummies. The CEE, Latin America, Sub-Saharan Africa and Asia dummies were all statistically significant. Although adding these dummies reduced the size and significance of the coefficient on the slim cigarette market share, the latter remained significant at the 1% level. Equation [3] summarises the results of adding additional control variables. Again, income per head proved to be the best performing amongst these additional control variables (i.e., not including the cultural and regional dummies) - the other variables were statistically insignificant and were ultimately rejected. When income per head was controlled for (using with both a linear and a non-linear term), the slim cigarette market share was statistically significant only at the 10% level or higher, but not at the 5% or 1% levels.

The lowermost section in Table 4 summarises the results of the same exercise for female smoking prevalence in 2012. As in the simple correlation analysis, the slim cigarette market share entered with a small negative coefficient and was not statistically significant. This finding was robust to including the regional and cultural dummy variables, and doing the latter also increased the R^2 to 0.53 (and the adjusted R^2 was a similar level of 0.50). Of the additional control variables, income per head was again the best-performing by some distance - price entered significantly but with the opposite sign to what theory would suggest, and so was ultimately rejected, while education and the tobacco control index were insignificant. For females, however, only the linear term in income entered significantly, with a positive coefficient, and including the income term in the equation caused the Sub-Saharan Africa dummy to drop out as insignificant.

Repeating the above procedure for the year 2006 for the 75 countries in that sample, the simple correlation between the overall smoking prevalence rate and the slim cigarette market share was positive but this time statistically insignificant. For male smoking prevalence, the relationship is again positive and significant (although this time only at the 1% level). The correlation for females was again negative and insignificant.

Table 5 summarises the results of the multivariate regressions for the year 2006. In the overall smoking prevalence and female smoking prevalence regressions, the slim cigarette market share was never significant. The slim cigarette market share was positive and significant in the simple univariate regression for males, but became insignificant when controls were added. The regional and cultural dummies generally entered with the same signs and significance as in the 2012 regressions. As with the 2012 regressions, income per head was by far the best-performing of the additional control variables - price and education were always insignificant. Income per head again entered with both a linear and non-linear term, except for in the male regression where only the linear term was significant.

For the year 1996 for the 28 countries in that sample, none of the associations were statistically significant. Furthermore, the magnitudes of the correlations were small, including virtually no correlation at the overall level. Table 6 summarises the results of the multivariate regressions for this year. The slim cigarette market share was never significant in any of them. In the 1996 regressions, fewer of the dummy variables entered significantly; in addition, none of the additional control variables entered significantly into the overall or female regressions, and only the linear income term entered significantly in the male regressions.

DISCUSSION

This study found positive and statistically significant univariate correlations between the slim cigarette market share and both the overall and male smoking prevalence rate for the year 2012, but no significant correlation between the slim cigarette market share and female smoking prevalence for this year (and indeed a negative sign). For 2006, a positive and significant correlation only existed for males; and in 1996 there were no significant correlations at all. In all cases except for one (Male 2012), any positive and significant correlation between slim cigarette market share and smoking prevalence disappeared when potential confounding factors were fully controlled for in a multivariate regression setting. The cross-country variation in smoking prevalence was substantially explained by a number of regional and cultural dummies, as well as socio-economic factors. In the 2012 specification, the correlation between slim cigarette market share and male smoking prevalence remained significant when cultural and socio-economic controls were included, but only at levels of statistical significance of 10% or above. Importantly, no positive statistically significant correlations between the slim cigarette market share and smoking prevalence were found for females for any year in a raw correlation, univariate or multivariate regression setting.

Table 4. Smoking prevalence regression models, 2012 (N = 95).

2012			
Overall			
	(1)	(2)	(3)
CONSTANT	19.66 (23.10) ***	22.01 (23.76) ***	– 67.61 (–1.57)
SLIM	0.19 (3.21) ***	0.01 (0.24)	0.004 (0.08)
CEE (D)	—	6.23 (3.87) ***	5.56 (3.36) ***
LATAM (D)	—	– 7.23 (–3.81) ***	– 8.12 (–3.82) ***
AFRICA (D)	—	– 8.28 (–6.29) ***	– 6.79 (–4.18) ***
ASIA(D)	—	—	—
MUSLIM (D)	—	– 3.47 (–2.63) ***	– 3.39 (–2.48) **
LOG (GDPCAP)	—	—	19.43 (2.07) **
LOG (GDPCAP)^2	—	—	– 1.04 (–2.06) **
R^2	0.10	0.48	0.49
Adjusted R^2	—	0.45	0.45
Observations	95	95	95
Degrees of freedom	93	89	87
Male			
	(1)	(2)	(3)
CONSTANT	26.58 (23.30) ***	26.76 (18.85) ***	– 121.75 (–1.84) *
SLIM	0.47 (5.84) ***	0.23 (2.86) ***	0.15 (1.82) *
CEE (D)	—	8.40 (3.40) ***	6.46 (2.52) **
LATAM (D)	—	– 6.76 (–2.77) ***	– 11.06 (–3.80) ***
AFRICA (D)	—	– 7.62 (–3.17) ***	– 10.89 (–4.20) ***
ASIA (D)	—	8.68 (2.99) ***	7.07 (2.82) ***
MUSLIM (D)	—	—	—
LOG (GDPCAP)	—	—	19.43 (2.50) **
LOG (GDPCAP)^2	—	—	– 2.11 (–2.70) ***
R^2	0.28	0.49	0.57
Adjusted R^2	—	0.46	0.54
Observations	95	95	95
Degrees of freedom	93	89	87
Female			
	(1)	(2)	(3)
CONSTANT	12.57 (11.25) ***	19.25 (18.09) ***	– 2.47 (–0.34)
SLIM	– 0.06 (–0.81)	– 0.08 (–1.09)	– 0.03 (–0.39)
CEE (D)	—	—	—
LATAM (D)	—	– 9.30 (–4.49) ***	– 7.09 (–3.28) ***
AFRICA (D)	—	– 7.41 (–4.15) ***	—
ASIA (D)	—	– 11.40 (–6.26) ***	– 9.79 (–5.28) ***
MUSLIM (D)	—	– 11.93 (–7.37) ***	– 10.83 (–5.65) ***
LOG (GDPCAP)	—	—	2.09 (2.97) ***
LOG (GDPCAP)^2	—	—	—
R^2	0.01	0.53	0.53
Adjusted R^2	—	0.50	0.50
Observations	95	95	95
Degrees of freedom	93	89	89

* significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Numbers in brackets represent the relevant t-statistic. D: Dichotom factor.

Table 5. Smoking prevalence regression models, 2006 (N = 75).

2006			
Overall			
	(1)	(2)	(3)
CONSTANT	22.96 (24.25) ***	24.04 (21.59) ***	– 117.77 (– 1.71) *
SLIM	0.15 (1.35)	0.01 (0.14)	– 0.01 (– 0.13)
CEE (D)	—	5.23 (3.48) ***	3.65 (1.97) *
LATAM (D)	—	– 6.15 (– 1.98) *	– 8.107 (– 2.17) **
AFRICA (D)	—	– 9.30 (– 3.66) ***	—
ASIA(D)	—	—	—
MUSLIM (D)	—	– 5.26 (– 3.01) ***	– 5.93 (–3 .34) ***
LOG (GDPCAP)	—	—	31.21 (2.07) **
LOG (GDPCAP)^2	—	—	– 1.69 (– 2.07) **
R^2	0.02	0.39	0.39
Adjusted R^2	—	0.34	0.34
Observations	75	75	75
Degrees of freedom	73	69	68
Male			
	(1)	(2)	(3)
CONSTANT	30.51 (22.78) ***	27.51 (18.54) ***	61.61 (5.00) ***
SLIM	0.56 (4.00) ***	0.26 (1.79) *	0.21 (1.52)
CEE (D)	—	10.78 (5.20) ***	9.02 (4.07) ***
LATAM (D)	—	—	—
AFRICA (D)	—	– 11.53 (– 3.09) ***	– 20.77 (– 3.67) ***
ASIA (D)	—	10.03 (2.34) **	9.53 (2.84) ***
MUSLIM (D)	—	—	—
LOG (GDPCAP)	—	—	– 3.43 (– 2.84) ***
LOG (GDPCAP)^2	—	—	—
R^2	0.12	0.39	0.47
Adjusted R^2	—	0.35	0.43
Observations	75	75	75
Degrees of freedom	73	70	69
Female			
	(1)	(2)	(3)
CONSTANT	15.16 (12.03) ***	20.85 (20.46) ***	– 130.31 (– 2.12) **
SLIM	– 0.21 (– 1.37)	– 0.17 (– 1.13)	– 0.18 (– 1.29)
CEE (D)	—	—	—
LATAM (D)	—	– 8.96 (– 3.17) ***	– 8.90 (– 2.91) ***
AFRICA (D)	—	– 4.31 (– 2.37) **	—
ASIA (D)	—	– 10.08 (– 4.01) ***	– 9.77 (– 4.18) ***
MUSLIM (D)	—	– 13.60 (– 7.12) ***	– 11.81 (-5.25) ***
LOG (GDPCAP)	—	—	31.09 (2.34) **
LOG (GDPCAP)^2	—	—	– 1.59 (–2.22) **
R^2	0.02	0.53	0.57
Adjusted R^2	—	0.50	0.54
Observations	75	75	75
Degrees of freedom	73	69	68

* significant at 10% level; ** significant at 5% level; *** significant at 1% level
Numbers in brackets represent the relevant t-statistic. D: Dichotom factor

Table 6. Smoking prevalence regression models, 1996 (N = 28).

	2006		
	Overall		
	(1)	(2)	(3)
CONSTANT	25.57 (12.60) ***	30.32 (18.39) ***	
SLIM	0.15 (0.32)	– 0.43 (– 1.14)	
CEE (D)	—	—	—
LATAM (D)	—	– 7.35 (– 2.68) **	—
AFRICA (D)	—	—	—
ASIA(D)	—	—	—
MUSLIM (D)	—	– 11.07 (– 2.86) ***	—
LOG (GDPCAP)	—	—	—
LOG (GDPCAP)^2	—	—	—
R^2	0.00	0.34	—
Adjusted R^2	—	0.26	—
Observations	28	28	
Degrees of freedom	26	24	—
	Male		
	(1)	(2)	(3)
CONSTANT	32.23 (13.02) ***	36.70 (15.85) ***	147.62 (4.36) ***
SLIM	1.06 (0.84)	0.65 (0.45)	0.58 (0.52)
CEE (D)	—	—	—
LATAM (D)	—	–13.36 (–2.71) **	– 23.26 (– 3.48) ***
AFRICA (D)	—	—	
ASIA (D)	—	—	
MUSLIM (D)	—	– 9.86 (– 2.05) *	– 9.89 (– 2.62) *
LOG (GDPCAP)	—	—	– 10.94 (– 3.30) ***
LOG (GDPCAP)^2	—	—	—
R^2	0.05	0.26	0.47
Adjusted R^2	—	0.17	0.37
Observations	28	28	28
Degrees of freedom	26	24	23
	Female		
	(1)	(2)	(3)
CONSTANT	17.34 (6.21) ***	24.61 (16.22) ***	—
SLIM	– 0.049 (– 0.66)	– 0.62 (– 1.48)	—
CEE (D)	—	—	—
LATAM (D)	—	—	—
AFRICA (D)	—	—	—
ASIA (D)	—	– 13.59 (– 3.88) ***	—
MUSLIM (D)	—	– 16.19 (– 3.67) ***	—
LOG (GDPCAP)	—	—	—
LOG (GDPCAP)^2	—	—	—
R^2	0.01	0.60	—
Adjusted R^2	—	0.55	—
Observations	28	28	
Degrees of freedom	26	24	—

* significant at 10% level; ** significant at 5% level; *** significant at 1% level
Numbers in brackets represent the relevant t-statistic. D: Dichotom factor

To summarise, when potential confounding factors were controlled for, any statistically significant correlations at the 5% level or below between slim cigarettes and smoking prevalence disappeared. The results are summarised in Table 7.

Table 7. Results summary table.

Year	Specification	Overall		Male		Female	
		Sign	Sig	Sign	Sig	Sign	Sig
2012	Correlation	+	**	+	***	–	
	Regression (1)	+	***	+	***	–	
	Regression (2)	+		+	***	–	
	Regression (3)	+		+	*	–	
2006	Correlation	+		+	*	–	
	Regression (1)	+		+	***	–	
	Regression (2)	+		+	*	–	
	Regression (3)	–		+		–	
1996	Correlation	+		+		–	
	Regression (1)	+		+		–	
	Regression (2)	–		+		–	
	Regression (3)	na	na	+		na	na

* significant at 10% level; ** sig. at 5% level; *** sig. at 1% level
Sign: Sign of association between slim cigarette market share and smoking prevalence
Sig.: Significance (statistically significant at a defined level)

This suggests that the few positive and significant raw correlations that were observed do not reflect an association between slim cigarette market shares and smoking prevalence rates, but rather reflect the confounding effect of other regional, cultural and socio-economic factors. An important aspect relates to the gender issue. The positive and significant correlation at the overall level in 2012 is clearly being driven by male smokers, but this is contrary to what might have been expected, given that traditionally literature on slim cigarettes has overwhelmingly focused on the potential impact on female smoking. More recently it has been suggested that slim cigarettes are also relevant for male customers (6).

The most important controls were the regional and cultural dummies, which are intended to control for confounding factors. The CEE region has many features that potentially make it highly predisposed to novel products such as slim cigarettes - disposable incomes are fairly high, while at the same time smoking prevalence is high and in many cases still rising, particularly among females (although not significant in this particular equation, Asia shares some of these factors that make it potentially predisposed to slim cigarettes, particularly among the more developed countries in the region). By contrast, Latin America, Sub-Saharan Africa and Muslim majority countries are unlikely to be very predisposed to novel tobacco products like slims - the former two have relatively low disposable income, and low smoking prevalence, particularly among females; while the latter have strong cultural norms against smoking, particularly among females. Including these dummies in the regression attempts to control for these regional and cultural factors.

Of the other socio-economic controls, by far the best-performing was income per capita. Although it did not always dramatically improve the fit of the equations, it did give us additional insight into the determinants of the cross-country variation in smoking prevalence. The non-linear specification suggests that as income levels rise, overall smoking prevalence rises, reflecting rising disposable income. The marginal effect of higher income is declining, and past a certain point higher income starts to reduce overall smoking prevalence, most likely reflecting the fact that wealthier populations are likely to have more access to healthier lifestyle options.

This study makes a number of contributions towards improving upon the previous literature. Firstly, and most importantly, it addresses the question of the relationship between the preference for slim cigarettes and actual smoking behaviour (in terms of the adoption and retention mechanisms). This is in contrast to the focus of the existing literature on smoking perceptions which have not been shown to translate into changes in smoking prevalence. The results of this study suggest that slim cigarettes do not encourage the take-up of smoking. This is in stark contrast to the existing literature, which posits that this effect is particularly relevant for young females. Secondly, this study employed quantitative techniques that allowed a statistical assessment to be made as to whether there is a link between the preference for slim cigarettes and smoking prevalence rates, in contrast to the qualitative focus of the existing literature. Thirdly, the geographical and temporal coverage was far wider than most previous studies looking at the same issues: the core sample consists of 95 countries (including a mix of both developed and developing economies from all regions of the world), and the period of study spans over a decade and a half (the years 1996, 2006 and 2012). Fourthly, the robustness of the findings was assessed by looking at overall smoking prevalence and male and female prevalence separately, and by employing a range of control variables in a multivariate regression setting, in contrast to the existing literature which often focuses only on females and fails to control for potential confounding factors.

There are a number of limitations to this study. Firstly, the scope is limited to assessing how slim cigarettes affect smoking behaviour only through the adoption and retention mechanisms. It is possible that slim cigarettes may affect smoking behaviour by acting as a complement or substitute to traditional diameter cigarettes; however, as discussed in the Introduction, as all smoking products are harmful to health, these mechanisms are not within the scope of this research.

Secondly, the limited data coverage for the slim cigarette market share means the sample sizes for the earlier years, particularly 1996, are quite small, meaning we probably cannot place a large degree of confidence on them. There may also be a degree of selection bias here - the 1996 sample, for example, includes very few countries in the crucial CEE region, and this skew in the country coverage may be influencing the results for this year.

It is possible that even if there is no causal association between slim cigarettes and smoking prevalence across countries at a given point in time, there may be one within countries across time. Due to the data issues as described in

the Methods sections, it was not possible to pursue this line of enquiry, but the author would welcome future research doing so.

In addition, the relatively poor performance of many of the socio-economic controls in the multiple regression section suggests that there may be a degree of measurement error in these variables, so that part of the cross-country variation in smoking prevalence rates that is due to socio-economic factors are not being captured correctly. For example, the tobacco control index only captures the letter of the law – this study did not have access to sufficient information to adjust for cross-country variation in strictness of enforcement.

Finally, many of the countries had a small slim cigarette market share during each of the years tested, which may be creating noise in the data and affecting the results. In order to explore whether this was the case, the set of regressions for 2012 was re-run, only including the 30 countries with a market share at or above the average for that year (8.5%). These tests largely supported the conclusions derived from our main set of regression tests. When only markets with an above average market share of slim cigarettes are included, there was no statistically significant relationship between slim cigarette market share and overall smoking prevalence when running a univariate regression between these two variables, and the results suggested that male smoking prevalence was explained by social and cultural factors. Interestingly, in the female case, a negative statistically significant relationship existed between slim cigarette market share and female smoking prevalence even when other controlling factors are included, which is not in line with what some studies in the literature would suggest.

While it was not within the scope of this study to further examine the drivers of female smoking prevalence, further research into this area would provide a useful complement. Female smoking prevalence rates have increased significantly in the last twenty years, yet a gender difference still exists, particularly in developing countries (11). An interesting follow-up to this study would be to compare gender differences in smoking prevalence rates across countries, in particular comparing countries where female smoking prevalence has increased considerably (and by more than men) versus where it has not. This would help to isolate the factors influencing female smoking prevalence.

In conclusion, this study has found no indication that a higher market share of slim cigarettes was associated with greater smoking prevalence among females, and has failed to provide a strong indication that a higher market share of slim cigarettes was associated with greater smoking prevalence among males, once confounding factors are controlled for. The cross-country variation in smoking prevalence was substantially explained by a number of regional and cultural dummies, as well as socio-economic factors.

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APPENDIX

A: LIST OF ABBREVIATIONS AND DATA SOURCES FOR VARIABLES CONSIDERED IN REGRESSION ANALYSIS

SLIM = Share of slim cigarettes in total national cigarette market by volume, %
Source: Philip Morris International Management SA, based on AC Nielsen and other in-market sales data

CEE = Dummy variable taking value 1 if country is in Central and Eastern Europe, 0 otherwise
Source: Oxford Economics

LATAM = Dummy variable taking value 1 if country is in Latin America, 0 otherwise
Source: Oxford Economics

AFRICA = Dummy variable taking value 1 if country is in Sub-Saharan Africa, 0 otherwise
Source: Oxford Economics

ASIA = Dummy variable taking value 1 if country is in Asia, 0 otherwise
Source: Oxford Economics

MUSLIM = Dummy variable taking value 1 if country was majority Muslim in 2010, 0 otherwise
Source: Pew Research Centre (2012)

$LOG_{(GDPCAP)}$ = Natural log of real GDP per capita at PPP exchange rates
Source: International Monetary Fund / Oxford Economics

PPP = Purchasing Power Parity

EDU = gross secondary school enrolment ratio, %
Source: World Bank World Development Indicators (WDI)

[Considered but not used in final regression models]

$LOG_{(PRICE)}$ = Natural log of the average price of a packet of cigarettes in constant 2012 US dollars at PPP exchange rates
Source: Philip Morris International Management SA / Oxford Economics

[Considered but not used in final regression models]

$LOG_{(AFFORD)}$ = Natural log of the proportion of nominal GDP per capita required to purchase 100 packets of cigarettes at the average cigarette price
Source: Philip Morris International Management SA / Oxford Economics

[Considered but not used in final regression models]

TCI = Index of strictness of tobacco control policies, score 0 to 10
Source: WHO Report on the Global Tobacco Epidemic 2013 / Oxford Economics

[Considered but not used in final regression models]

B: CONSTRUCTION OF TCI INDEX

This index was constructed using data from the World Health Organisation tobacco control country profiles, collected for the WHO Report on the global tobacco epidemic 2013. The WHO rankings for different tobacco control indicators were transformed into numeric values, and then assembled into an overall index. The choice of indicators was designed to be similar to that used by JOOSSENS and RAW (2006, 2010).

The indicators were scored as follows:

1. Smoke-free areas (scored 0–9) - a point is given for each area/facility where smoking is banned: Health-care facilities; Educational facilities (except universities); Universities; Government facilities; Indoor offices; Restaurants; Pubs and bars; Public transport; all other indoor public places.
2. Advertising bans (scored 0–8) - a point is given on each aspect of advertising listed below. This score is then scaled up to a maximum score of 10 to allow equal weighting in the final overall index. Aspects comprise: Bans on direct advertising (National TV and radio; International TV and radio; Local magazines and newspapers; International magazines and newspapers; Billboard and outdoor advertising; Point of sale; Internet) and other subnational bans on advertising.
3. Cessation programmes (scored 0–3) - total scores were based on the level of cessation services available. This score is then scaled up to a maximum score of 10 to allow equal weighting in the final overall index.
   0 No services
   1 Nicotine replacement therapy (NRT) and/or some cessation services (not fully cost-covered)
   2 NRT and/or some cessation services (at least one fully cost-covered)
   3 National quit line and both NRT and some cessation services fully cost-covered
4. Health warnings (scored 0–4) - total scores based on the % covering and type of health warning on tobacco products. This score is then scaled up to a maximum score of 10 to allow equal weighting in the final overall index.
   0 No health warning
   1 Warning covering < 30% of pack surface
   2 Warning covering 30% of pack surface or more but no pictures or other appropriate characteristics
   3 Warning covering 31–49% of pack surface and also pictures and other appropriate characteristics
   4 Warning covering 50% or more of pack surface including pictures and other appropriate characteristics

These subcomponent scores were then combined into an overall index by scaling each one up to a maximum value of 10 and then summing the subcomponents using equal weights. The choice of equal weights was based on there being no clear rationale for varying the weights among the subcomponents.