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Working Paper No: 150017

www.canadiancentreforhealtheconomics.ca

October 23, 2015

Canadian Centre for Health Economics
Centre canadien en économie de la santé
155 College Street
Toronto, Ontario

CCHE/CCES Working Paper No. 150017
September 17, 2015

How To Sell A Condom? The Impact Of Demand Creation Tools On Male And Female Condom Sales In Resource Limited Settings

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Abstract

Despite condoms being cheap and effective in preventing HIV, there remains an 8 billion shortfall in condom use in risky sex-acts. Social marketing organisations apply private sector marketing approaches to sell public health product. This paper investigates the impact of marketing tools, including promotion and pricing, on demand for male and female condoms in 52 countries between 1997 and 2009. A static model differentiates drivers of demand for male and female condoms, while a dynamic panel data estimator estimates their short- and long-run impacts. Products are not equally affected: female condoms are not affected by advertising, but highly affected by interpersonal communication and HIV prevalence. Promotion has significant short- and long-run effects on both condoms. Price changes have a large impact on the short- and long-run female condom demand, but only affect long-run male condom demand. Programming for HIV prevention technologies needs to consider both product and target population characteristics.

Highlights

- Social marketing tools stimulate male and female condom demand differently.
- Advertising is highly effective in raising demand for male- but not female- condoms.
- Interpersonal communication is more potent for stimulating female condom demand.
- Female condom demand is >3 times as sensitive as male condoms to price changes.
- Investing in promotion has lasting impacts on demand for both condoms.

JEL Classification: l1

Keywords: advertising; consumer demand; HIV prevention; dynamic panel data estimators; condoms; low and middle income countries

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1 Introduction

Since the onset of the HIV epidemic around 50 million HIV infections have been averted by the use of condoms (Stover, 2014). Condoms are cheap and highly cost-effective. However, in 2012, 2.3 million people still became infected with HIV (Joint United Nations Programme on HIV/AIDS, 2013). A recent UNAIDS meeting identified a condom gap of over 8 billion condoms, i.e. the difference between the UNAIDS target condom use in risky sex acts and actual use, with an annual use of just eight condoms per sexually active person in sub-Saharan Africa (Deperthes, 2014). Though there is new optimism that bio-medical tools exist to stem the HIV epidemic in the form of anti-retroviral (ARV)-based HIV prevention (Fauci and Folkers, 2012), these are service intensive, expensive, and not widely available. Achieving high levels of uptake of preventive interventions is particularly challenging because it requires a change in behaviour among populations who may not perceive themselves to be at risk, feel ill or face barriers, real or perceived, to accessing products and product support. For condoms and new HIV prevention products to fulfil their public health potential they must be used widely and effectively; this requires both ensuring consistent and accessible condom supplies and demand creation activities such as mass media advertising and inter-personal communication (IEC) promotion approaches.

Though public sector distribution may be free or very cheap for consumers to access public health products, it has a number of potential drawbacks such as limited opening hours, inconsistent supply, and low perceived quality of products and services (Hanson et al., 2001).Where private sector markets do exist, prices are often too high for those who need the products most. Additionally, competitive prices will be above the socially optimal price for HIV prevention because they are not capturing external benefits to society attributable to reductions in HIV. To fill this gap, social marketing organisations have been active for decades, initially distributing subsidised contraceptives including condoms, and more recently expanding to a range of public health commodities and services, such as mosquito nets, voluntary counselling and testing services and male and female condoms for HIV prevention.

Social marketing is the application of private sector demand creation tools to stimulate positive behaviour change (Kikumbih et al., 2005). In particular, consideration is given to the four Ps: product, promotion, price and place (Grier and Bryant, 2005). Branded products aim to segment the market and appeal to different user groups. Promotion applies both generic advertising to increase the overall market size as well as branded advertising to appeal to different user groups, and interpersonal communication strategies. Differentially priced products allow for cross-subsidisation of high to low priced products, with the higher priced products capturing more of the consumer surplus, whilst providing a low-end product to ensure broad access. Additionally, having a sufficiently low, but positive, price aims to instil a sense of value and has been shown to have lower wastage associated with freely distributed condoms (Chapman et al., 2012). Subsidised products tend to be placed within the private sector retail distribution networks to increase outlets, while being sold by retailers for a profit, to ensure consistent supply and sustainability. In many countries social marketing is now the dominant source of condom supply (Chapman et al., 2012). Because social marketing applies traditional demand stimulation tools to public health, while public sector distribution generally does not, it provides an opportunity for studying the effectiveness of these tools for stimulating demand for new and existing HIV prevention products, in the absence of private markets. Understanding drivers of demand for the male and female condom not only informs programmes on how to better stimulate demand for existing products, it also provides lessons

that can potentially be applied to the introduction of both new single ARV based HIV prevention products and multi-purpose products that prevent both HIV and other infections or unwanted pregnancies.

No recent studies have addressed this question. A few older studies provide some guidance as to the effect of social marketing on male condoms and oral contraceptive demand and they showed that the demand for products responded differently to the same stimulation tools. For example, Boone et al. (1985) showed that male condom demand was much more sensitive to changes in prices and advertising expenditures than oral contraceptive demand. Meekers and Rahaim (2005) looked at the impact of market environment and showed that, while male condom demand reacts consistently to variables representing country level socio-economic context, oral contraceptives were not significantly influenced by these in most of their analyses. Ciszewski and Harvey (1995) showed that condoms had much larger and quicker declines in sales than oral contraceptives following price increases in Bangladesh. More specifically for male and female condoms, a few important product and programme differences suggest potential differences in their demand responses. Firstly, male condoms have long been distributed and used as contraceptives, with the additional benefit of reducing the risk of STI and later HIV. Male condoms have generally been distributed through a wide range of distribution channels with minimal training and support for the users. Female condoms were developed as a method that women could use to protect themselves from HIV and pregnancy (Warren and Philpott, 2003). However women need significant introductory support: interpersonal communication and peer support groups have been shown to help women continue to use female condoms (Vijayakumar et al., 2006).

While these studies have shed some light on how marketing tools can stimulate demand, they have methodological weaknesses. None have tested for differences in drivers of demand between HIV prevention products nor have any accounted for the fact that demand adjusts slowly to changes and therefore analyses that fail to account for this may obtain biased estimates of the responsiveness of demand to changes in marketing tools and their long-run effects.

In this paper we explore the drivers of demand for HIV prevention products targeted at women and men (i.e. female and male condoms), using unique social marketing expenditure and sales data from Population Services International (PSI) in an unbalanced panel of 52 countries over the 11 years 1997 to 2009[3]. To the best of our knowledge, this is the first study to conduct an economic/econometric analysis of the drivers of demand for female and male condoms. In addition to price, both programmatic demand creation tools (mass media advertising; 'information, education, and communication' (IEC) and programme effort), as well as the broader country context (income levels and adult HIV prevalence) are considered as potential drivers of demand. A dynamic panel data estimator is used to identify the short- and long-run impact of advertising, price and programme effort (staffing). This study can guide programs on how best to allocate funds across their social marketing tools to maximise uptake and to inform programming of new HIV prevention products.

Broadly speaking this paper belongs to the advertisement/promotion and product/service use literature and is hence close in spirit to some papers in the health economics literature. Avery et al. (2012) study the impact of direct-to-consumer advertising on antidepressant use in the US, and similarly to this paper, they make a comparative analysis of female and male use of the product.

[3] 2005 and 2006 data were not collected centrally and were therefore not available for this analysis.

Windmeijer et al. (2006) examine the responsiveness of general practitioners to promotional activities for ethical drugs by pharmaceutical companies in the Netherlands. Ridley (2015) investigates price and advertisement elasticities of demand in the US drug market. Dave and Saffer (2013) show that in the USA smokeless tobacco advertising both increases the market demand (primary demand) as well as shifting existing users to the advertised brand. Moreover they show taxes (i.e. higher prices) have a differential effect, reducing demand more among younger male smokers and lower educated individuals. These papers are all in high income settings and in the context of profit maximising firms. Our paper thus complements this literature by presenting evidence on a very different type of product, in resource limited settings and for a non-profit organisation aiming to maximise output.

The remainder of the paper is organised as follows. Section 2 introduces the conceptual framework for analysing demand, especially the impact of demand creation tools on sales. Section 3 describes the data and Section 4 outlines the econometric approach. Section 5 presents and discusses the results and Section 6 concludes.

2 A Model of Male And Female Condom Demand

The starting point for this analysis is the basic relationships underlying an aggregate demand model, where the quantity of a good demanded is a function of its price, the price of its substitutes (or complements)[4], and income. *Quantity* demanded is proxied by aggregate country level male and female condom social marketing sales by PSI. *Price* is set by country offices with the aim of high levels of distribution while aiming for sustainability and low wastage rather than being determined by market forces. Price can therefore be treated as exogenous. *Income* is proxied by GDP per capita.

Given our interest in the effect of demand stimulation tools, the natural starting point is a generic model of the impact of advertisement on sales. The most common dynamic approach to estimating advertising impact is to specify Koyck's infinite geometric distributive lag model (Koyck, 1954), given by

$$ln(q_i) = \alpha + \sum_j \beta^j ln(X_t^j) + \lambda ln(q_{t-1}) + \epsilon_t$$

where q_t is condom sales in period t and the X_t^j are variables impacting on the quantity of condoms sold. λ is a coefficient representing the habit persistence/speed of adjustment and ϵ_t is a random

[4]Though we would have liked to examine the substitute market in detail, the substitute markets are not well defined in this case. Conceptually substitutes for condoms are both contraceptives and HIV prevention products. Alternatively these could be more narrowly defined as female condoms as substitutes for male condoms and vice versa. However, the full country level aggregate distribution of each was not available for this analysis. An alternative approach would be to define it more specifically as socially marketed products. Prices for social marketing male condoms were available as the substitute market for female condoms; for male condoms this approach would result in a very large loss of observations: only 25% to 50% of condoms distributing male condoms also distribute female condoms. An alternative definition of the substitute market for male condoms could be to define a dummy variable for the availability of female condoms in the social marketing method mix. Inclusion of this is explored in the robustness checks presented in Table A6.

error term. In this model λ lies between 0 and 1. If λ is 0, past experience has no impact on current purchasing decisions; if λ is 1, the process is non-stationary. A larger λ implies slower adjustment to external stimuli.

The short-run marginal effects of the explanatory variables (advertising and other external stimuli) are represented by β, and the long-run marginal effect is given by

$$\beta/(1-\lambda) \tag{1}$$

In the case of advertisement, the expression in (1) is commonly referred to as 'carryover' or 'goodwill'. To estimate how long it takes for 90% of the effect to have occurred, we use the 90% duration interval define by Clark (1976) as

$$\left(\frac{ln(1-0.9)}{ln(\lambda)}\right)^{-1} \tag{2}$$

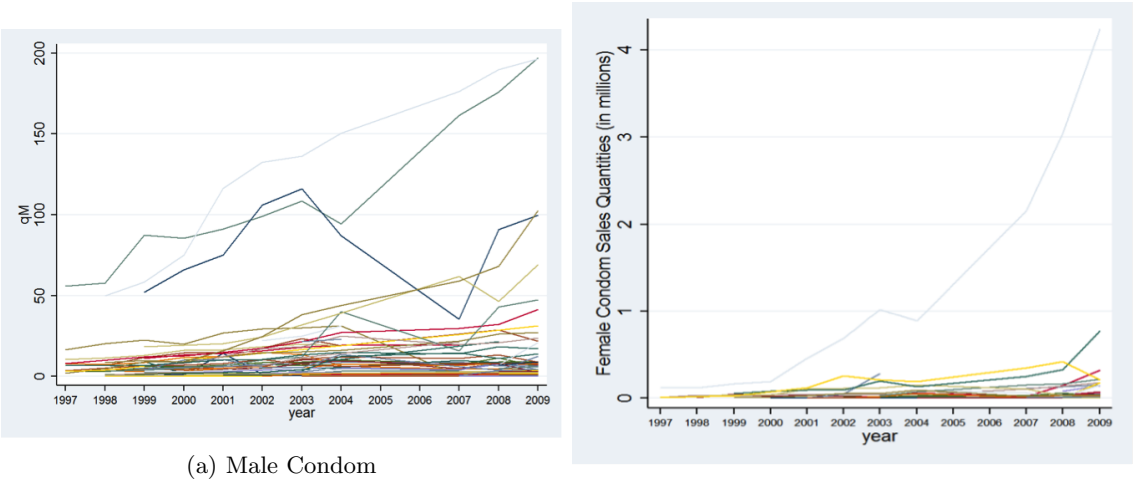
As we are using logarithmic transformations of the variables, the marginal effects are the short- and long-run elasticities.

In addition, the following determinants of condom demand are included. *Promotion* is explored as a composite of mass media advertising and 'information, education, and communication' (IEC) expenditures as well as in its disaggregated forms. As programmes can increase the quantities sold in various ways, including expanding distribution systems and improving the consistency of supply, *programme effort* (proxied by PSI local salary expenditures) is included. Acceptability and use of innovations (new products) increase with exposure (Bass, 1969; Rogers, 1962), we therefore include a measure of exposure called *product maturity*, i.e. the number of years each product has been sold. Although condoms can be used as a contraceptive, they are also an HIV prevention technology and their use is thus likely to be related to HIV-risk, represented by adult *HIV prevalence*. In contrast to a typical demand function, the dependent variable is not individual condom demand, but rather aggregate country level demand, making the size of the market, i.e. *population size*, important. As an issue of special interest, we will examine whether the relationship under discussion differs by product type: female versus male condoms.

3 Data

Though PSI distributes a wide variety of public health products, this analysis focuses exclusively on male and female condom distribution. Aggregate condom demand is proxied by country level sales of social marketing male and female condoms in an unbalanced panel of 63[5] countries over the period 1997-2009. The sample includes countries in Africa, Latin America, Asia and Eastern Europe. We have a total of 430 and 155 observations on male and female condoms, respectively. Appendix 1 provides an overview of the data availability across countries and years.

[5]The number of country programmes increased over time.



(a) Male Condom

(b) Female Condom

Figure 1: Sales (in millions) by product, country and year

Figure 1 presents the sales quantities of male and female condoms over time. Generally, an increasing trend can be seen, with more widespread and larger scale male - than female - condom sales. India, Nigeria, and Pakistan have very large male condom sales, while Zimbabwe has exceptionally high female condom sales, often attributed to an intensive and community based programme of distribution (Warren and Philpott, 2003).

The data consist of country level PSI financial accounts used for routine programme monitoring. The definition and descriptive statistics of each variable are presented in Table 1. Within this dataset, total country programme expenses are captured by expenditure category, here: local salaries; advertising and promotion; and information, education and communication (IEC), and are allocated across the range of products being distributed, including other public health products. The PSI dataset is supplemented by data from the World Development Indicators (WDI) database for country level variables: population size, HIV prevalence, and per capita incomes (World Bank, 2006). All prices are adjusted to 2011 purchasing power parity (PPP) dollars ($). Descriptive statistics of the WDI data are also presented in Table 1.

Table 1: Summary statistics

Variable	Definition, source	Male condom programme			Female condom programme		
		N	*Mean (Min- Max)	# of 0-values	N	*Mean (Min-Max)	# of 0-values
Demand	Condom quantity sold, PSI	430	15,900,000 (249-197,000,000)		155	147,802 (26-4,238,960)	
Price	Condom price, PSI	416	$0.10 ($0-$0.95)	9	142	$0.37 ($0-$4.14)	21
Programme effort	Local salary expenditures, PSI	416	$1,065,602 ($0-$17,600,000)	4	145	$116,555 ($0-$1,159,756)	13
Advertising	Advertising expenditures, PSI	416	$778,457 ($0-$8,263,314)	20	145	$64,170 ($0-$690,505)	11
Information & Education Campaign	Advertising refers to mass media promotion strategies, IEC expenditures, PSI	414	$467,164	94	145	$28,930	49
	IEC refers to one-on-one or small group intra-personal communication promotion strategies		($0-$12,400,000)			($0-$441,515)	
Promotion	IEC expenditures + Advertising expenditures, PSI	416	$1,240,311 ($0-$15,800,000)	9	144	$93,746 ($0-$690,505)	27
Product maturity	Years of condom product sales, PSI	430	8.89 (0.2-24)		155	4.21 (1-13)	
HIV adult prevalence	Prevalence of HIV in the adult population, WDI	394	5.53% (0.10%-28.70%)		141	8.16% (0.10%-28.70%)	
GDP per capita	GDP per capita, WDI	406	$4,150 ($548-$22,630)		139	$3,576 ($583-$14,023)	
Population Size	Population size, WDI	406	66,700,000 (293,544-1,330,000,000)		139	80,600,000 (301,016-1,330,000,000)	

All prices are presented in 2011 purchasing power parity dollars. *values are presented in natural units (not logarithms)
PSI: Population Services International programme accounts, the social marketing organisation. WDI: World Development Indicators database.

4 Estimation Strategy

Static analysis to compare drivers of demand between products

We start with a static model of the demand for male and female condoms to test for differences between their responsiveness to the various demand determinants. We estimate static pooled OLS and fixed effects models where we include intercept and slope dummies to distinguish between female and male condoms as follows:

$$ln(q_{kit}) = \alpha + \theta FC + \sum_j \beta^j ln(X^j_{kit}) + \sum_j \phi FC * ln(X^j_{kit}) + \upsilon_i + \omega_t + \epsilon_{kit}$$

$$k=1,2;\ i=1...N;\ t=1...T,$$

where k, i and t index respectively: product type (female or male condoms), country and time period, and FC is a dummy variable taking the value one if the product is female condom and zero otherwise. As already enumerated in Section 2, the full set of variables to be explored is: *Price of condoms, Promotion (or Advertising and IEC)* and *Programme effort, Income, HIV prevalence, Product maturity*, and *Population size*. The υ_i and ω_t are country and time effects, respectively. The country fixed effects absorb the effects of any unobserved country characteristics, such as geography and culture. The time fixed effects capture the impacts of factors such as yearly fluctuations in funding flows that may affect all country programmes and both product types in a certain time period. Given the strain on degrees of freedom, we will also experiment with an alternative specification of the time fixed effect by including just a trend variable.

Dynamic models of demand

Following our discussion in Section 2, a dynamic model of demand for each product (female or male condom) can be specified as follows:

$$ln(q_{it}) = \alpha + \sum_j \beta^j ln(X^j_{kit}) + \lambda ln(q_{i,t-1}) + \upsilon_i + \omega_t + \epsilon_{kit},$$

$$i=1...N;\ t=1...T$$

where variables and coefficients are defined as above. As is well known, the OLS and fixed effects estimators for λ are expected to be biased upwards and downwards, respectively. Thus the fixed effects estimator is likely to imply a higher rate of annual advertising depreciation (thus a smaller λ) compared to estimation using pooled OLS (Blundell et al., 2000).

The generalised methods of moments (GMM) estimator provides consistent estimators for dynamic panel data models (Arellano and Bond, 1991). With GMM, the model is first-differenced to remove the country effects υ_i. Then $\ln(q_{it-2})$,$\ln(q_{it-3})$,...,$\ln(q_{i1})$ can be used as valid instruments for the lagged sales difference [$\ln(q_{it-1})$ - $\ln(q_{it-2})$], which is endogenous in the first-differenced model. The instruments are valid as $E[(\epsilon_{it} - \epsilon_{i,t-1})\{\ln(q_{i,t-2}),\ln(q_{i,t-2}),...,\ln(q_{i1}\}] = 0$, under the assumption that the ϵ_{it} are serially uncorrelated.

It has been shown that the Arellano and Bond estimator suffers from finite sample weak instruments bias when the series are persistent (Blundell et al., 2000). To mitigate this problem Blundell and Bond proposed the 'system' (SYS) GMM estimator, which estimates the parameter based on a combination of levels and differences. Specifically, the SYS-GMM employs the lagged differences as instruments for the equations in levels, assuming that initial conditions, like mean-stationarity, are in place such that

$$E[(\upsilon_i + \epsilon_{it})\Delta ln(q_{i,t-1})] = 0$$

The main disadvantage of this estimation approach is the loss of degrees of freedom. This loss of degrees of freedom is not random: the early years of a sample, which often represent new market entry, are lost. The GMM estimator quantifies advertising effects only in the more mature markets because it includes only groups with three or more years of sales history. It can thus not provide information on the relative value of advertising in early years of a product's history. Moreover the number of potential instruments becomes very large when there are many time periods and variables; it is therefore recommended to limit the number of instruments included. The one-step system GMM estimator using instruments dated t-2 to t-3 is used to estimate the parameters of the dynamic panel data model (4), using Stata command xtabond2 (Roodman, 2009).

As the marketing tool variables include zero values, i.e. when condoms are distributed freely or there were no expenditures for promotion or local staff, we assign a small value (0.1) to these observations before taking logs, and include binary indicator variables and their lags for those observations. The GMM estimates are then used to estimate the long-run effects of the demand stimulation tools on sales. The variances of these long-run effects are estimated using the delta method. We will use this to evaluate the significance of the long run elasticities.

5 Empirical Results

As already discussed our aim is to understand the drivers of demand and whether they vary by product, in order to inform the appropriate approach to demand stimulation (i.e. which type of marketing tool will give the greatest increase in sales per dollar spent). Table 2 presents the results of the static pooled OLS and fixed effects models with female condom dummy variables to test for differences in the determinants of demand. The pooled OLS model is rejected in favour of the FE model allowing for estimated country fixed effects. The Log-likelihood Ratio (LR) test could not reject the year trend in favour of the 10 year-specific effects; as such time is captured by a trend in the presented models. The results with alternative specifications of the time effects are presented in the Appendix Table A5. The results are very similar, though the IEC*female condom interaction variable loses significance in the alternative specification.

Table 2: Estimation results: static model of the demand for condoms

Dependent variable: Ln Aggregate Country Level Condom Sales	(1)		(2)	
VARIABLES	Pooled OLS Year as trend		Fixed effects Year as trend	
Constant	21.33	(30.68)	-84.41	(62.11)
Female Condom dummy (FC)	2.423	(2.215)	0.385	(1.996)
Ln Advertising	**0.241*** **	(0.085)	**0.192*** **	(0.067)
*FC	**-0.199***	(0.116)	**-0.192***	(0.101)
Ln IEC	**0.124*** **	(0.044)	**0.081** **	(0.032)
*FC	0.162	(0.121)	**0.176***	(0.105)
Ln Own Price	**-0.230*** **	(0.076)	-0.123	(0.100)
*FC	**-0.246***	(0.143)	-0.179	(0.133)
Ln Programme Effort	**0.231*** **	(0.075)	0.131	(0.081)
*FC	-0.148	(0.194)	-0.035	(0.178)
Ln GDP per capita	0.108	(0.096)	-0.53	(0.407)
*FC	0.002	(0.198)	0.146	(0.188)
Ln Population Size	**0.407*** **	(0.050)	-0.036	(1.293)
*FC	**-0.242** **	(0.114)	**-0.317*** **	(0.122)
Ln Adult HIV prevalence	**0.055***	(0.033)	**0.445***	(0.259)
*FC	**0.282** **	(0.112)	**0.336*** **	(0.097)
Ln Product maturity	**0.484*** **	(0.075)	**0.383** **	(0.150)
*FC	0.004	(0.193)	-0.048	(0.243)
Year	-0.011	(0.015)	0.05	(0.039)
Observations	515		515	
R-squared	0.865		0.93	
LR-test (H0: no country effects)		335***		

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Country effects and coefficients for the 'Year' trend and 'No expenditures' dummies (No advertising, No local salaries, No IEC, free products, respectively) are not presented. Table A6 presents the same model run separately for Male and Female condoms, but including HIV prevention substitutes in the marketing mix (female condoms as substitutes for male condom, and the price of substitutes (the price of male condoms as a driver of demand for female condoms).

The signs of the marketing coefficients conform to expectations: *Advertising, IEC* and *Programme Effort* all have positive signs while *Price* has a negative sign. In the fixed effects model *Price* and *Programme Effort* are not significant at conventional levels of significance; *Price* does however have a significant negative effect on condom sales when estimated jointly for both products (not shown).

The static model suggests considerable differences between male and female condom demand responses, with female condoms being more responsive than male condoms to: *IEC, Population size* and *HIV prevalence* and less (to the point of not at all) responsive to mass media advertising.

This static approach is arguably satisfactory for exploring differences in the determinants of demand by product. However, as discussed in the previous section, demand is expected to be driven not only by current marketing strategies, but also by previous period investments. In such cases a dynamic model is more appropriate. A one-step system GMM estimator is used to estimate the short- and long-run effects of promotion, prices and programme effort and country contexts and the duration of their effects (Table 3). 'Promotion' is introduced as the sum of mass media advertising and IEC to prevent instrument proliferation.

The specification tests for the GMM estimator are satisfied, i.e. we find 1st order serial correlation (ar1), albeit slightly above a conventional p-value for the male condom estimate, and no 2nd order serial correlation (ar2). The Hansen test does not reject the over-identifying conditions. The Hansen p-value of 1.0 for the female condom estimates is caused by the small sample size. Conforming with expectations, the system GMM estimate for λ lies between the OLS and FE estimates.

Qualitatively, the three estimators provide reasonably consistent results across the three estimators, particularly for the presence of persistence and effectiveness of promotion for increasing demand. In contrast to the significantly positive coefficient on population size in the GMM model, the OLS and fixed effects models did not identify this effect.

Both the male and female condom display significant persistence, with male condom demand slower to adjust to stimulae than female condom demand, as seen in the relatively higher λ in the male condom estimates (0.503) relative to the female condom estimates (0.378). It takes 2.4 and 1.4 years for 90% of the cumulative effects to be exhausted, respectively, for male and female condoms.

The main drivers of short-run male condom demand are promotion and population size. In the long-run, however price and programme effort also affect demand. The GMM estimates show that the short-run impact of a 10% increase in promotion spending is 1.65%, whereas such an investment is expected to increase demand by 3.32% in the long-run. Price is negative and not significant in the short-run, but in the long-run a 10% increase in price is expected to generate a 1.7% decrease in male condom demand. Again, programme effort has no immediate effect but a 10% increase in local staffing leading to a 2.56% increase in male condom demand. It can be further seen that income, as proxied by GDP per capita, does not significantly affect male condom demand.

In the female condom fixed effects model all coefficients loose significance except product age which is likely attributable to the small sample size. Demand for female condoms changes more rapidly than demand for the male condom; the short-run effect of a 10% increase in promotion spending is 1.85% rising to 2.97% in the long-run. Price has a very large effect on demand, with a 10% price increase leading to a 3.65% and a 5.87% decrease in demand in the short- and long-run, respectively. In contrast to male condom demand, female condom demand is affect by HIV prevalence in both the short- and long-run.

Table 3: Estimation results: dynamic panel data model of the demand for condoms

Dependent variable:	Dynamic Male Condom Estimates			Dynamic Female Condom Estimates		
Ln Aggregate Country Level Condom Sales						
VARIABLES	OLS	Fixed effects	GMM	OLS	Fixed effects	GMM
Lag Ln Condom sales	0.731***	0.484***	0.503***	0.474***	0.145	0.378***
	(0.0767)	(0.0893)	(0.135)	(0.121)	(0.198)	(0.099)
Ln Promotion	0.164***	0.146***	0.165**	0.173*	0.168*	0.185**
	(0.0591)	(0.0531)	(0.0664)	(0.095)	(0.089)	(0.091)
Ln Price	-0.0539	-0.176**	-0.0845	-0.332***	-0.14	-0.365***
	(0.0512)	(0.0671)	(0.0525)	(0.116)	(0.110)	(0.110)
Ln Programme effort	0.053	0.104	0.128	-0.099	-0.111	-0.077
	(0.0688)	(0.102)	(0.0881)	(0.101)	(0.133)	(0.075)
Ln GDP per capita	-0.00704	0.158	-0.0042	-0.038	-0.796	-0.022
	(0.0695)	(0.364)	(0.0798)	(0.174)	(2.990)	(0.185)
Ln Product age	-0.0602	-0.113	0.102	0.205	2.863**	0.314
	(0.0751)	(0.198)	(0.131)	(0.235)	(1.293)	(0.222)
Ln Population size	0.0751	1.492	0.191**	0.169	-13.96	0.166*
	(0.0594)	(1.088)	(0.0746)	(0.113)	(15.83)	(0.100)
Ln Adult HIV prevalence	0.00453	0.488***	0.0205	0.178	0.287	0.206**
	(0.0232)	(0.168)	(0.0292)	(0.119)	(0.829)	(0.099)
ar1p			0.128			0.073
ar2p			0.514			0.141
Hansen's p-value			0.201			1
Long-run effects						
Promotion			0.332** (0.155)			0.297** (0.150)
Price			-0.17* (0.090)			-0.587*** (0.132)
Programme effort			0.256* (0.149)			-0.123 (0.124)
GDP per capita			-0.008 (0.161)			-0.035 (0.301)
Age			0.0206 (0.219)			0.504 (0.321)
Population Size			0.385*** (0.089)			0.269 (0.166)
HIV Prevalence			0.041 (0.058)			0.331** (0.149)
90% duration interval			2.4 years			1.4 years
Observations	280	280	280	85	85	85
R-squared	0.893	0.597		0.766	0.631	
Number of Countries		58			26	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Parameters for year, country and dummies for: no promotion, free condoms and no staffing and their lags are not shown; available upon request.

As robustness checks, we have estimated these relationships under a variety of alternative specifications and the exclusion of Eastern European and Central Asian countries in the male condom sample. These specifications do not qualitatively change the results (see Table A7). Estimation of the 'ordinary' first-differenced GMM did result in considerably different results (see Table A7). Because Zimbabwe had far high female condom sales than the other countries and contributed 10% of the observations, we removed its observations to check for its influence on the results; again the results remain broadly intact when excluding Zimbabwe (not shown).

Within the scope of HIV prevention products, the full substitute market was not observed. We only analysed data on condom sales through PSI; the free public sector was not incorporated nor was the private condom sector (in the few countries where it existed). When considering condoms as contraceptives, there exist both private and public markets for contraceptives in these countries, which were also not captured. We did however run our static models capturing the price of PSI male condoms as the price of substitute for female condoms and found no significant effect, while programmes selling female condoms had significantly higher male condom sales (Table A6). The study period covered the introduction of HIV treatment in some countries. Though the general trend is captured by the time dummies, ideally it would have been included in more detail. Other variables that theoretically should have been included were: Gini coefficient (to account for aggregation bias in country level analyses), and age and sex distribution of the population (to capture the at-risk population). Complete time series data on these variables across our sample countries were not available and changed little over the study period, however the country and time effects remove biases potentially introduced by their omission.

The social marketing data may contain measurement error and inconsistencies over time and countries attributable to the following factors. While PSI has provided financial data on the allocation of costs from 1997 to 2009, it should be noted that during this timeframe, PSI implemented a rolling upgrade of its financial system, which contributes to some variation in the data by country and year. Reporting requirements by PSI funders sometimes vary, leading to differences in allocations of costs between expenditure categories. Allocations of shared expenditures across products may not have been applied consistently. The data do not differentiate between generic and branded promotional expenditures. However, this dataset is the largest of its kind that can be used to estimate the effects of marketing tools on condom sales, albeit still small compared to many other analyses of advertising and price elasticities of demand.

Despite these limitations, we find largely robust results, in particular for the male condom analysis. The female condom results should be considered indicative rather than conclusive due to the smaller sample size. These results are largely consistent with the literature of advertising impact, however given the products at hand and the country settings, direct comparison of the magnitude of demand elasticities is not productive.

6 Conclusion

Mass media advertising is an important marketing tool for male condoms and has an effect that is observed throughout the second year. Advertising is however not found to be effective in stimulating demand for female condoms. Female condoms need more interpersonal support and are highly affected by IEC strategies, though IEC remained important for stimulating male condom demand as

well. For both products, promotion and price have strong long-run effects, approximately doubling the short-run effects. Care needs to be taken when setting prices to ensure they remain consistent with social marketing aims: sufficiently low to not form a barrier to demand, while reducing wastage and instilling a sense of value associated with the products.

More research needs to be done to better understand the differences between the price elasticities of demand between the male and female condom, to disentangle if it relates to differences in price levels and products, or are more related to the user groups, with female condoms targeted particularly for purchase by women, known to have lower ability to pay.

The findings of this paper also have a bearing beyond condoms. When developing demand creation approaches for new HIV prevention products, it is important to consider the target user as well as the product characteristics. If sold, consideration to purchasing power of the intended target users may be critical to the scale of their distribution, as well as the fact that the product price is only part of the cost of product use; many people face high costs to access health services, both in terms of direct transport costs and labour time lost. Social marketing can play a critical role in diversifying distribution outlets to bring products to more accessible locations and in increasing demand through interpersonal communication and mass media advertising.

Conflict Of Interest

None

Acknowledgements

Data obtained and analyzed with permission from Population Services International, Research & Metrics Department, Washington, D.C. (`www.psi.org/research`) and analysed independently. All rights reserved by PSI. Steve Chapman provided very useful comments on earlier versions of this study while research director at PSI. The authors take full responsibility for the conclusions drawn.

We also thank Audrey Laporte for her thorough and very useful comments on a draft of this paper. This paper benefitted from feedback from participants of a seminar at the Institute on Health Economics, Health Behaviors and Disparities at Cornell University; in particular we thank Donald Kenkel and John Cawley for their detailed comments. The usual disclaimer applies.

This work was undertaken over more than a decade during which a number of grants and fellowships contributed to its finalisation. FTP received support for this work from an International Academic Fellowship from the Leverhulme Trust (grant number IAF-2015-015). The latter funded FTP's visit at the Dalla Lana School of Public Health at the University of Toronto, where this work was in part written up. The early analysis was undertaken while Fern Terris-Prestholt was part of the UK Department for International Development funded Microbicide Development Programme (2002-2008) and later the Bill and Melinda Gates Foundation project titled "ARV-Based Prevention Technologies: Developing the Capacity and Needed Tools to Deliver New Prevention Products" (2011-2015). The funders had no influence on the study.

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Appendix: Tables And Figures

Table A1: Overview of panel data structure (number of country's programmes distributing each condom type by year)

Year	Male Condom	Female condom
1997	11	3
1998	21	4
1999	37	7
2000	36	9
2001	43	11
2002	43	15
2003	48	16
2004	44	19
2007	44	17
2008	51	26
2009	52	28
Total	430	155

Table A2: Male condom data availability

	Year										
Country	1997	1998	1999	2000	2001	2002	2003	2004	2007	2008	2009
Afghanistan							1	1			
Albania			1	1	1	1	1				
Angola					1	1	1	1	1	1	1
Belize										1	1
Benin	1	1	1	1	1	1	1	1	1	1	1
Bolivia		1	1	1	1	1					
Botswana			1	1	1	1	1	1	1	1	1
Burkina Faso			1	1	1	1	1	1	1		
Burundi			1	1	1	1	1	1	1	1	1
Cambodia	1	1	1	1	1	1	1	1			
Cameroon		1	1	1	1	1	1	1	1	1	1
Caribbean											1
Central African Republic			1		1	1	1	1	1	1	1
Central America		1	1	1	1	1	1	1	1		
Chad	1	1	1								
China								1	1	1	1
Congo(Dem. Rep. & Rep.)						1	1	1			
Congo, Dem. Rep.				1	1				1		1
Congo, Rep.			1	1	1					1	
Costa Rica										1	1
Cote d'Ivoire	1	1	1	1	1	1	1	1	1	1	1
Cuba					1	1					
Dominican Republic							1	1	1	1	1
El Salvador										1	1
Eritrea			1	1	1	1	1	1			
Ethiopia										1	1
Georgia					1	1	1	1			
Guatemala										1	1
Guinea	1	1	1	1	1	1	1	1	1	1	1
Guinea-Bissau					1	1	1				
Guyana								1			
Haiti	1	1	1	1	1	1	1	1	1	1	1
Honduras										1	1
India	1	1	1	1	1	1	1	1	1	1	1
Kazakhstan						1	1		1	1	1
Kenya	1		1	1	1	1	1	1	1	1	1
Kosovo					1	1	1				
Kyrgyzstan							1	1	1	1	1
Lao PDR			1	1	1	1	1	1	1	1	1
Lesotho			1	1				1	1	1	1
Lesotho & Swaziland					1	1	1				
Liberia											1
Madagascar			1	1	1	1	1	1	1	1	1
Malawi		1	1	1	1	1	1	1	1	1	1
Mali					1	1	1	1	1	1	1
Mexico									1	1	1
Mozambique		1	1	1	1	1	1	1	1	1	1
Myanmar			1	1	1	1	1	1	1	1	1
Namibia		1	1	1	1	1	1	1	1	1	1
Nepal							1	1			
Nicaragua										1	1
Nigeria		1	1	1	1	1	1	1	1	1	1
Pakistan			1	1	1	1	1	1	1	1	1
Panama										1	
Papua New Guinea									1	1	1
Paraguay		1	1	1	1	1	1		1	1	1
Romania		1	1	1	1	1	1	1	1	1	1
Russian Federation		1	1	1	1	1	1	1	1	1	1
Rwanda		1	1	1	1	1	1	1	1	1	1
South Africa		1	1	1	1	1	1	1	1	1	1
Sudan										1	1
Swaziland								1	1	1	1
Tajikistan							1		1	1	1
Tanzania			1	1	1	1	1	1	1	1	1
Thailand							1	1	1	1	1
Togo	1	1	1	1	1	1	1	1	1	1	1
Uganda			1	1	1	1	1	1	1	1	1
Uzbekistan							1				
Vietnam									1	1	1
Zambia	1		1	1	1	1	1	1	1	1	1
Zimbabwe	1	1	1	1	1	1	1	1	1	1	1
Total	11	21	37	36	43	43	48	44	44	51	52

Table A3: Female condom data availability

Country	Year										
	1997	1998	1999	2000	2001	2002	2003	2004	2007	2008	2009
Belize											1
Benin										1	1
Bolivia		1	1	1	1	1					
Botswana						1	1	1		1	
Burkina Faso								1			
Cambodia							1	1	1		
Cameroon						1	1	1	1	1	1
Caribbean											1
Central African Rep.										1	1
Central America				1	1	1	1	1	1		
China								1	1	1	1
Congo(Dem. Rep. & Rep.)								1			
Congo, Dem. Rep.									1		1
Congo, Rep.										1	
Costa Rica										1	
Cote d'Ivoire								1			
El Salvador										1	1
Guatemala										1	1
Guinea-Bissau						1	1				
Haiti	1	1	1	1	1	1	1	1	1	1	1
India									1	1	1
Lesotho								1	1	1	1
Lesotho & Swaziland					1	1	1				
Madagascar										1	1
Malawi										1	1
Mali						1	1	1	1	1	1
Mozambique				1	1	1	1	1	1	1	1
Myanmar							1	1	1	1	1
Namibia										1	1
Nicaragua										1	1
Nigeria											1
Papua New Guinea										1	1
Paraguay					1	1	1			0	0
South Africa		1	1	1	1	1	1	1	1	1	1
Swaziland								1			
Tanzania			1	1	1	1	1	1	1	1	1
Togo			1	1	1	1	1	1	1	1	1
Uganda											1
Vietnam									1	1	1
Zambia	1		1	1	1	1	1	1	1	1	1
Zimbabwe	1	1	1	1	1	1	1	1	1	1	1
Total	3	4	7	9	11	15	16	19	17	26	28

Table A4: Correlation matrix

Male condom correlations (n=382)											
	Ln Condom sales	Ln Promotion	Ln Advertising	IEC	Ln Price	Ln Programme effort	Ln Product age	Substitute (dummy)	Ln GDP per capita	Ln Population size	Ln Adult HIV prevalence
Ln Male condom sales	1										
Ln Promotion	0.3	1									
Ln Advertising	0.32	0.7	1								
Ln IEC	0.16	0.26	0.09	1							
Ln Price	0.13	0.09	0.24	-0.04	1						
Ln Programme effort	0.28	0.83	0.57	0.23	0.1	1					
Ln Product age	0.53	0.02	0.07	0.22	0.05	0.06	1				
Substitute (dummy)	0.21	0.08	0.06	0.22	0.01	0.05	0.16	1			
Ln GDP per capita	-0.19	-0.07	-0.13	-0.02	-0.06	-0.06	-0.22	-0.01	1		
Ln Population size	0.56	0.17	0.08	0.06	-0.11	0.14	0.24	0	0	1	
Ln Adult HIV prevalence	0.17	0.01	0.08	-0.04	-0.05	0.01	0.32	0.29	-0.24	-0.2	1
female condom (N=131)											
Ln Female condom sales	1										
Ln Promotion	0.22	1									
Ln Advertising	0.33	0.8	1								
Ln IEC	0.2	0.7	0.48	1							
Ln Price	0.33	0.15	0.3	-0.02	1						
Ln Programme effort	0.19	0.45	0.34	0.39	0.06	1					
Ln Product age	0.5	-0.08	0.07	0.14	0.21	-0.06	1				
Substitute (dummy)	-0.09	-0.03	0.1	-0.11	0.52	0.04	0.03	1			
Ln GDP per capita	-0.18	-0.17	-0.11	-0.22	-0.36	-0.13	-0.12	-0.11	1		
Ln Population size	0.16	0.01	0.03	-0.09	0.09	-0.1	0.05	0.02	-0.03	1	
Ln adult HIV prevalence	0.46	-0.06	-0.01	-0.05	0.23	-0.02	0.41	-0.17	-0.07	-0.14	1

Table A5: Estimation results (robustness check): static model with year-specific effects

VARIABLES	OLS trend	FE trend i.c	OLS i.y	FE i.y i.c
Constant	21.33	-84.41	-0.816	18.03
	(30.68)	(62.11)	(1.354)	(19.35)
Female condom dummy	2.423	0.385	2.543	0.349
	(2.215)	(1.996)	(2.205)	(1.975)
Ln Advertising	**0.241*** **	**0.192*** **	**0.245*** **	**0.192*** **
	(0.0846)	(0.0665)	(0.0858)	(0.0665)
*FC	**-0.199***	-0.192*	**-0.211***	**-0.196***
	(0.116)	(0.101)	(0.116)	(0.1000)
Ln IEC	**0.124*** **	**0.0812** **	**0.136*** **	**0.0893*** **
	(0.0444)	(0.0315)	(0.0451)	(0.0334)
*FC	0.162	**0.176***	0.136	0.148
	(0.121)	(0.105)	(0.125)	(0.107)
Ln Own Price	**-0.230*** **	-0.123	**-0.242*** **	-0.129
	(0.0763)	(0.100)	(0.0789)	(0.0987)
*FC	**-0.246***	-0.179	**-0.274***	-0.201
	(0.143)	(0.133)	(0.146)	(0.134)
Ln Programme Effort	**0.231*** **	0.131	**0.211*** **	0.12
	(0.0752)	(0.0813)	(0.0765)	(0.0826)
*FC	-0.148	-0.0349	-0.144	-0.0424
	(0.194)	(0.178)	(0.190)	(0.176)
Ln GDP per capita	0.108	-0.53	0.126	-0.555
	(0.0963)	(0.407)	(0.0991)	(0.416)
*FC	0.00248	0.146	-0.0063	0.149
	(0.198)	(0.188)	(0.199)	(0.186)
Ln Population Size	**0.407*** **	-0.0364	**0.409*** **	-0.207
	(0.0501)	(1.293)	(0.0499)	(1.332)
*FC	**-0.242** **	**-0.317*** **	**-0.230** **	**-0.298** **
	(0.114)	(0.122)	(0.113)	(0.121)
Ln Adult HIV prevalence	**0.0547***	**0.445***	0.0525	**0.503***
	(0.0327)	(0.259)	(0.0331)	(0.284)
*FC	**0.282** **	**0.336*** **	**0.281** **	**0.333*** **
	(0.112)	(0.0972)	(0.114)	(0.0980)
Ln product maturity	**0.484*** **	**0.383** **	**0.493*** **	**0.372** **
	(0.0752)	(0.150)	(0.0739)	(0.149)
*FC	0.00396	-0.0477	0.0131	-0.0269
	(0.193)	(0.243)	(0.193)	(0.246)
Year	-0.0112	0.0496		
	(0.0153)	(0.0390)		
Robust standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1	
Observations	515	515	515	515
R-squared	0.865	0.93	0.868	0.931
LR-test		2 versus 1	3 versus 1	4 versus 2
		335***	12.2	12.8

Table A6: Estimation results: static model including substitutes/substitute price

	Male Condom, FE		Female Condom, FE	
	coefficient	St. Err.	coefficient	St. Err.
Ln Advertising	0.194***	(-0.069)	-0.0486	(-0.121)
Ln IEC	0.087***	(-0.029)	0.299**	(-0.127)
Ln Own price	-0.143	(-0.099)	0.0959	(-0.165)
Substitute dummy; Psub for FC model	0.328***	(-0.103)	-1.733	(-2.698)
Ln Programme effort	0.096	(-0.081)	0.0832	(-0.123)
Ln GDP per capita	-0.119	(-0.357)	-4.247*	(-2.151)
Ln Population size	-0.788	(-1.134)	12.81	(-8.678)
Ln Adult HIV prevalence	0.665***	(-0.229)	1.513*	(-0.843)
Ln Product maturity	0.523***	(-0.121)	0.541	(-0.489)
Year	0.0129	-0.036	-0.09	-0.136
Constant	-2.494	(-56.52)	12.41	(-204.4)
Observations	381		132	
R-squared	0.9		0.854	

Table A7: Robustness checks of the dynamic male condom model under alternative specifications

VARIABLES	Base: Systems GMM	1st-Differenced GMM	lags 2-4	No lagged dummies	MC-GMM-XEurAsia
Lag Ln Condom Sales	0.503***	-0.125	0.503***	0.570***	0.844***
	(0.135)	(0.208)	(0.135)	(0.113)	(0.0957)
Ln Promotion	0.165**	0.0602	0.162**	0.166***	0.135*
	(0.0664)	(0.0516)	(0.0664)	(0.0612)	(0.0726)
Ln Price	-0.0845	-0.0383	-0.0857	-0.0826*	-0.051
	(0.0525)	(0.0934)	(0.0522)	(0.0490)	(0.0475)
Ln Programme effort	0.128	-0.0187	0.128	0.112	-0.00286
	(0.0881)	(0.226)	(0.0876)	(0.0885)	(0.0599)
Ln GDP per capita	-0.0042	1.114	-0.00406	-0.00341	0.0217
	(0.0798)	(0.957)	(0.0798)	(0.0773)	(0.0626)
Ln product age	0.102	0.065	0.103	0.0872	-0.0984
	(0.131)	(0.453)	(0.131)	(0.113)	(0.101)
Ln Population size	0.191**	1.838	0.192***	0.148**	0.04
	(0.0746)	(2.547)	(0.0747)	(0.0645)	(0.0471)
Ln Adult HIV prevalence	0.0205	0.372	0.0206	0.0189	0.0217
	(0.0292)	(0.268)	(0.0294)	(0.0262)	(0.0211)
No Promotion	8.339**	2.709	8.203**	8.451***	7.646**
	(3.345)	(2.516)	(3.338)	(3.078)	(3.666)
Lag.No Promotion	-0.39	-1.080*	-0.403		-0.0237
	(0.412)	(0.646)	(0.414)		(0.614)
Price_free	0.832**	0.809**	0.836**	0.411	0.734*
	(0.386)	(0.374)	(0.387)	(0.532)	(0.393)
Lag.Price_free	-1.051*	-0.29	-1.056*		-0.521
	(0.540)	(0.262)	(0.543)		(0.475)
No Local staff	2.978***	-1.356	3.007***	3.084**	-0.395
	(1.037)	(3.665)	(1.035)	(1.230)	(0.679)
Lag.No Local staff	Dropped due to collinearity				
_Iyear_1998	0.0326		0.0317	0.0623	
	(0.137)		(0.136)	(0.124)	
_Iyear_1999		0.25			0.0805
		(0.183)			(0.111)

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Table A7 – *Continued from previous page*

VARIABLES	Base: Systems GMM	1st-Differenced GMM	lags 2-4	No lagged dummies	MC-GMM-XEurAsia
_Iyear_2000	-0.237**	0.255	-0.237**	-0.212**	-0.177*
	(0.106)	(0.274)	(0.106)	(0.0942)	(0.0974)
_Iyear_2001	-0.0177	0.489	-0.0169	0.00874	-0.018
	(0.115)	(0.341)	(0.115)	(0.0972)	(0.0793)
_Iyear_2002	-0.0805	0.51	-0.08	-0.0446	0.0309
	(0.113)	(0.454)	(0.113)	(0.0966)	(0.104)
_Iyear_2003	-0.113	0.596	-0.113	-0.087	-0.0558
	(0.0967)	(0.551)	(0.0965)	(0.0836)	(0.0842)
_Iyear_2004	0.0335	0.66	0.0328	0.0674	0.0412
	(0.116)	(0.650)	(0.116)	(0.105)	(0.0883)
_Iyear_2008	-0.0391	0.257**	-0.0402	-0.0386	0.109
	(0.165)	(0.127)	(0.167)	(0.145)	(0.146)
_Iyear_2009	-0.375**		-0.375**	-0.349**	-0.279**
	(0.164)		(0.164)	(0.140)	(0.110)
Constant	0.534		0.537	0.379	0.0831
	(1.108)		(1.113)	(1.160)	(0.803)
Observations	280	190	280	280	267
Number of Countries	58	46	58	58	53
ar1p	0.128	0.786	0.126	0.137	0.0175
ar2p	0.514	0.428	0.517	0.521	0.514
sarganp		0.0937			
hansenp	0.201		0.319	0.165	0.289
Long-run effects					
Ln Promotion	0.332**	0.054	0.327**	0.385**	0.332**
	(0.155)	(0.045)	(0.154)	(0.161)	(0.155)
Ln Price	-0.170*	-0.034	-0.172*	-.192**	0.170*
	(0.090)	(0.086)	(0.090)	(0.098)	(0.09)
Ln Programme effort	0.257*	-0.017	0.258*	0.261	0.257
	(0.149)	(0.199)	(0.149)	(0.177)	(0.085)
Ln GDP per capita	-0.008	0.99	-0.008	-0.008	-0.008

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Table A7 – *Continued from previous page*

VARIABLES	Base: Systems GMM	1st-Differenced GMM	lags 2-4	No lagged dummies	MC-GMM-XEurAsia
	(0.161)	(0.898)	(0.161)	(0.180)	(0.161)
Ln product age	0.206	0.058	0.206	0.203	0.206
	(0.220)	(0.398)	(0.220)	(0.227)	(0.22)
Ln Population size	0.385***	1.633	0.387***	0.345***	0.385***
	(0.385)	(2.355)	(0.089)	(0.101)	(0.089)
Ln Adult HIV prevalence	0.041	0.33	0.041	0.044	0.041
	(0.058)	(0.196)	(0.058)	(0.062)	(0.058)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1