

## Supplementary File

We present coefficients for household expenditure and household size from tertile-wise unit value and budget share regressions, and expenditure elasticities in Supplementary Table 1. The coefficient of the logarithm of expenditure in the unit value equation yields the expenditure elasticity of quality. Cigarettes have the highest expenditure elasticity of quality in T3, with a value of 0.07 (p value <0.001). This implies that a doubling of household expenditure will increase the average price paid for cigarettes by 7%. For leaf tobacco, the highest expenditure elasticity of quality is found in T3, with a value of 0.13 (p value <0.01). This implies that doubling of household expenditure will increase the price paid for leaf tobacco by approximately 13%. Logarithms of household size coefficients are approximately similar in size and opposite in sign to the coefficients of the logarithm of household expenditure in the unit value equations. This implies that increases in household size are likely to reduce household income.

**Supplementary Table 1: Household Expenditure and Household Size Coefficients**

	Tertile 1 Poorest		Tertile 2 Middle		Tertile 3 Richest	
	Unit Values	Budget Shares	Unit Values	Budget Shares	Unit Values	Budget Shares
<b>BIDI (n)</b>	7118	16513	7728	18010	4538	15159
<b>F-statistic</b>	3.80*	13.61*	4.94*	38.71*	1.35	50.57*
<b>Adjusted-R</b>	0.8188	0.6885	0.929	0.8201	0.7848	0.6221
<b>Clusters</b>	4010*	6704*	4590*	8511*	3054*	7568*
<b>lnexp</b>	0.0215	-0.0030*	0.0373	-0.0080*	0.0312	-0.0044*
<b>lnsize</b>	-0.024	0.0018**	-0.0369	0.0035**	-0.0295	0.0010**
<b>Exp elasticity</b>	0.6503		0.0917		0.1352	
<b>_cons</b>	-1.4032*	0.0338*	-1.4324*	0.0747*	-1.2485*	0.0497*
<b>CIGARETTE (n)</b>	959	16513	3169	18010	5618	15159
<b>F-statistic</b>	1.25	5.76*	6.11**	11.10*	7.31*	17.02*
<b>Adjusted-R</b>	0.9918	0.6591	0.7355	0.5822	0.9044	0.7768
<b>Clusters</b>	764*	6704*	2244*	8511*	3478*	7568*
<b>lnexp</b>	0.0374	0.0006**	0.0736	0.0032*	0.0718*	-0.0002
<b>lnsize</b>	-0.023	-0.0003	-0.0921	-0.0026*	0.0005	-0.0028*
<b>Exp elasticity</b>	1.4693		1.6502		0.9459	
<b>_cons</b>	0.5931	-0.0043**	0.7309	-0.0215*	0.5188*	0.0041

<b>LEAF TOBACCO (n)</b>	6887	16513	6025	18010	3884	15159
<b>F-statistic</b>	2.26*	40.12*	4.79*	18.14*	4.40*	14.92*
<b>Adjusted-R</b>	0.7741	0.8011	0.7852	0.6468	0.7249	0.5368
<b>Clusters</b>	3154*	6704*	3392*	8511*	2580*	7568*
<b>lnexp</b>	0.0012	-0.0025*	-0.0041	-0.0009*	0.1313**	-0.0007*
<b>lnsize</b>	-0.0134	-0.0003	-0.0371	-0.0007***	-0.1549**	-0.0003***
<b>Exp elasticity</b>	0.2334		0.6084		0.4097	
<b>_cons</b>	-1.6209*	0.0251*	-1.5850*	0.0122*	-2.438*	0.0089*

**Legend:**

\*p value<=0.001; \*\*p value<=0.01; \*\*\*p value<=0.05

lnexp: logarithm of household expenditure; lnsize: logarithm of household size

Exp elasticity: Expenditure Elasticity

Coefficients of the logarithms of household expenditure and household size are generally opposite in sign in the budget share regressions, for both *bidis* and cigarettes. At constant household expenditure, an increase in household size leads to increased budget shares on *bidis*, but reductions in budget shares on cigarettes and leaf tobacco. The highest reductions in budget share are seen for cigarettes in T2, with a unit increase in household size resulting in a decrease of household budget share by 0.26%.

The total of the expenditure elasticities of quality and quantity gives the expenditure elasticity. This is less than one for both *bidis* and leaf tobacco across all tertiles, and for cigarettes in T3; and more than one for cigarettes in T1 and T2. This suggests that cigarettes are luxury goods for T1 and T2 groups.

**Supplementary Table 2: Own and Cross Price Elasticity Estimates of Tobacco Products, 2011-12**

	Tertile 1 Poorest			Tertile 2 Middle			Tertile 3 Richest		
	B	C	L	B	C	L	B	C	L
<b>B</b>	-0.4328	0.0131	-0.0223	-0.2499	-0.0388	0.0278	-0.0815	-0.1112	0.0143
<b>C</b>	0.0911	-0.832	-0.0111	-0.0958	-0.0913	-0.0132	-0.0634	-0.2645	0.0627
<b>L</b>	-0.0577	-0.0025	-0.557	0.1007	-0.0189	-0.4537	0.0459	0.4021	-0.0507

**Legend:**

B: *Bidis*; C: Cigarettes; L: Leaf Tobacco

Shaded and un-shaded areas depict own and cross-price elasticities, respectively

**Simulation Exercise**

We simulated the effects on consumption of cigarettes and *bidis* if the current excise tax was to be increased, using simulation models as used by John[1]. We assume that there would be constant reductions in

consumption (elasticity) across consecutive tax increases; changes in price correspond to changes in tax; and there would be no substitution effects due to the changes in price. The decreased consumption is in units of sticks consumed and we make no inferences upon whether the reductions in consumption are due to cessation, delayed initiation, or decreased frequency of use.

Estimates on the number of cigarettes and bidis consumed by Indian consumers vary. Industry estimates range from 108-137 billion cigarette sticks consumed for the year 2011[2,3]. The Global Adult Tobacco Survey India 2009-10 estimated 46,358,000 cigarette smokers, consuming a mean number of 6.2 cigarettes a day, yielding an estimate of 104 billion sticks for 2009-10[4]. We therefore use the conservative estimate of 100 billion sticks consumed for 2011-12 and apportion this total consumption to the three tertiles based on the proportion of consumption in the CES survey data: 9.9% to tertile1 (T1), 29.8% to tertile2 (T2), and 60.26% to tertile3 (T3); the corresponding revenue accrued for cigarettes for the same time period was Rupees 111.7 billion.<sup>1</sup> This yields an average excise of Rupees 1.03 per stick. We also rely on the ERC, 2013 estimate of unit cost of a cigarette to be Rs. 2.9965[2]. A constant VAT is also assumed. We apply the price elasticities obtained for each expenditure tertile to estimate the proportion decline in consumption in number sticks consumed in that particular tertile. For example, the price elasticity of cigarettes in T1 was estimated to be -0.832; implying that a 10% increase in tax would lead to an 8.32% decline in the number of sticks consumed in T1. The corresponding number of sticks multiplied by the new excise per stick yields the expected excise revenue. Similar estimations are conducted for all tertiles, and for sequential 10% increases in excise tax rates. Supplementary Table 3 shows the change in excise revenue accrued due to changes in excise rates, assuming the above mentioned constants. As per the table, revenue from cigarettes increases from the current Rs. 111.7 billion to more than Rs. 224 billion, if excise tax is increased by 300 percent of its present levels, while almost halving the number of sticks consumed. As the elasticity for cigarettes is the highest in T1, the greatest relative reductions in the number of sticks consumed is observed in this tertile. Excise tax can be increased from the present Rs 1.12 per stick to Rs. 4.468 per stick, without any loss of revenue. This corresponds to an excise increase from Rs. 22.4 to Rs. 89.4 for a pack of 20 cigarettes.

Information on the number of *bidis* produced and consumed in the country is harder to come by. Based on the prevailing excise rate of Rs. 10 for every thousand handmade *bidis* and excise revenue of Rs. 4.716 billion<sup>1</sup>, it

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<sup>1</sup> As per data obtained from the Directorate of Data Management, Customs and Central Excise, Ministry of Finance, Government of India

would imply that nearly 0.47 trillion *bidis* were consumed in the year 2011-12, assuming that 98 percent of *bidis* in the market are handmade[5]. However, given the large informal sector manufacturing and *bidi* being a cottage industry, this figure is not complete without additions of estimations from informal enterprises, which are not under the excise net if they are produced by manufacturers making less than 2 million sticks annually. A study notes an overall decline in *bidi* production from a peak of 1.2-1.3 trillion sticks in the mid-1990s to nearly 0.6 trillion in 2008[6]. Sunley estimated that there were 750 billion to 1.2 trillion *bidi* sticks consumed in India in 2008 but also mentioned that there are no credible estimates due to the fragmentation of *bidi* manufacturing and distribution[5]. We therefore assume a conservative total national consumption of 750 billion *bidis* annually in 2011-12. We further apportion this consumption across expenditure tertiles based on the proportion of sticks consumed in each tertile in the CES survey: 41.05% (308 billion sticks) in T1, 40.75% (305.6 billion sticks) in T2, and 18.2% (136.5 billion sticks) in T3. For unit prices, we use the WHO's estimate of Rs 5.6 for a pack of 20 *bidis* of the most sold brand in 2010, with a price of Rs. 0.28 per stick[7]. This yields a net excise of Rs. 0.0047 per stick. We simulate changes in consumption and revenue generation using estimates of tertile-wise *bidi* price elasticities, as conducted for cigarettes. *Bidi* excise increases by 300% will result in a decline in total *bidi* consumption in T1 by almost 73.50%; 53.2% in T2; and 21.8% in T3; while overall total *bidi* revenues will continue to rise.

We were unable to find any credible national and sub-national estimates of units of leaf/ smokeless tobacco products consumed in the country, and therefore could not simulate changes in consumption using the estimated elasticities. As per government estimates, Rs. 10.5 billion was the revenue accrued from central excise on smokeless tobacco products in 2001-12. This is almost double the revenue accrued from *bidis* but almost a tenth of the revenue from cigarettes; this is of concern considering that almost one in three adults in the country consumes these products[4].

**Supplementary Table 3: Cigarette and Bidi Excise Revenue Simulation, 2011-12**

% increase in tax	Retail price per stick	Existing tax rate and increase per stick	T1 Consumption	T1 Excise	T2 Consumption	T2 Excise	T3 Consumption	T3 Excise	T1+ T2 + T3 Consumption	T1+ T2 + T3 Revenue
<b><u>Cigarettes</u></b>										
Baseline	2.9965	1.11705	9900	11059	29836	33328	60264	67317	100000	111705
10%	3.108205	1.228755	9077	11153	29564	36326	58670	72091	97900	119570
20%	3.21991	1.34046	8321	11155	29294	39267	57118	76564	95844	126986
30%	3.331615	1.452165	7629	11079	29026	42151	55607	80751	93831	133980
40%	3.44332	1.56387	6994	10938	28761	44979	54136	84662	91861	140579
50%	3.555025	1.675575	6412	10745	28499	47752	52704	88310	89932	146806
60%	3.66673	1.78728	5879	10507	28238	50470	51310	91706	88043	152683
70%	3.778435	1.898985	5390	10235	27981	53135	49953	94860	86194	158230
80%	3.89014	2.01069	4941	9936	27725	55747	48632	97784	84384	163466
90%	4.001845	2.122395	4530	9615	27472	58307	47346	100486	82612	168408
100%	4.11355	2.2341	4153	9279	27221	60815	46093	102977	80877	173071
150%	4.672075	2.792625	2690	7512	26001	72611	40312	112575	72734	192699
200%	5.2306	3.35115	1742	5839	24836	83228	35255	118145	65411	207211
250%	5.789125	3.909675	1129	4412	23722	92747	30833	120546	58826	217705
300%	6.34765	4.4682	731	3266	22659	101245	26965	120486	52903	224997
<b><u>Bidis</u></b>										
Baseline	0.28	0.0047	307900	1447	305600	1436	136500	642	750000	3525
10%	0.28047	0.00517	294574	1523	297963	1540	135388	700	727925	3763
20%	0.28094	0.00564	281825	1589	290517	1639	134284	757	706626	3985
30%	0.28141	0.00611	269628	1647	283257	1731	133190	814	686074	4192
40%	0.28188	0.00658	257958	1697	276178	1817	132104	869	666241	4384
50%	0.28235	0.00705	246794	1740	269277	1898	131028	924	647098	4562
60%	0.28282	0.00752	236112	1776	262547	1974	129960	977	628620	4727
70%	0.28329	0.00799	225893	1805	255986	2045	128901	1030	610780	4880
80%	0.28376	0.00846	216117	1828	249589	2112	127850	1082	593556	5021

90%	0.28423	0.00893	206763	1846	243352	2173	126808	1132	576923	5152
100%	0.2847	0.0094	197815	1859	237271	2230	125775	1182	560860	5272
150%	0.28705	0.01175	158556	1863	209069	2457	120732	1419	488357	5738
200%	0.2894	0.0141	127089	1792	184219	2597	115892	1634	427200	6024
250%	0.29175	0.01645	101866	1676	162323	2670	111246	1830	375435	6176
300%	0.2941	0.0188	81650	1535	143029	2689	106786	2008	331465	6232

**Legend:**

T1: Tertile1; T2: Tertile2; T3: Tertile3

Retail price per stick and excise per stick are in Indian Rupees; Consumption is in million sticks; Excise revenue is in million Indian Rupees

Baseline values indicate the existing tax rates and excise per stick in the country.

## REFERENCES

1. John RM. 2008. *Price elasticity estimates for tobacco products in India*. (2008) Health Policy and Planning. 2008;23:200-209.
2. ERC Statistics International PLC. (2013) *Tobacco Insights*. Issue No:145 - January 2013. Available at: <http://www.west-info.eu/files/Consumption-ERC.pdf> Accessed on 01/20/2014
3. Euromonitor International. (2009) *Tobacco in India, November 2009*. Euromonitor International, 2009.
4. International Institute for Population Sciences (IIPS), Mumbai and Ministry of Health and Family Welfare, Government of India, 2010. (2010) *Global Adult Tobacco Survey India (GATS India), 2009-2010*.
5. Sunley, EM. (2008) *India: The tax treatment of bidis*. Bloomberg Initiative to Reduce Tobacco Use. ISBN: 978-2-914365-35-2
6. Lal P, Wilson N. (2012) *The Perverse Economics of the Bidi and Tendu Trade*. Economic & Political Weekly. January 14, 2012 Vol XLVII No 2 page numbers 77-80
7. World Health Organization. (2014) *Global Health Observatory Data Repository*. "Raise taxes on tobacco: Bidi prices - most sold brand by country". Available at: <http://apps.who.int/gho/data/node.main.1308?lang=en> Accessed on 04/02/2014