

Do State Minimum Markup/Price Laws Work? Evidence from Retail Scanner Data and TUS-CPS

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ABSTRACT

Background

Minimum markup/price laws (MPLs) have been proposed as an alternative non-tax pricing strategy to reduce tobacco use and access. However, the empirical evidence on the effectiveness of MPLs in increasing cigarette prices is very limited. This study aims to fill this critical gap by examining the association between MPLs and cigarette prices.

Methods

State MPLs were compiled from primary legal research databases and were linked to cigarette prices constructed from the Nielsen retail scanner data and the self-reported cigarette prices from the Tobacco Use Supplement to the Current Population Survey. Multivariate regression analyses were conducted to examine the association between MPLs and the major components of MPLs and cigarette prices.

Results

The presence of MPLs was associated with higher cigarette prices. In addition, cigarette prices were higher, above and beyond the higher prices resulting from MPLs, in states that prohibit below-cost combination sales; do not allow any distributing party to use trade discounts to reduce the base cost of cigarettes; prohibit distributing parties from meeting the price of a competitor, and prohibit distributing below-cost coupons to the consumer. Moreover, states that had total markup rates greater than 24% were associated with significantly higher cigarette prices.

Conclusion

MPLs are an effective way to increase cigarette prices. The impact of MPLs can be further strengthened by imposing greater markup rates and by prohibiting coupon distribution, competitor price matching, and use of below-cost combination sales and trade discounts.

INTRODUCTION

Substantial research has demonstrated that increasing cigarette taxes is one of the most effective ways to reduce cigarette consumption,[1] however, the impact of raising cigarette taxes can be diluted through the tobacco industry's discounting and promotional tactics, particularly in states where cigarette price regulations do not address cigarette sales prices. Tobacco industry's price-reducing tactics diminish the impact of increasing cigarette taxes, and for price-sensitive smokers, such as price-sensitive youth, and low-income smokers, who are more likely to take advantage of discounting programs, these tactics can be detrimental to price-based tobacco control efforts.[2–4] While raising state cigarette taxes further can mitigate the negative impact of industry's price-reducing tactics, in many cases, it is not politically feasible to do so due to a lack of political will, along with supermajority voting requirements for tax measures and gubernatorial veto power, as well as the threats from tobacco industry to force tax measures to a ballot measure.[5] It was within this context that the tobacco control community advocated for non-tax pricing measures, such as minimum markup/price laws (MPLs), as an alternative to cigarette tax increases.[5,6]

MPLs emerged in the United States in mid-20th century,[7] and were originally implemented to protect small businesses from the unfair sales tactics of larger competitors[8,9] rather than to bolster tobacco control or protect state tax interests. The effect of these laws wasn't truly felt until the 1980's, when tobacco manufacturers began introducing price-reducing mechanisms, such as couponing and multi-pack discounts, in an effort to minimize the impact of price increases on price-sensitive smokers.[10] The use of these mechanisms spread with additional Federal tax increases, the introduction of the Master Settlement Agreement of 1998 (MSA),[11]

and the continued rise in cigarette prices throughout the 1990s and early 2000s.[12] At a base level, pricing laws prohibit the intentional injury of competitors through price-cuts, and can impose both civil and criminal penalties for violations.[13] Pricing laws fall into two main categories: 1) those that require a statutory markup to be applied to the base cost of wholesalers and/or retailers (hereafter “minimum markup”); and 2) those that simply prohibit sales of products below actual cost (hereafter “minimum price”).[14] While most pricing laws regulate cigarettes or tobacco products explicitly, several states (e.g. California, Hawaii, Colorado[15]) have applied more general pricing laws to tobacco sales through agency opinions or state-level courts. Both types of laws utilize a base cost of cigarettes, which can be defined in a variety of ways, including manufacturer’s list price, invoice cost, or purchase price. Minimum markup laws require one or more levels of the distribution chain to apply a markup percentage to this base cost, meant to represent a presumed cost of doing business.[7,16] In addition to the markup, these laws also often require the application of excise taxes (Federal, state, and/or local), cartage costs (where incurred), or other fees to the base cost.[16] Minimum price laws function similarly to markup laws, however the definition of “cost” tends to be less formulaic; there is no established markup applied, and they are often silent to the application of taxes, cartage, or fees. Fewer states utilize this method than minimum markup laws.[14] In addition to establishing a minimum sales price, these laws also often regulate mechanisms that can work to decrease established prices, including trade discounts, price-matching, multi-pack discounts, and coupons.

To what extent MPLs can reduce cigarette consumption depends on whether such laws increase retail cigarette prices, particularly the prices for non-premium cigarettes. Empirical evidence on the effectiveness of MPLs is limited. The results from two early studies were mixed

at best. Feighery and her colleagues examined a sample of eight US states with MPLs and seven states without MPLs, and concluded that average cigarette prices were not significantly different between the two groups. However, they did find that New York, which had stronger MPLs that banned price promotions from being considered in the minimum price calculation, had higher average cigarette prices.[17] Tynan et al. examined Nielsen retail scanner data and found that average cigarette prices were lower in states with MPLs.[18] Our paper builds on these two studies and expands this literature by examining, instead of average cigarette prices, the low-priced cigarettes using Nielsen retail scanner data. Unlike Tynan et al., which utilized data from all 52 Nielsen markets, the majority of which cross state boundaries, we focused our analysis on a subset of Nielsen markets that do not cross state boundaries in an effort to reduce the measurement errors. To overcome the limited number of states in analyzing Nielsen retail scanner data, and to corroborate our findings, we also conducted analysis linking MPLs with self-reported prices using the data from the Tobacco Use Supplement to the Current Population Survey (TUS-CPS). More importantly, we analyzed not just the presence of MPLs, but also the main components present within state minimum markup/price laws.

METHODS

Data Sources

Minimum markup/price laws for each of the 50 states and the District of Columbia (hereafter referred to collectively as “states”) from 2006 to 2014 were compiled through primary legal research databases available through commercial legal research service providers, Lexis-Nexis and Westlaw. Relevant state laws were identified through Boolean keyword searches conducted for each state and were limited to each state’s statutes and regulations, case law,

Attorney's General (AG) opinions, and Department of Revenue notices/rulings. Collection was focused on laws that specifically related to the pricing of cigarettes or tobacco products. State regulations establishing general pricing laws were included where agency opinions, rulings, or case law specifically applied them to tobacco products; those without specific ties were excluded from collection. Similarly, state laws invalidated by case law or AG opinions were excluded. Publicly available secondary sources, such as information from state department of revenue or taxation websites, published articles, and state reports were used to verify initial collection results and clarify ambiguities.[19] Additionally, ambiguities regarding California and Idaho's respective pricing laws' applicability to tobacco were clarified by directly contacting state enforcement agencies.

Cigarette price data used in this study were compiled from two different sources: retail scanner data from the Nielsen Company and TUS-CPS. The Nielsen retail scanner data contain quarterly product and market level cigarette sales and price data from 2007 to 2014, collected from Nielsen participating retail stores, which include food, drug and mass merchandise stores, as well as convenience stores. A Nielsen market consists of groups of counties centered on a major city. In many cases, counties in the same Nielsen market belong to different states, as a Nielsen market can cross state borders and cover areas in two or multiple states. To reduce the measurement errors in measuring state level prices, we decided to focus our analysis on 19 Nielsen markets that fall completely within a state boundary (see Table 1 for the complete list of these 19 markets). Because the price data were not provided to us in one market for two years, our total number of data points was 600 (19 markets*8 years*4 quarters minus 8). We also conducted sensitivity analysis by including 3 additional Nielsen markets that had at least 80% of

its population resided in one single state. In addition, a sensitivity analysis that includes all 52 Nielsen markets, similar to those in Tynan et al. (2013) was also conducted.

The Current Population Survey (CPS) was conducted by the Bureau of Labor Statistics through telephone and face-to-face interviews. Every month the CPS surveys a sample of approximately 60,000 households to collect a wide range of demographic, labor force, and household characteristics. Data on special topics are also gathered from these same respondents in periodic supplemental surveys, including the Tobacco Use Supplement (TUS). Seven waves of the TUS have been sponsored by the National Cancer Institute (NCI) starting in 1992. We use the most recent two waves 2006-07 and 2010-11 for this analysis given the availability of MPL data. Our sample consisted of 40,838 self-responding smokers ages 15 and older that resided in the continental United States, who reported the prices that they paid in their last purchase of cigarettes. Proxy respondents were allowed in TUS-CPS, but we excluded those respondents because they were not asked the full range of smoking questions, including some key cigarette price questions. When analyzing TUS-CPS data, we controlled for individual level demographic characteristics, including gender, age, race, Hispanic ethnicity, education, real family income, and employment/labor force participation. Appendix Tables 1 and 2 provide descriptive statistics for the Nielsen and TUS-CPS samples, respectively.

Measures

MPL Measures. A series of dichotomous and categorical measures were created to capture the presence of and components of the MPLs. A dichotomous measure captured the presence of MPLs in a state. Additionally, separate variables were constructed to reflect MPL components: 1) the number of distributing parties subject to MPLs (a score of 1=2+ regulated

parties; 0=1 or no regulated parties); 2) an ordinal measure, as well as five dichotomous variables, of the total markup percentage across the standard distribution channel (0=zero markup, 1=>0 to 6% markup, 2=>6% to 12% markup, 3=>12% to 18% markup, 4=>18% to 24% markup, and 5=>24% markup); 3) whether cartage is applied to the base cost (1=yes, 0=no); 4) whether excise taxes are applied to the base cost (1=yes, 0=no); 5) whether any other fees or taxes (non-excise) are applied to the base cost (1=yes, 0=no); 6) whether the state permits the use of coupons that lower the price below statutory minimums (1=does not allow, 0=allowed or silent); 7) whether any type of vendor may distribute below-cost coupons to the consumer (1=not allowed, 0=allowed) ; 8) whether combination sales (e.g., buy-one-get-one/multi-pack, cigarette and other tobacco products (OTPs), and tobacco and non-tobacco) are permitted where they reduce the price below cost (1=not permitted, 0=permitted); 9) whether trade discounts may be used by any distributing party to reduce the base cost of cigarettes (1=not allowed, 0=allowed); 10) whether trade discounts are defined to include discount programs such as master-type plans or buydowns (1=not included/defined/used to reduce cost, 0=included); 11) whether distributing parties may meet the price of a competitor (1=may not meet/state silent, 0=may meet).

Additionally, we created two composite dichotomous index measures that captured the aspects of MPLs related to restrictions applied pre-sale (1=yes if trade discounts are not allowed to be used by any distributing party to reduce the base cost of cigarettes, trade discounts are defined not to include discount programs, and/or distributing parties are not allowed to meet the price of a competitor; 0=if otherwise) and applied at sale (1=yes if a state does not allow coupon use to reduce cost, vendors are not allowed to distribute below-cost coupons to the consumer, and/or combination sales are not permitted; 0=if otherwise).

Cigarette prices from Nielsen retail scanner data. The price for a pack of cigarettes for a specific brand and product type in a given market/quarter/store type was first calculated by dividing the dollar sales by sales volume for that specific brand and product type in the same market/quarter/store type. Then the prices for all cigarette brands and product types within a given market/quarter were ranked from the highest to the lowest, regardless of store types (a store type variable was included in our analysis indicating the type of stores the price was from), and the price at 25th percentile and 50th percentile (median) were extracted and used as the cigarette price variables in the analysis. The price variables used in our analyses were adjusted for inflation using the Consumer Price Index (indexed to 1 for the last quarter of 2014) obtained from the Bureau of Labor Statistics.

Cigarette prices from TUS-CPS were self-reported last purchase price for a pack of cigarettes. For those who reported carton purchase, the price was converted to per pack price, and an indicator of carton purchase was included in our analysis. Similarly, cigarette prices from TUS-CPS were also inflation-adjusted.

Analytical Model

The following model was used to estimate the association between MPLs and cigarette prices using the Nielsen retail scanner data:

$$\text{CigPrice}_{\text{market/quarter}} = \beta_0 + \beta_1(\text{MPLs}) + \beta_2(\text{MPLs - component}) + \beta_3\text{TaxRate} + \beta_4\text{Year} + \beta_5\text{Quarter} + \varepsilon$$

CigPrice is either the cigarette price at 25th percentile or at 50th percentile in a given market/quarter. MPLs captures the presence of a MPL in a state. MPLs - component are the 11 major MPL components, along with two composite index dichotomous variables, discussed

above. We examined each component separately because of the high collinearity among them. TaxRate are state cigarette excise tax rates. A similar model, which also controls for individual demographic characteristics, as well as survey waves, was used for TUS-CPS. This equation was estimated using ordinary least square methods with Huber–White standard errors, which were clustered at state level.

RESULTS

Table 2 presents the results examining the association between cigarette prices and MPLs in 19 Nielsen markets. Regardless of the price percentiles examined, the presence of MPLs was positively and significantly associated with cigarette prices. The results indicate that per pack cigarette prices at the 25th percentile in states with MPLs were 25 to 55 cents higher than those without MPLs, and cigarette prices at the 50th percentile in states with MPLs were 18 to 52 cents higher than those without MPLs. The higher prices represent approximately 5% - 11% and 3% - 9% increases in prices at the 25th and 50th percentiles, respectively. The association between the presence of MPLs in a state and cigarette prices were highly significant across all MPL component model specifications with the exception of one (allowing below-cost combination sales). This is likely due to the fact that this variable is almost perfectly correlated with the MPL variable, and hence affected the association between prices and MPLs.

In terms of the specific MPL components, we found that states that prohibit below-cost combination sales, states that do not allow any distributing party to use trade discounts to reduce the base cost of cigarettes, and states that prohibit distributing parties from meeting the price of a competitor all had higher cigarettes prices than states without such MPL components. The results suggest that per pack cigarette price was about 30 cents higher, above and beyond the impact of

MPLs, in states with those components. Other MPL components were found either negatively associated with cigarette prices or no significant association. For some components, such as the number of parties regulated and applying cartage to the base cost, the negative association offsets the positive association between MPLs and cigarette prices.

Table 3 presents the sensitivity analyses examining the association between cigarette prices and MPLs in 22 Nielsen markets (i.e., the 19 entirely within-state markets and the 3 markets with at least 80% of population located within a single state). The results were similar to those presented in Table 2. A notable difference is that there is now a positive and significant association between having restrictions on promotions applied at sale (prohibit coupon use to reduce cost, prohibit distributing below-cost coupons to the consumer and/or prohibit combination sales) and cigarette prices. Not shown in the paper, the sensitivity analyses that includes all 52 Nielsen markets revealed no statistical significant relationship between MPLs and cigarette prices.

Table 4 presents the results that show the association between cigarette prices and MPLs/MPL components using TUS-CPS data. Similar to the results using Nielsen data, the presence of MPLs was positively associated with self-reported cigarette prices in the majority of model specifications. The results that were significant indicate that self-report per pack cigarette prices in states with MPLs were 8 to 34 cents higher than those without MPLs, representing a 2% to 8% increase in cigarette prices. In terms of the MPL components, the total markup rates were found to be positively associated with cigarette price as well, in particular, states that had total markup rates greater than 24% were associated with 53 cents higher cigarette prices, representing a 12% price increase. In addition, states that prohibit below-cost combination sales and states prohibiting the distribution of below-cost coupons to the consumer had higher cigarette prices

compared to states that did not. Other MPL components were found either negatively associated with cigarette prices or not significantly associated with price.

DISCUSSION

MPLs have been proposed to counteract tobacco industry's price-reducing strategies in the context of the industry's massive promotional and marketing spending.[5] In the ten years in the first decade of this century, cigarette manufacturers' annual spending on price-reducing promotions and other price-reducing mechanisms, whose sole purpose is to reduce the real costs smokers pay for cigarettes, more than doubled to \$6.72 billion in 2010, accounting for more than 80% of all promotional expenditures by the industry.[20] However, to date, the empirical evidence on the effectiveness of MPLs in raising cigarette prices has been limited. In fact, previous studies found either no difference in prices between states with MPLs and states without,[17] or the prices were lower in states with MPLs compared to states with MPLs.[18]

In this study, we examine the association between the presence of MPLs and major components within MPLs in a state and cigarette prices. Our results provide the strongest and most comprehensive evidence to date on the impact of MPLs on cigarette prices. We found that the presence of MPLs in a state was associated with 5% - 11% increase in prices for low-priced cigarettes, and was associated with 3% - 9% increase in median cigarette price. In addition, we also found that cigarette prices were higher, above and beyond the higher prices resulted from MPLs, in states that prohibit below-cost combination sales; do not allow any distributing party to use trade discounts to reduce the base cost of cigarettes; prohibit distributing parties meet the price of a competitor, and prohibit distributing below-cost coupons to the consumer. Moreover,

we found states that had total markup rate greater than 24% were associated with significant higher (12% increase in) cigarette prices.

Our study differs from the previous studies in several key aspects. First, while previous studies examined the association between MPLs and *average* cigarette prices, we focused on the prices for low-priced cigarettes. If MPLs indeed had intended impact on increasing cigarette prices, their impact would be most pronounced at the low price end. Second, unlike Tynan et al.,[18] which included all 52 Nielsen markets in their analysis, we only focus on 19 Nielsen markets that fall completely within state boundaries. Because most Nielsen markets cross state boundaries, including all markets in the analysis likely resulted in significant measurement error in cigarette prices and biased the results. In fact, in the sensitivity analyses we conducted including all 52 Nielsen markets, we did not find any significant relationship between MPLs and cigarette prices. Third, unlike previous studies of MPLs, which primarily focused on statutes, the MPLs used in our analysis also include key information found in regulations, revenue notices, case law, and AG opinions. Kentucky, for example, had an MPL that was invalidated by AG opinion, but was erroneously identified as having MPL in previous studies. Hawaii was marked as a non-MPL state in previous studies, where its general pricing laws were included in our study based on tobacco application via case law. Most important, we not only examined the presence of MPLs, but also analyzed the association between major MPL components and cigarette prices, which can help researchers and policy-makers identify the most effective mechanisms within MPLs that would increase cigarette prices. In particular, we found the impact of MPLs can be further strengthened by prohibiting coupon distribution, competitor price matching, and use of below-cost combination sales and trade discounts. In addition, by creating a statutory framework for markups and imposing a high markup rate, higher than the markup rate

dictated by the free market (generally 18% [18]), states can significantly raise the prices of cigarettes and reduce the cigarette consumption and tobacco-induced disease and mortality burden.

The results from our study suggest that MPLs have the potential to become an effective tool to mitigate the impact of the price-reducing promotions by the industry. Combined with decades of research on the effectiveness of increasing cigarettes taxes, our study suggests that further increasing cigarette taxes and strengthening MPLs can both reduce the impact of the price-reducing promotions by the industry, and cigarette excise taxes and MPLs can and should be used as part of the coordinated pricing strategy. In addition, given our finding that prohibiting coupon distribution was associated with higher cigarette prices, policies such as price discount bans and coupon redemption bans, similar to those adopted in New York city, Providence, and Chicago, could also be considered by other cities and localities to counteract tobacco industry's price-reducing tactics, particularly in states without MPLs or states with MPLs but do not prohibit distributing below-cost coupons to the consumer.

Our findings should be viewed in the context of the following limitations. First, the MPLs were based on state-level codified law; other state policy instruments, including session laws (except for effective date verification), legislative bills, state constitutions, and non-codified policies were excluded. Similarly, laws pertaining to enabling, direct sales, master settlement agreements or other non-tax issues, were considered beyond the scope, and were not included in collection. Implementation or actual enforcement of these pricing laws (where not explicitly applied within the scope of collection) was beyond the scope of this study. Second, since there was virtually no within-state variation in MPLs during our study period, we were unable to identify the causal impact of MPLs on cigarette prices using the change in MPLs overtime within

a state. Additionally, we were also limited by the number of Nielsen markets with which we could work in our analysis.

Despite these limitations, our study provides strong evidence to support recent calls for reducing tobacco use and access through adopting and strengthening MPLs.[5] In addition, policymakers that seek to strengthen MPLs can also do so by imposing high markup rate and by regulating the distribution of coupons, preventing wholesalers or retailers from providing them directly to consumers, as well as prohibiting combination or multi-pack sales, restricting competitor price matching and trade discounts.

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Table 1. Nielsen Markets Included in Analysis

Market	State	Percent of Population within state	Minimum Price/Markup Laws	Store Types	19 Market Sample	22 Market Sample
Baltimore	MD	100%	Yes	FDM	1	1
Birmingham	AL	100%	No	CV+FDM	1	1
Buffalo-Rochester	NY	86%	Yes	FDM	0	1
Columbus	OH	100%	Yes	FDM	1	1
Dallas	TX	92%	No	CV+FDM	0	1
Des Moines	IA	100%	Yes	FDM	1	1
Grand Rapids	MI	100%	No	FDM	1	1
Houston	TX	100%	No	CV+FDM	1	1
Las Vegas	NV	100%	Yes	FDM	1	1
Los Angeles	CA	100%	Yes	CV+FDM	1	1
Miami	FL	100%	No	CV+FDM	1	1
Milwaukee	WI	100%	Yes	FDM	1	1
Orlando	FL	100%	No	CV+FDM	1	1
Phoenix	AZ	100%	No	CV+FDM	1	1
Raleigh-Durham	NC	86%	No	CV+FDM	0	1
Sacramento	CA	100%	Yes	FDM	1	1
San Antonio	TX	100%	No	CV+FDM	1	1
San Diego	CA	100%	Yes	FDM	1	1
San Francisco	CA	100%	Yes	CV+FDM	1	1
Seattle	WA	100%	Yes	CV+FDM	1	1
Syracuse	NY	100%	Yes	FDM	1	1
Tampa	FL	100%	No	CV+FDM	1	1

Note: CV - convenience stores. FDM - food, drug and mass merchandise stores.

Table 2: Association Between Cigarette Price and Minimum Price Laws: Results from Nielsen Retail Scanner Data 2007 - 2014 (19 Markets)

25th Price Percentile							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Baseline Result	Number of Parties Regulated > 1	Total Markup Across Standard Distribution	Cartage Applied to Base Cost	Any Taxes Applied to Base Cost	Other Fees Applied to Base Cost	State Does Not Allow Coupons
Minimum Pricing Law	0.273*** (0.0267)	0.463*** (0.0277)	0.495*** (0.0375)	0.315*** (0.0268)	0.442*** (0.0290)	0.282*** (0.0279)	0.272*** (0.0277)
State Cigarette Excise Tax Rate	0.0113*** (0.000126)	0.0125*** (0.000168)	0.0113*** (0.000125)	0.0112*** (0.000125)	0.0118*** (0.000131)	0.0114*** (0.000130)	0.0113*** (0.000135)
MPL-Component		-0.404*** (0.0337)	-0.122*** (0.0141)	-0.434*** (0.0278)	-0.331*** (0.0305)	-0.0561* (0.0311)	0.00580 (0.0343)
Observations	600	600	600	600	600	600	600
R-squared	0.929	0.940	0.935	0.936	0.940	0.929	0.929
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
VARIABLES	Consumers Cannot Receive Below-Cost Coupon	Below-Cost Combination Sales Not Allowed	Trade Discounts May Not Be Used	Trade Discount Definition Does Not Include Buy Downs, etc	Parties May Not Meet Competitor Pricing	Promotion Restrictions Applied Pre-Sale	Promotion Restrictions Applied at Sale
Minimum Pricing Law	0.272*** (0.0277)	0.00932 (0.0299)	0.253*** (0.0266)	0.353*** (0.0442)	0.253*** (0.0266)	0.548*** (0.0546)	0.278*** (0.0376)
State Cigarette Excise Tax Rate	0.0113*** (0.000135)	0.0114*** (0.000129)	0.0110*** (0.000123)	0.0113*** (0.000128)	0.0110*** (0.000123)	0.0110*** (0.000123)	0.0113*** (0.000135)
MPL-Component	0.00580 (0.0343)	0.321*** (0.0276)	0.295*** (0.0491)	-0.0873** (0.0401)	0.295*** (0.0491)	-0.295*** (0.0491)	-0.00580 (0.0343)
Observations	600	600	600	600	600	600	600
R-squared	0.929	0.936	0.932	0.929	0.932	0.932	0.929
50th Price Percentile							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Baseline Result	Number of Parties Regulated > 1	Total Markup Across Standard Distribution	Cartage Applied to Base Cost	Any Taxes Applied to Base Cost	Other Fees Applied to Base Cost	State Does Not Allow Coupons
Minimum Pricing Law	0.208*** (0.0263)	0.424*** (0.0287)	0.437*** (0.0365)	0.259*** (0.0261)	0.411*** (0.0293)	0.219*** (0.0281)	0.207*** (0.0280)
State Cigarette Excise Tax Rate	0.0114*** (0.000122)	0.0128*** (0.000163)	0.0114*** (0.000120)	0.0113*** (0.000120)	0.0120*** (0.000123)	0.0115*** (0.000123)	0.0114*** (0.000128)
MPL-Component		-0.460*** (0.0353)	-0.126*** (0.0145)	-0.524*** (0.0316)	-0.398*** (0.0315)	-0.0696** (0.0296)	0.00624 (0.0311)
Observations	600	600	600	600	600	600	600
R-squared	0.931	0.945	0.936	0.940	0.946	0.931	0.931
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
VARIABLES	Consumers Cannot Receive Below-Cost Coupon	Below-Cost Combination Sales Not Allowed	Trade Discounts May Not Be Used	Trade Discount Definition Does Not Include Buy Downs, etc	Parties May Not Meet Competitor Pricing	Promotion Restrictions Applied Pre-Sale	Promotion Restrictions Applied at Sale
Minimum Pricing Law	0.207***	-0.0717**	0.185***	0.233***	0.185***	0.522***	0.213***

	(0.0280)	(0.0300)	(0.0262)	(0.0408)	(0.0262)	(0.0508)	(0.0318)
State Cigarette Excise Tax Rate	0.0114***	0.0115***	0.0111***	0.0114***	0.0111***	0.0111***	0.0114***
	(0.000128)	(0.000123)	(0.000117)	(0.000124)	(0.000117)	(0.000117)	(0.000128)
MPL-Component	0.00624	0.341***	0.337***	-0.0271	0.337***	-0.337***	-0.00624
	(0.0311)	(0.0303)	(0.0469)	(0.0387)	(0.0469)	(0.0469)	(0.0311)
Observations	600	600	600	600	600	600	600
R-squared	0.931	0.938	0.934	0.931	0.934	0.934	0.931

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, *

p<0.1

Notes:

- 1) Promotion Variables Applied Pre-Sale (Trade Discount Used to Reduce Base Cost + Trade Discount Definition Includes Buydowns + State Permits Distributors to Meet Competitor Pricing + State Restricts Meeting of Competitor Pricing)
- 2) Promotions Applied at Sale (Coupons May Reduce Price Below Cost + Number of Parties Distributing Below-Cost Coupons to Consumer + Below-Cost Combination Sales Allowed + Restrictions on Below-Cost Combination Sales)
- 3) Control Variables not Shown: Quarter and Year Fixed Effects

Table 3: Association Between Cigarette Price and Minimum Price Laws: Results from Nielsen Retail Scanner Data 2007 - 2014 (22 Markets)

25th Price Percentile							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline Result	Number of Parties Regulated > 1	Total Markup Across Standard Distribution	Cartage Applied to Base Cost	Any Taxes Applied to Base Cost	Other Fees Applied to Base Cost	State Does Not Allow Coupons
Minimum Pricing Law	0.324*** (0.0285)	0.445*** (0.0301)	0.593*** (0.0437)	0.363*** (0.0290)	0.509*** (0.0305)	0.304*** (0.0301)	0.367*** (0.0291)
State Cigarette Excise Tax Rate	0.00963*** (0.000296)	0.0103*** (0.000362)	0.00961*** (0.000292)	0.00952*** (0.000296)	0.0101*** (0.000288)	0.00957*** (0.000303)	0.0100*** (0.000254)
MPL-Component		-0.264*** (0.0426)	-0.147*** (0.0169)	-0.405*** (0.0274)	-0.361*** (0.0319)	0.134*** (0.0459)	-0.249*** (0.0538)
Observations	696	696	696	696	696	696	696
R-squared	0.882	0.887	0.889	0.887	0.894	0.883	0.886

VARIABLES	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Consumers Cannot Receive Below-Cost Coupon	Below-Cost Combination Sales Not Allowed	Trade Discounts May Not Be Used	Trade Discount Definition Does Not Include Buy Downs, etc	Parties May Not Meet Competitor Pricing	Promotion Restrictions Applied Pre-Sale	Promotion Restrictions Applied at Sale
Minimum Pricing Law	0.367*** (0.0291)	0.148*** (0.0355)	0.292*** (0.0287)	0.585*** (0.0604)	0.292*** (0.0287)	0.863*** (0.0617)	0.118** (0.0553)
State Cigarette Excise Tax Rate	0.0100*** (0.000254)	0.00960*** (0.000298)	0.00931*** (0.000305)	0.00955*** (0.000300)	0.00931*** (0.000305)	0.00931*** (0.000305)	0.0100*** (0.000254)
MPL-Component	-0.249*** (0.0538)	0.213*** (0.0347)	0.570*** (0.0589)	-0.280*** (0.0582)	0.570*** (0.0589)	-0.570*** (0.0589)	0.249*** (0.0538)
Observations	696	696	696	696	696	696	696
R-squared	0.886	0.885	0.892	0.885	0.892	0.892	0.886

50th Price Percentile							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline Result	Number of Parties Regulated > 1	Total Markup Across Standard Distribution	Cartage Applied to Base Cost	Any Taxes Applied to Base Cost	Other Fees Applied to Base Cost	State Does Not Allow Coupons
Minimum Pricing Law	0.246*** (0.0267)	0.406*** (0.0298)	0.515*** (0.0419)	0.294*** (0.0268)	0.466*** (0.0295)	0.232*** (0.0287)	0.286*** (0.0283)
State Cigarette Excise Tax Rate	0.0100*** (0.000260)	0.0109*** (0.000317)	0.0100*** (0.000256)	0.00991*** (0.000260)	0.0107*** (0.000249)	0.0100*** (0.000266)	0.0104*** (0.000222)
MPL-Component		-0.347*** (0.0418)	-0.147*** (0.0170)	-0.495*** (0.0310)	-0.428*** (0.0319)	0.0949** (0.0420)	-0.227*** (0.0490)

Observations	696	696	696	696	696	696	696
R-squared	0.904	0.911	0.910	0.911	0.919	0.904	0.907
	(9)	(10)	(11)	(12)	(13)	(14)	(15)
VARIABLES	Consumers Cannot Receive Below-Cost Coupon	Below-Cost Combination Sales Not Allowed	Trade Discounts May Not Be Used	Trade Discount Definition Does Not Include Buy Downs, etc	Parties May Not Meet Competitor Pricing	Promotion Restrictions Applied Pre-Sale	Promotion Restrictions Applied at Sale
Minimum Pricing Law	0.286*** (0.0283)	0.0439 (0.0349)	0.215*** (0.0269)	0.426*** (0.0557)	0.215*** (0.0269)	0.780*** (0.0554)	0.0585 (0.0481)
State Cigarette Excise Tax Rate	0.0104*** (0.000222)	0.0100*** (0.000262)	0.00973*** (0.000265)	0.00999*** (0.000264)	0.00973*** (0.000265)	0.00973*** (0.000265)	0.0104*** (0.000222)
MPL-Component	-0.227*** (0.0490)	0.245*** (0.0364)	0.565*** (0.0540)	-0.193*** (0.0551)	0.565*** (0.0540)	-0.565*** (0.0540)	0.227*** (0.0490)
Observations	696	696	696	696	696	696	696
R-squared	0.907	0.907	0.913	0.905	0.913	0.913	0.907

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, *

p<0.1

Notes:

1) Promotion Variables Applied Pre-Sale (Trade Discount Used to Reduce Base Cost + Trade Discount Definition Includes Buydowns + State Permits Distributors to Meet Competitor Pricing + State Restricts Meeting of Competitor Pricing)

2) Promotions Applied at Sale (Coupons May Reduce Price Below Cost + Number of Parties Distributing Below-Cost Coupons to Consumer + Below-Cost Combination Sales Allowed + Restrictions on Below-Cost Combination Sales)

3) Control Variables not Shown: Quarter and Year Fixed Effects

Table 4: Association Between Cigarette Price and Minimum Price Laws: Results from TUS-CPS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Baseline Result	Number of Parties Regulated > 1	Total Markup Across Standard Distribution	Total Markup Across Standard Distribution (Categorical)	Cartage Applied to Base Cost	Any Taxes Applied to Base Cost	Other Fees Applied to Base Cost	State Does Not Allow Coupons
Minimum Pricing Law	0.0908*** (0.0335)	0.345*** (0.0614)	-0.0167 (0.0485)	0.0337 (0.0541)	0.129*** (0.0385)	0.341*** (0.0522)	0.125*** (0.0339)	0.0866** (0.0346)
State Cigarette Excise Tax Rate	0.00996** * (0.000219)	0.0105*** (0.000224)	0.00992*** (0.000220)	0.00989*** (0.000221)	0.00996** * (0.000219)	0.0101*** (0.000220)	0.00990** * (0.000214)	0.00991** * (0.000218)
MPL-Component		-0.360*** (0.0620)	0.0518*** (0.0175)		-0.0958** (0.0390)	-0.329*** (0.0511)	-0.110** (0.0463)	0.0285 (0.0439)
Total Markup 0-6%				-0.323*** (0.0954)				
Total Markup 6-12%				0.0705 (0.0547)				
Total Markup 12-18%				-0.00567 (0.0597)				
Total Markup Greater than 24%				0.529*** (0.112)				
Observations	49,548	49,548	49,548	49,548	49,548	49,548	49,548	49,548
R-squared	0.146	0.147	0.146	0.146	0.146	0.147	0.146	0.146
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
VARIABLES	Consumers Cannot Receive Below-Cost Coupon	Below-Cost Combination Sales Not Allowed	Trade Discounts May Not Be Used	Trade Discount Definition Does Not Include Buy Downs, etc	Parties May Not Meet Competitor Pricing	Promotion Variables Applied Pre-Sale	Promotions Applied at Sale	
Minimum Pricing Law	0.0774** (0.0346)	-0.0215 (0.0436)	0.136*** (0.0350)	0.0823 (0.0591)	0.0972*** (0.0326)	0.0161 (0.0943)	0.110** (0.0486)	
State Cigarette Excise Tax Rate	0.00981** * (0.000218)	0.00993*** (0.000220)	0.00991*** (0.000217)	0.00996*** (0.000220)	0.00995** * (0.000218)	0.00994** * (0.000216)	0.00992** * (0.000218)	
MPL-Component	0.0825* (0.0437)	0.145*** (0.0436)	-0.149*** (0.0464)	0.00943 (0.0562)	-0.0575 (0.0853)	0.0839 (0.0905)	-0.0220 (0.0445)	
Observations	49,548	49,548	49,548	49,548	49,548	49,548	49,548	
R-squared	0.146	0.146	0.146	0.146	0.146	0.146	0.146	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes:

1) Promotion Variables Applied Pre-Sale (Trade Discount Used to Reduce Base Cost + Trade Discount Definition Includes Buydowns + State Permits Distributors to Meet Competitor Pricing + State Restricts Meeting of Competitor Pricing)

2) Promotions Applied at Sale (Coupons May Reduce Price Below Cost + Number of Parties Distributing Below-Cost Coupons to Consumer + Below-Cost Combination Sales Allowed + Restrictions on Below-Cost Combination Sales)

3) Control Variables not Shown: Age, Sex, Race, Education, Employment, Income, and Year/Month of CPS-TUS Interview, as well as indicator for carton purchase.

Appendix Table 1: Descriptive Statistics for Nielsen Retail Scanner Data with Minimum Pricing Laws						
Variable	19 Markets			22 Markets		
	Count	Mean	SD	Count	Mean	SD
Price at 25th Percentile (Range 2.17-8.73)	600	4.79	1.13	696	4.74	1.15
Price at 50th Percentile (Range 2.38-8.56)	600	5.61	1.17	696	5.57	1.20
Minimum Pricing Law (Dichotomous Variable, States with Laws=1)	600	0.59	0.49	696	0.55	0.50
State Tax Rate (Range 7-435)	600	143.39	81.90	696	147.77	92.97
Number of Parties Regulated > 1	352	0.55	0.50	384	0.58	0.49
Total Markup Across Standard Distribution (Range 0-5)	352	1.81	0.93	384	1.82	0.89
Total Market No Markup	64	0.11	0.31	64	0.09	0.29
Total Markup 6-12%	228	0.38	0.49	260	0.37	0.48
Total Markup 12-18%	60	0.10	0.30	60	0.09	0.28
Cartage Applied to Base Cost (Dichotomous Variable, Cartage Applied to Base Cost=1)	352	0.09	0.29	384	0.08	0.28
Any Taxes Applied to Base Cost (Dichotomous Variable, Any Taxes Applied to Base Cost=1)	352	0.55	0.50	384	0.58	0.49
Other Fees Applied to Base Cost (Dichotomous Variable, Other Fees Applied to Base Cost=1)	352	0.18	0.39	384	0.17	0.37
State Does Not Allow Coupons	352	0.82	0.39	384	0.75	0.43
Consumers Cannot Receive Below-Cost Coupon (Dichotomous Variable, Consumers Cannot Receive Below-Cost Coupon=1)	352	0.82	0.39	384	0.75	0.43
Below-Cost Combination Sales Not Allowed (Dichotomous Variable, Below-Cost Combination Sales Not Allowed=1)	352	0.18	0.39	384	0.17	0.37
Trade Discounts May Not Be Used (Dichotomous Variable, Trade Discounts May Not be Used = 1)	352	0.91	0.29	384	0.92	0.28
Trade Discount Definition Does Not Include Buy Downs, etc (Dichotomous Variable, Trade Discount Definition Does Not Include Buy Downs=1)	352	0.09	0.29	384	0.08	0.28
Parties May Not Meet Competitor Pricing (Dichotomous Variable, Parties May Not Meet Competitor Pricing =1)	352	0.91	0.29	384	0.92	0.28
Promotion Variables Applied Pre-Sale (Trade Discount Used to Reduce Base Cost + Trade Discount Definition Includes Buy downs + State Permits Distributors to Meet Competitor Pricing + State Restricts Meeting of Competitor Pricing)	600	0.53	0.50	696	0.51	0.50
Promotions Applied at Sale (Coupons May Reduce Price Below Cost + Number of Parties Distributing Below-Cost Coupons to Consumer + Below-Cost Combination Sales Allowed + Restrictions on Below-Cost Combination Sales)	600	0.48	0.50	696	0.41	0.49
Year: 2007	76	0.13	0.33	88	0.13	0.33
Year: 2008	72	0.12	0.33	84	0.12	0.33
Year: 2009	72	0.12	0.33	84	0.12	0.33
Year: 2010	76	0.13	0.33	88	0.13	0.33
Year: 2011	76	0.13	0.33	88	0.13	0.33
Year: 2012	76	0.13	0.33	88	0.13	0.33
Year: 2013	76	0.13	0.33	88	0.13	0.33
Year: 2014	76	0.13	0.33	88	0.13	0.33
1st Quarter	150	0.25	0.43	174	0.25	0.43
2nd Quarter	150	0.25	0.43	174	0.25	0.43
3rd Quarter	150	0.25	0.43	174	0.25	0.43
4th Quarter	150	0.25	0.43	174	0.25	0.43

Appendix Table 2: Descriptive Statistics for CPS-TUS Data with Minimum Pricing Laws

Variable	All Smokers: Everyday, Someday			Everyday Smokers			Someday Smokers		
	Count	Mean	SD	Count	Mean	SD	Count	Mean	SD
Price (Range 0-98)	51,881	4.50	3.01	42,832	4.42	3.00	9,049	4.87	3.04
Minimum Pricing Law (Dichotomous Variable, States with Laws=1)	59,276	0.55	0.50	47,589	0.55	0.50	11,687	0.56	0.50
State Tax Rate (Range 7-435)	59,276	113.47	79.93	47,589	112.41	79.69	11,687	117.54	80.69
Number of Parties Regulated > 1	59,276	0.42	0.49	47,589	0.43	0.50	11,687	0.40	0.49
Total Markup Across Standard Distribution (Range 0-5)	59,276	1.17	1.26	47,589	1.17	1.26	11,687	1.17	1.25
Total Market No Markup	27,449	0.50	0.50	22,109	0.50	0.50	5,340	0.50	0.50
Total Markup 0-6%	904	0.00	0.05	747	0.00	0.06	157	0.00	0.05
Total Markup 6-12%	21,169	0.37	0.48	16,976	0.37	0.48	4,193	0.38	0.48
Total Markup 12-18%	9,068	0.11	0.32	7,209	0.11	0.32	1,859	0.11	0.31
Total Markup Greater than 24%	686	0.02	0.13	548	0.02	0.13	138	0.02	0.13
Cartage Applied to Base Cost (Dichotomous Variable, Cartage Applied to Base Cost=1)	59,276	0.22	0.41	47,589	0.22	0.42	11,687	0.19	0.39
Any Taxes Applied to Base Cost (Dichotomous Variable, Any Taxes Applied to Base Cost=1)	59,276	0.42	0.49	47,589	0.43	0.50	11,687	0.38	0.49
Other Fees Applied to Base Cost (Dichotomous Variable, Other Fees Applied to Base Cost=1)	59,276	0.15	0.36	47,589	0.16	0.36	11,687	0.14	0.34
State Does Not Allow Coupons	59,276	0.13	0.33	47,589	0.13	0.33	11,687	0.13	0.34
Consumers Cannot Receive Below-Cost Coupon (Dichotomous Variable, Consumers Cannot Receive Below-Cost Coupon=1)	59,276	0.14	0.35	47,589	0.14	0.35	11,687	0.15	0.36
Below-Cost Combination Sales Not Allowed (Dichotomous Variable, Below-Cost Combination Sales Not Allowed=1)	59,276	0.43	0.50	47,589	0.43	0.50	11,687	0.45	0.50
Trade Discounts May Not Be Used (Dichotomous Variable, Trade Discounts May Not be Used = 1)	59,276	0.15	0.36	47,589	0.16	0.36	11,687	0.15	0.35
Trade Discount Definition Does Not Include Buy Downs, etc (Dichotomous Variable, Trade Discount Definition Does Not Include Buy Downs=1)	59,276	0.49	0.50	47,589	0.49	0.50	11,687	0.50	0.50
Parties May Not Meet Competitor Pricing (Dichotomous Variable, Parties May Not Meet Competitor Pricing =1)	59,276	0.06	0.24	47,589	0.06	0.24	11,687	0.05	0.22
Promotion Variables Applied Pre-Sale (Trade Discount Used to Reduce Base Cost + Trade Discount Definition Includes Buy downs + State Permits Distributors to Meet Competitor Pricing + State Restricts Meeting of Competitor Pricing)	59,276	0.50	0.50	47,589	0.49	0.50	11,687	0.51	0.50
Promotions Applied at Sale (Coupons May Reduce Price Below Cost + Number of Parties Distributing Below-Cost Coupons to Consumer + Below-Cost Combination Sales Allowed + Restrictions on Below-Cost Combination Sales)	59,276	0.43	0.49	47,589	0.43	0.49	11,687	0.43	0.49
Age (Range 15-85)	59,276	42.21	15.00	47,589	42.85	14.90	11,687	39.78	15.12
Sex (Dichotomous Variable, Male=1)	59,276	0.54	0.50	47,589	0.53	0.50	11,687	0.56	0.50
Race (White Only)	50,198	0.83	0.38	40,820	0.84	0.37	9,378	0.78	0.41
Race (Black Only)	5,370	0.11	0.32	3,935	0.11	0.31	1,435	0.15	0.36
Race (Other)	1,216	0.01	0.11	891	0.01	0.11	325	0.02	0.13
Race (Asian Only)	1,129	0.02	0.15	844	0.02	0.14	285	0.03	0.17
Race (Multiracial)	1,363	0.02	0.14	1,099	0.02	0.14	264	0.02	0.14
Education (Less than HS Diploma)	10,261	0.19	0.39	8,512	0.19	0.39	1,749	0.17	0.38
Education (HS Diploma)	23,561	0.39	0.49	19,909	0.41	0.49	3,652	0.31	0.46
Education (Some College)	17,991	0.30	0.46	14,167	0.29	0.46	3,824	0.32	0.47
Education (College Grad Plus)	7,463	0.12	0.33	5,001	0.10	0.30	2,462	0.20	0.40
Labor Force (Employed-At Work)	35,441	0.60	0.49	28,141	0.60	0.49	7,300	0.63	0.48
Labor Force (Employed-Absent)	1,435	0.02	0.15	1,134	0.02	0.15	301	0.02	0.15
Labor Force (Unemployed-On Layoff)	664	0.01	0.10	526	0.01	0.10	138	0.01	0.11
Labor Force (Unemployed-Looking)	4,060	0.08	0.27	3,233	0.08	0.27	827	0.08	0.27
Labor Force (Not in Labor Force)	6,077	0.09	0.28	5,024	0.09	0.29	1,053	0.07	0.26
Labor Force (Not in Labor Force-Disabled)	5,797	0.09	0.29	4,878	0.10	0.29	919	0.07	0.26
Labor Force (Not in Labor Force-Other -	5,802	0.10	0.31	4,653	0.10	0.30	1,149	0.11	0.31

Excluded Category is Employed-At Work)									
Income (Less than \$20,000)	15,423	0.27	0.45	12,496	0.28	0.45	2,927	0.26	0.44
Income (\$20,000 to \$34,999)	12,887	0.23	0.42	10,519	0.23	0.42	2,368	0.22	0.41
Income (\$35,000 to \$49,999)	8,989	0.16	0.37	7,295	0.16	0.37	1,694	0.15	0.36
Income (\$50,000 to \$74,999)	9,927	0.17	0.38	7,921	0.17	0.38	2,006	0.17	0.38
Income (\$75,000 or More)	9,042	0.16	0.37	6,846	0.16	0.36	2,196	0.20	0.40
Interview Month May, Year: 2006	11,432	0.18	0.38	9,185	0.18	0.38	2,247	0.18	0.39
Interview Month: August, Year: 2006	8,651	0.18	0.38	7,022	0.18	0.38	1,629	0.17	0.38
Interview Month: January, Year: 2007	1,158	0.17	0.38	9,411	0.17	0.38	2,171	0.16	0.37
Interview Month: May, Year: 2010	10,441	0.16	0.37	8,299	0.16	0.37	2,142	0.17	0.37
Interview Month: August, Year: 2010	7,503	0.16	0.36	6,018	0.16	0.36	1,485	0.16	0.36
Interview Month: January, Year: 2011	9,667	0.16	0.36	7,654	0.15	0.36	2,013	0.16	0.37

What the paper adds:

- This study examines the association between MPLs and cigarette prices, focusing on the association between MPLs and low-priced cigarettes, and the impact of the major MPLs components.
- We found MPLs was associated with higher cigarette prices and that certain components of MPLs, such as markup rates, and restrictions on distributing coupons, competitor price matching, and prohibition of below-cost combination sales and trade discounts, are particularly effective in increasing cigarette prices.

Contributor statement:

FJC, JC and JH designed the study; JC, HD, MD, and MM collected data; JH, MD, MM conducted data analysis; FJC, JC, and HD contributed to data interpretation; JH and HD wrote the first draft; FJC and JC revised the draft; The final version of this paper has been reviewed and approved by all coauthors.

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None

Patient consent:

Not Applicable

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