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# Who Benefits from Repealing Tampon Taxes? Empirical Evidence from New Jersey

*Christopher Cotropia, and Kyle Rozema**

Many state and local governments exclude some medical products from the sales tax base, including some that are primarily used by men such as hair growth products. However, tampons and other menstrual hygiene products are subject to sales taxes in most states. A recent social movement advocates for the repeal of these "tampon taxes" and several class action lawsuits have been filed against states citing equal protection violations. In this article, we use the 2005 elimination of menstrual hygiene products from the sales tax base in New Jersey as a natural experiment to study who benefits from the repeal of tampon taxes. We find that the tax break is fully shifted to consumers, but that the tax break is not distributed equally. Low-income consumers enjoy a benefit from the repeal of the tax by more than the size of the repealed tax. For high-income consumers, the tax break is shared equally with producers. The results suggest that repealing tampon taxes removes an unequal tax burden and could make menstrual hygiene products more accessible for low-income consumers.

## I. Introduction

On March 3, 2016, actress Margo Seibert and others filed a class action lawsuit against the New York State Department of Taxation and Finance to "eliminate the 'Tampon Tax' imposed … on women in New York State" on the grounds that it violates the Equal Protection Clause.[1] The "tampon tax" referenced in the lawsuit refers to the inclusion of

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[1]See Compl., Siebert v. N.Y. St. Dep't of Tax. & Finance, No. 151800/2016 (N.Y. Sup. Ct. Mar. 3, 2016). The lawsuit frames the tampon tax as a tax on "women." The authors understand that there are individuals who do not identify as a "woman" or "female" and menstruate. Furthermore, there are those who may identify as a "man" or "male" and menstruate. We will mostly use the term consumer to identify those purchasing menstrual hygiene products, but at times use the language "female" and "woman" because that is used in the relevant lawsuits and most academic and popular press discussions surrounding recent efforts to eliminate tampon taxes.

menstrual hygiene products, such as tampons and sanitary pads,[2] in the sales tax base.[3] Given that almost all menstruating women essentially must use menstrual hygiene products in today's society, the main argument is that the tax is akin to imposing a tax on women.[4] The lawsuit notes that many medical products used primarily by men, including Rogaine, are not subject to sales taxes. The lawsuit is an illustration of a movement to exclude menstrual hygiene products from sales taxes.[5] In 2017, 15 states introduced legislation targeting the tampon tax.[6] If passed, these states would join 13 other states and the District of Columbia that do not tax menstrual hygiene products.

The emphasis on women bearing the burden of tampon taxes is a crucial point for the movement. To our knowledge, however, no empirical evidence has documented the extent that the tax break from repealing tampon taxes is shifted to consumers. The empirical question of who bears the burden of tampon taxes is important because tax laws only dictate how much a tax is and who remits the tax, but who bears the burden of a tax is not necessarily who remits the tax. Social scientists distinguish the legal incidence of the tax (how much a tax is and who remits the tax) from the economic incidence of the tax (who bears the burden of the tax), and emphasize that the behavior of buyers and sellers in markets—not laws—determines who bears the burden of the tax (the economic incidence). To see the distinction, consider the following example. Suppose that Margo Seibert purchases a menstrual hygiene product with a retail price of $5.00 and the product is subject to a 5 percent sales tax. The after-tax price of the product is $5.25, and the store collects the $0.25 tax and remits the collected tax to the government. Does this mean that Margo would be better off by $0.25 if there was no sales tax on the menstrual hygiene product?

Not necessarily. To see why, we must assess what happens to consumer prices in the counterfactual world in which menstrual hygiene products are no longer taxed. Now suppose that a law is passed that excludes menstrual hygiene products from the sales tax base, and that the retail price of the product Margo purchased increases from $5.00 to $5.25. Because retail price fully adjusted after the product was not subject to the tax, Margo enjoyed no benefit from the tax repeal: Margo paid $5.25 for the same product

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[2]We will collectively refer to these products as menstrual hygiene for menstrual hygiene products. Menstrual hygiene products are also commonly referred to as feminine hygiene products. Some have argued that the use of the term "feminine" when describing these products needs to be stopped because of the implicit information it conveys about the user of the products and because it "perpetuates the fear of body parts and fluids" (Licorish 2017).

[3]Unlike excise taxes that are specific to some goods like alcohol and cigarettes, this tampon tax instead refers to the application of the general state sales tax to menstrual hygiene products.

[4]The tampon tax in New York, the complaint argues, "denies women equal protection and discriminates against women, because a tax on [menstrual hygiene] products is on its face a tax on women, and because it results in the disparate treatment of women." "A tax on wearing yarmulkes is a tax on Jews." quoting Bray v. Alexandria Women's Health Clinic, 506 U.S. 263, 270 (1993) (Scalia, J., dissenting).

[5]Jennifer Weiss-Wolf of the Brennan Justice Center at New York University School of Law identifies this movement as part of the "mainstream policy agenda" promoting "[m]enstural equality" (Weiss-Wolf 2016).

[6]See the Appendix for more details.

regardless of whether the product was included in the sales tax base. Instead, the tax benefit was entirely enjoyed by individuals on the supply side of the market, including those individuals involved in producing and selling menstrual hygiene products.

In this article, we estimate the economic incidence of the 2005 elimination of menstrual hygiene products from the sales tax base in New Jersey. To do so, we use data on over 16,000 purchases of menstrual hygiene products in New Jersey and surrounding states between 2004 and 2006 from Nielsen Consumer Panel Data.

To what extent do we expect consumers to enjoy the tax benefit of the tampon tax repeal? In general, the side of the market that is less able to respond to taxes should bear more of the tax burden (Fullerton & Metcalf 2002). Here, the need to use menstrual hygiene products is driven by nature: women cannot decide whether to menstruate.[7] The only major response for menstruating women to avoid the tampon tax burden is to not use menstrual hygiene products, which is unlikely to be a realistic option in today's society. One would therefore predict consumers to bear most of the tax burden, implying that the benefit of eliminating tampon taxes would be enjoyed by consumers. We find evidence consistent with this prediction: relative to consumer prices in control states on the East Coast, consumer prices in New Jersey decreased by 7.3 percent after the repeal of the 6.9 percent sales tax on menstrual hygiene products. The results suggest that the tax break was fully enjoyed by consumers.

The movement to repeal tampon taxes often articulates a second motivation for eliminating tampon taxes: to make menstrual hygiene products more affordable, particularly for low-income women (Garcia 2017). There are reports that some women have difficulty affording menstrual hygiene products (Weiss-Wolf & Burns 2016), with some using alternative, less expensive products that pose higher health risks (e.g., Roberts 2017). Thus, we next investigate the distributional consequences of tampons taxes by estimating how the tax break is distributed across consumers by income. For high-income consumers, we find that the benefit of repealing the tampon tax is roughly shared with producers (consumer prices in New Jersey decreased by 3.9 percent relative to prices in the control states). In contrast, we find that prices for low-income consumers decrease by more than the size of the tax (by 12.4 percent relative to prices in the control states).[8] In other words, the tax benefit is undershifted to prices of menstrual hygiene products purchased by high-income consumers at a rate of 0.57 and overshifted to prices of menstrual hygiene products purchased by low-income consumers at a rate of 1.8.[9] These findings suggest that repealing tampon taxes will promote the affordability of menstrual hygiene products to low-income consumers.

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[7]Women can engage in menstruation suppression, which poses health risks (Hillard 2014:631).

[8]Differential shifting of taxes to prices by consumer attributes like income has been found in previous studies, including for cigarette taxes (e.g., Harding et al. 2012).

[9]Overshifting has been found for other consumptions taxes, including sales taxes more generally (e.g., Besley & Rosen 1999), cigarette taxes (e.g., Keeler et. al. 1996; Delipalla & O'Donnell 2001; Hanson & Sullivan 2009), and alcohol taxes (Young & Bielinska-Kwapisz 2002; Kenkel 2005).

An ideal tax incidence analysis characterizes the effect of a tax change on the utility levels of consumers, which incorporates the change in prices but also any opportunity cost to achieve the prices actually paid. If, for example, the opportunity costs associated with consumer price search increased after the tax repeal, the tax pass through results would overstate the true benefits obtained by consumers. One potentially important opportunity cost is that associated with coupon use. In the sample, 22 percent of all menstrual hygiene purchases used a coupon. We investigate whether the tax pass through results adequately capture the consumer benefit by estimating the extent that New Jersey consumers respond to the tax repeal by changing their use of coupons when purchasing menstrual hygiene products. We find that coupon use for high-income consumers in New Jersey decreased by 4 percent of menstrual hygiene purchases following the tax repeal and coupon use for low-income consumers in New Jersey increased by 5 percent of menstrual hygiene purchases following the tax repeal. The differential changes in coupon use by income provides some evidence that the tax pass through results overstate the true differences in benefits from the tax repeal between these groups.

In a final step, we explore two mechanisms that could be driving the differential tax incidence results. First, we investigate differential between-product pass through. Taxes could be passed through to prices differently by product, and consumers do not all purchase the same products. Second, we investigate differential within-product pass through. Even for the low-income and high-income consumers purchasing the same menstrual hygiene product, there is not a single price for a given product across the market and between consumers within a market. For example, prices for a given product differ between stores, and different consumers shop at different stores. As a result, taxes could be passed through to prices at different rates even within a product. We find no evidence that the differential pass through by income is explained by differential between-product pass through, but find evidence it is partly explained by differential within-product pass through.

The findings build on the legal research documenting how actual or potential changes in tax laws affect distributional outcomes (e.g., Griffith 1989; Kaplow 1994; Kamin 2008; Hayashi 2014; Schizer 2015; Stolper 2016; Hemel & Rozema forthcoming).[10] More generally, it builds on legal research documenting how laws affect distributional outcomes, including, for instance, recent work on the distributional consequences of deficit reduction (Doran 2008), federal sentencing guidelines (Fischman & Schanzenbach 2012), legislative attempts to make the courts more accessible (Niblett & Yoon 2017), and the Supreme Court's federalism jurisprudence (Hemel forthcoming). The results provide policy-relevant information to state policymakers considering repealing tampon taxes.

This article proceeds in four sections. Section II offers an overview of tampon taxes and the debate it has engendered. Section III first describes the data and identification

[10]A related economics literature investigates the distributional effects of taxes, including consumption taxes (e.g., Rubenstein & Scafidi 2002; Bento et al. 2009).

strategy and then reports the results. Section IV explores the mechanisms for the tax pass through results. Section V concludes.

## II. Background

A recent social movement has made some strides to change sales tax laws regarding menstrual hygiene products in the United States and in other countries,[11] but a majority of states in the United States still tax them. A sales tax is a rate that is applied to goods at the point of sale. Five states have no sales taxes. In the 45 states with sales taxes, only five states exempted menstrual hygiene products from the sales tax base before the recent tampon tax movement.[12] One example of an earlier repeal of the tampon tax is New Jersey's passage of an exemption in 2005. In 2005, New Jersey had a state-wide sales tax of 6.9 percent.[13] On October 1, 2005, New Jersey's Streamlined Sales and Use Tax legislation went into effect,[14] which included the exemption of "tampons or like products" from the sales tax. Recently, four states and the District of Columbia have passed exemptions. However, not all recent efforts to eliminate the tampon tax have been successful (Dillion 2016). As of this writing, a number of states are currently considering legislation to repeal the tax. See the Appendix for more details.

### *A. Reasons Offered for Repealing Tampon Tax*

#### 1. Equality

The main argument made against taxing menstrual hygiene products is that it is unfair and inequitable because they are necessities in today's society (e.g., Crawford & Spivack 2017). The theory of not taxing necessities has supported sales tax exemptions for other products in some jurisdictions, including food and medications (e.g., *CRH Catering Co. v. Commonwealth*).[15] Proponents argue that access to proper menstrual hygiene products is crucial to women's health, in part because lack of proper menstrual hygiene is linked to many types of infections (Sumpter & Torondel 2013; House et al. 2013; Sommer et al. 2015). The American Medical Association has even advocated for exempting menstrual hygiene products from sales taxes because "menstrual hygiene products are essential for women's health" (AMA 2016). The Illinois Supreme Court in *Geary*

[11]Canada recently repealed its tampon taxes (Watters 2015), and there are recent proposals to repeal tampon taxes in the United Kingdom and Australia (Chadwick 2015).

[12]The Appendix provides a detailed account of state sales taxes and state proposals to repeal tampon taxes.

[13]ST-75, Sales Tax Collection Schedule, available at http://www.state.nj.us/treasury/taxation/pdf/other_forms/sales/st75.pdf.

[14]P.L. 2005, c. 126, codified as N.J.S.A. 54:32B-8.1.

[15]521 A.2d 497, 500 (1987).

*v. Dominick's Finer Foods* held that menstrual hygiene products "are necessities of life" for menstruating women.[16]

Proponents of tampon tax repeal also argue that the taxes are particularly inequitable given that they target an immutable characteristic of roughly half the population at some point in their life (Gass-Poore 2016). Proponents of repealing tampon taxes assert that the taxes uniquely target those who menstruate, meaning, in practice, the taxes have a discriminatory effect resulting in unequal treatment under the law (Myers 2016; Ooi forthcoming). The argument is that the tampon tax is, accordingly, a de facto tax on being a woman (Crawford & Spivack 2017). This inequality becomes even more apparent, proponents argue, considering the fact that many products that are used to treat male-oriented[17] conditions are exempt from sales taxes. Many male-oriented products are deemed medical, and many jurisdictions exempt medical products from sales taxes (Due & Mikesell 1983). Proponents of repealing tampon taxes further argue that these male-oriented products are not directed at conditions that must be remedied to participate in society (Garcia 2017). Thus, the argument goes, not only do most jurisdictions tax a necessary product for women, many exempt products that addresses elective medical concerns of men.

This inequality argument is the basis for equal protection challenges to sales taxes on menstrual hygiene products, including the lawsuit against New York discussed in Section I.[18] A similar argument is being made in the Florida class action suit *Wendell v. Fl. Dep't of Revenue*.[19] The plaintiffs argue that "[t]he State Defendants' decision to tax [menstrual hygiene products], used exclusively by women, but not tax other common household remedies also used by men, is irrational and discriminatory."[20]

### 2. Affordability

The other main argument made in favor of repealing tampon taxes is that it would increase the affordability (and thus accessibility) of menstrual hygiene products by lowering consumer prices (e.g., Weiss-Wolf 2015). Most proponents are particularly concerned

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[16]544 NE.2d 344, 346 (Ill. 1989). The Illinois Supreme Court ultimately found that the Chicago City Council intended to exempt "tampons and sanitary napkins," and thus the collection of such taxes by the state was improper.

[17]Such products include those to help treat erectile dysfunction and hair loss, products that address mainly male-oriented conditions. And, again, just as with our use of the term female, we will use the term male to identify those who biologically do not (or have or will not) menstruate even though they may not themselves identify as "male."

[18]See Compl., Siebert v. N.Y. St. Dep't of Tax. & Finance, No. 151800/2016 (Mar. 3, 2016).

[19]Compl., Wendell v. Fl. Dep't of Revenue, No. 43590417 (July 6, 2016). A similar suit was filed in Ohio. *See* Compl., Rowitz v. Ohio Dep't of Taxation, 2016-00197 (Ohio Ct. Claims, filed Mar. 14, 2016), dismissed without prejudice. Refiled as Rowitz v. State of Ohio et al., 2016-CV-003518 (Franklin Co. Ct. Common Pleas, filed Apr. 11, 2016).

[20]Compl., Wendell v. Fl. Dep't of Revenue, No. 43590417 (Fl. Ct. July 6, 2016).

with increasing access for low-income women (e.g., Weiss-Wolf 2016). Women spend, on average, $7 per month on menstrual hygiene products (BBC 2016). Given the average state and local sales tax in the United States of 6.25 percent, this means that the government collects $5.25 in sales taxes per year from the average menstruating woman (BBC 2016). Proponents of repealing tampon taxes argue that low-income women have a difficult time affording menstrual hygiene products (e.g., Garcia 2017), partly because most noncash public assistance programs like the Supplemental Nutrition Assistance Program do not cover menstrual hygiene products (USDA 2017). Some proponents argue that, as a result, some women use less sanitary alternatives or use menstrual hygiene products in unsanitary ways (a debated fact) (e.g., Roberts 2017). Proponents argue that restricted access to menstrual hygiene products can be particularly harmful for low-income women because it can make completing daily tasks like going to work or school difficult (e.g., Hennegan & Montgomery 2016).

### *B. Reasons Offered for Keeping Tampon Taxes*

#### 1. State Budgets and Tax Rates

Some opponents of repealing tampon taxes justify their opposition on revenue grounds (e.g., Kaeding 2017). Estimates suggest that the Commonwealth of Virginia would lose roughly $5 million per year in tax revenue if menstrual hygiene products were to be excluded from the sales tax base (VA Department of Taxation 2016), and estimates suggest that the State of California has annually raised over $20 million in revenues from menstrual hygiene product sales (CA Senate Committee 2016). In 2016, the California governor is said to have vetoed a tampon tax exemption specifically because of budgetary concerns (Dillon 2016).

Opponents point out several underlying motivations for not wanting to exclude menstrual hygiene products from the sales tax base. First, opponents argue that the revenue raised is used to fund important public policies (Kaeding 2017). Second, opponents argue that repealing tampon taxes, like repealing or decreasing any taxes, decreases government revenue that must then be raised by other means, such as by increasing the overall sales tax rate (Kaeding 2017). Recent evidence suggests that the rate of sales taxes increases by between 0.10 and 0.25 percentage points for each additional sales tax exemption (Stratmann 2017). Third, opponents point out that repealing the tampon tax is a slippery slope and would create difficult line-drawing problems for excluding other products from the sales tax base, particularly those deemed necessary (Ooi forthcoming). Fourth, opponents argue that excluding menstrual hygiene products from the sales tax base would increase the costs of administering the sales tax (for a general discussion of the costs of administering the sales tax, see Slemrod & Bakija 2008).

#### 2. Economically Efficient Taxes

A tax that does not change behavior is said to be economically efficient. Economists typically promote taxes that distort behavior the least (e.g., Gruber 2013). To see why, imagine a world without taxes where consumers are rational. Because consumers make decisions that are optimal (maximizing their own happiness), social welfare, given that

allocation of goods, is maximized. Now suppose the government needs to raise revenue through consumption taxes and must decide what goods to tax (known as Ramsey optimal taxation) (Ramsey 1927). Given that consumer decisions before any tax is imposed maximized social welfare, any tax that changes those decisions necessarily decreases social welfare. Therefore, government should choose to tax goods that lead to the lowest distortions. This simple scenario explains why economists typically advocate taxing goods for which consumers do not highly adjust quantity demanded when prices change (the most inelastically demanded goods).

Above, we discussed how menstrual hygiene products are essentially a necessity for menstruating women in today's society, implying that the demand for menstrual hygiene products is likely to be highly inelastic. Therefore, from an economic efficiency standpoint, menstrual hygiene products would be a good product to tax.

### 3. Superior Alternatives

Some opponents argue that repealing tampon taxes is not the best means for helping women who cannot afford menstrual hygiene products because the taxes only represent a small portion of the price (although this assumes that consumers bear the full burden of the tax) (Cauterucci 2016). Therefore, some opponents argue that repealing tampon taxes will not necessarily make menstrual hygiene products much more affordable because a reduction in consumer prices by the amount of sales taxes (usually 4–10 percent) will only make a marginal difference in the affordability of menstrual hygiene products. Instead, these opponents argue, only policies that cover a substantial proportion of the cost of menstrual hygiene products will make a meaningful difference in the affordability of menstrual hygiene products (Rampell 2016). Such alternative proposals include direct subsidies, allowing food stamps or Medicaid to be used to purchase menstrual hygiene products, and enacting tax credits for menstrual hygiene product purchases (for a review of the proposals, see Ooi forthcoming:13.). Opponents argue that because repealing tampon taxes will exhaust the political capital necessary to achieve better policies that promote the affordability of menstrual hygiene products to those that need the most help, tampon taxes should not be eliminated.

### 4. Distributional Consequences

The above affordability argument in favor of eliminating tampon taxes is directed at low-income individuals. If the only goal of repealing tampon taxes is to increase the affordability of menstrual hygiene products to low-income individuals, however, some opponents argue that repealing tampon taxes will have the unintended effect of reducing consumer prices for high-income women as well. In a *Washington Post* opinion column, Catherine Rampell pointed out that eliminating tampon taxes is "poorly targeted" at helping low-income women afford menstrual hygiene products, particularly because it also gives "a break to billionaires" (Rampell 2016). These distributional consequences of repealing tampon taxes are another reason advocated for adopting alternative policies that provide direct subsidies for menstrual hygiene products to low-income women (Eckl & Perez 2005:351).

## III. The Incidence of Tampon Taxes

Our discussion of tampon taxes so far has been about fairness, affordability, and the movement to repeal them. We are able to find no empirical evidence documenting the economic incidence of tampon taxes. In this part, we provide such a tax incidence analysis of tampon taxes exploiting as a natural experiment the 2005 New Jersey law that exempted menstrual hygiene products from the sales tax base.

### *A. Research Design*

Following a standard framework in the tax incidence literature, we use a differences-in-differences (DD) approach to estimate the economic incidence of tampon taxes in New Jersey. The approach uses the prices paid by consumers in other states as a control group. We restrict the control groups to states in close proximity to New Jersey because prices in these states serve as a better control group than prices in states throughout the country. This is because, for instance, there could be different supply-side shocks that could influence prices across some parts of the country but not near New Jersey (Angrist & Pischke 2009). The control states we use are Delaware, Connecticut, Maryland, and Pennsylvania,[21] but the results are consistent when we use an expanded definition of control states as well as using all states as control states.

On October 1, 2005, prices in New Jersey are "treated" with the new tax law repealing tampon taxes while prices in the control states are not.[22] The DD approach compares the average change in prices in New Jersey to the average change in prices from purchases made in the control states, after adjusting for differences in prices between states, over time, and by other covariates described below. The identifying assumption is that absent any change in the law in New Jersey, the trend in prices in the control states is what we should have expected to see in New Jersey.[23] Equation (1) sets out the DD specification:[24]

$$\ln(\mathrm{P}_{inst}) = \alpha + \alpha \mathrm{Post}_t + \lambda \mathrm{Treat}_s + \beta \mathrm{Post}_t \times \mathrm{Treat}_s + \gamma X_i + \delta_t + \mu_s + \zeta_u + \varepsilon_{ust} \quad (1)$$

[21]Note that New York changed sales taxes on June 1, 2005 (from 4.25 percent to 4 percent), so we do not use the state as a control group.

[22]As of the time of this analysis, Nielsen data were unavailable for other tampon tax repeals.

[23]There is a concern that New Jersey households who previously purchased menstrual hygiene products in a different state because of the New Jersey sales tax on menstrual hygiene products respond to tax repeal by purchasing menstrual hygiene products in New Jersey. Intuitively, one would be concerned about changes in cross-border shopping if the costs of traveling to another state to purchase tampons are less than the tax savings. In the Appendix, we investigate cross-border shopping and find no evidence that cross-border shopping biases the results.

[24]The literature uses various specifications that are slightly different but essentially arrive at the same result. This specification follows the standard DD step up and is used in some tax incidence analyses (e.g., Cawley & Frisvold 2017).

for product $u$ purchased by household $i$ in state $s$ in year-month $t$, where $P_{iust}$ denotes the consumer price. The dependent variable is the natural log of prices, which gives us a percent change interpretation and is a standard approach in the incidence literature on sales taxes (e.g., Poterba 1996; Besley & Rosen 1999).

The coefficient of interest is the DD estimator $\beta$, which is the coefficient on the interaction term $Post_t \times Treat_s$. The variable $Post_t \times Treat_s$ equals 1 if the product was purchased in New Jersey after the tampon tax was repealed, and is otherwise 0. The dummy variable $Post_t$ equals 1 if the product was purchased after New Jersey tampon taxes were repealed, and is otherwise 0. The dummy variable $Treat_s$ equals 1 if the product was purchased in New Jersey, and is otherwise 0.[25]

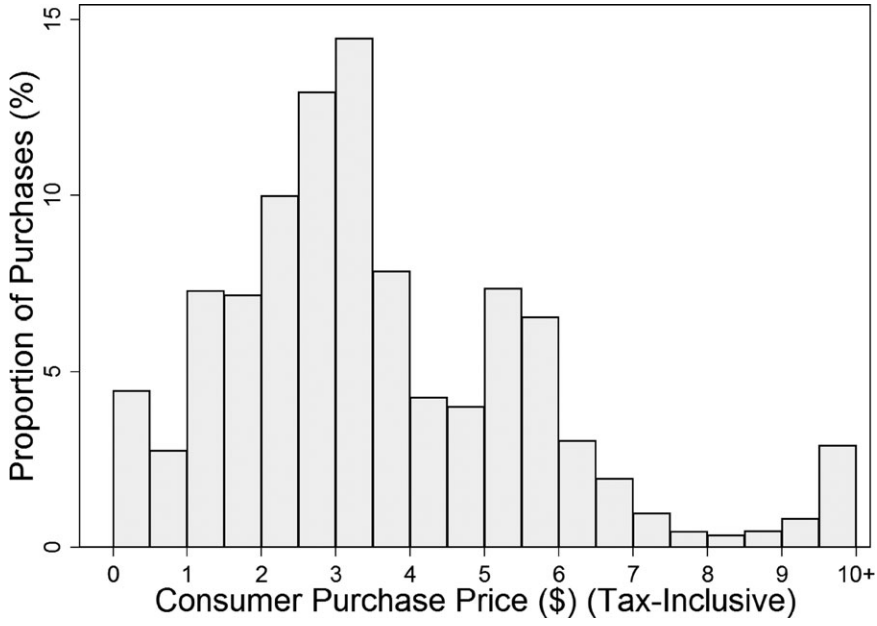
In Equation (1), we employ a standard set of control variables (see, e.g., Harding et al. 2012). First, we control for systematic changes in prices from month to month using year-month fixed effects, $\delta_t$. Second, we control for systematic differences in prices between each state using state fixed effects, $\mu_s$. Third, we control for household demographics, $X_i$, including household size, education, marital status, income, and race. Finally, we control for systematic differences in prices between each and every product using product fixed effects, $\zeta_u$, which is discussed in more detail below.

The estimated coefficient $\beta$ indicates the average percent change in prices in New Jersey after the products were no longer included in the sales tax base. The New Jersey sales tax was 6.9 percent before the tampon tax repeal. A point estimate of $-0.069$ would therefore indicate that the tax benefit was fully shifted to prices, implying that consumers obtain the full benefit of the tax repeal. A coefficient of 0 would indicate that prices fully adjusted after the law, implying that consumers obtain none of the benefit of the tax law (producers obtain the full benefit). A point estimate between 0 and $-0.069$ would indicate the tax benefit was undershifted to consumer prices, implying that consumers and producers share the benefit of the tax repeal. For instance, consumers and producers would share the benefit equally if the estimated coefficient was $-0.034$ (half of the sales tax rate of 0.069). A point estimate less than $-0.069$ would indicate that the tax benefit was overshifted to prices, implying that consumers benefit from the tax repeal an amount more than tax.

There is an important issue relating to the estimation of standard errors. The so-called clustering problem here addresses the fact that prices within a state tend to be correlated because they face similar market and other influences (Donald & Lang 2007; Angrist & Pischke 2009; Cameron & Miller 2015). In the context of one treatment state and multiple control states, a standard approach in the reduced form literature more generally is to cluster standard errors by state because that is the level of treatment assignment (e.g., Paik et al. 2012:203). We follow this common approach and report standard errors clustered by state. However, we acknowledge the problem here that we have only one treatment group so state-level clustering causes "'overfitting' with estimated residuals

[25]Note that the main effect for $Treat_s$ is actually included in the state fixed effects, but we include it in the expression for Equation (1) for completeness.

*Figure 1:* Distribution of retail prices paid.




systematically too close to zero compared to the true error terms" (Cameron & Miller 2015:341).

Cameron and Miller (2015) discuss the issue of few treated groups and suggests a test to be ran to assess the concerns with few treatment groups. We implement the test in Baker et al. (2008) that follows the guidance of Anderson and Meyer (2000), Conley and Taber (2011), and Gruber and Hungerman (2008). The test asks whether the changes in prices in New Jersey from before to after the tax change could fit within the distribution of the changes in prices witnessed by the control states in different periods. Intuitively, the test estimates the DD coefficient after randomly assigning treatments to the control states in different time periods. As in Baker et al. (2008), we run 10,000 placebo DD regressions. The test provides strong evidence that the estimated decrease in prices reported in the next section would not have happened by chance: the 99 percent confidence interval [0.000053, −0.000096], as we will see, does not come close to the decrease in prices observed in New Jersey after the tax repeal.

Although pointing to related recent literature that faces similar standard error concerns does not alleviate the clustering concern here, we note that recent published work faced similar settings: Cawley and Frisvold (2017) had two clusters; Harju et al. (2016) had three clusters; Berardi et al. (2012) had two clusters; Bergman and Hansen (2010) had two clusters; Grogger (2015) had two clusters; and Kenkel (2005) had only one cluster.

*B. Data*

We use data from the Nielsen Consumer Panel Data (Nielsen) from 2004 to 2006. Nielsen contains information about purchases of roughly 50,000 U.S. households. Households "continually provide information to Nielsen about their households, what products they buy, as well as when and where they make purchases" (Consumer Panel Dataset Manual 2016). The participating households "use in-home scanners to record all of their purchases, from any outlet, intended for personal, in-home use" (Consumer Panel Dataset Manual 2016). Nielsen is demographically balanced such that it represents the demography of the United States.[26] Households come from all states and all major markets. Nielsen contains demographic information for each household and some information for each household member, including state of residence, household size, and household income. For each head of the household, Nielsen contains information on age, race, education, and marital status.

Nielsen contains information about each purchase made by participating households. This includes the date of purchase and "detailed transaction information about each product purchased," including the Universal Product Code (UPC), the number of units in the UPC (e.g., a box of 10 tampons), quantity of the purchase (e.g., purchased two boxes of the product), the retail price, whether the product was on special, and any coupons used (and the amount of the coupon). We use the price per quantity purchased as the retail price, which reflects the price of a single purchase of a given UPC (where different UPCs can contain different number of units). We adjust retail prices by coupons (following Nielsen's data documentation) and apply the applicable state sales tax rate from Tax Policy Center (2017) to capture the actual price paid by consumers (herein "consumer prices"). We also adjust prices by the Consumer Price Index (CPI) (to 2006 dollars). Throughout, we use consumer prices as the outcome (prices actually paid by consumers, which includes the sales tax).

Nielsen provides detailed product attributes for each UPC. In total, there are roughly 1.5 million UPCs. Nielsen groups products by UPC into different product hierarchies. There are 10 "Departments" (e.g., Health and Beauty Care), roughly 125 "Product Groups" (e.g., Sanitary Protection), and roughly 1,100 "Product Modules" (e.g., sanitary napkins, tampons). The New Jersey law does not exclude all menstrual hygiene products from the sales tax base, including "douches, wipes and sprays (unless containing an active ingredient or a Drug Facts box)."[27] Using the detailed information in product descriptions, we restrict the analysis to the relevant menstrual hygiene products that were subject to the sales tax before the law went into effect but not after the law (menstrual hygiene products in the product modules of sanitary napkins and tampons). This includes 634 unique UPCs.

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[26]We use the provided sampling weights. The panel composition is also designed to be projectable to some Scantrack markets.

[27]P.L. 2005, c. 126, codified as N.J.S.A. 54:32B-8.1.

Table 1: Descriptive Statistics

| | *Consumer Prices (Mean $)* | *Household Income* | *Sample Size* | |
|---|---|---|---|---|
| | | | *# Households* | *# Purchases* |
| **Sample** | | | | |
| Entire sample | 3.61 | 59k | 2,133 | 16,170 |
| New Jersey | 3.45 | 61k | 510 | 3,612 |
| Control states | 3.66 | 58k | 1,623 | 12,558 |
| **Sample by Income Group** | | | | |
| High income | 3.89 | 80k | 1,361 | 10,527 |
| Low income | 3.2 | 28k | 772 | 5,643 |
| **Sample by Education** | | | | |
| College graduate | 3.85 | 76k | 1,080 | 7,944 |
| Not college graduate | 3.45 | 48k | 1,053 | 8,226 |

NOTE: Data from Nielsen Consumer Panel, 2004 to 2006. Mean consumer prices include relevant state sales taxes. Consumer prices and household income are adjusted to 2006 prices by the Consumer Price Index. Price differences by state, income, and education reflect both differences in product quality and differences in prices for the same product.

### *C. Descriptive Statistics*

Table 1 presents descriptive statistics. The sample consists of 510 households in New Jersey and 1,623 households in the control states. In New Jersey and the control states, there are 16,170 separate product purchases, of which 3,612 are in New Jersey and the remaining 12,558 are in the control states.[28] The average consumer price in the sample is $3.61. Figure 1 plots the distribution of consumer prices, and shows that just under 50 percent of all purchases were under $3 and roughly 75 percent were under $5.

Below, we investigate how the tax burden differs by income and education. We divide households into two income groups. To do so, we use the 2006 federal poverty guidelines (DHHS 2006). First are "low-income" households that have an annual income of less than 2.5 times the poverty line. Second are "high-income" households that have an annual income of at least 2.5 time the poverty line. Table 1 shows the average prices paid by households in these two income groups. Low-income households, which earn on average $28k per year, pay on average $3.20 for each menstrual hygiene product. High-income households, which earn on average $80k per year, pay on average $3.89 for each menstrual hygiene product. We note that we cannot divide households in finer income groups because of data limitations. Although we would be particularly interested in how the tampon tax burden is borne by the lowest income consumers, coverage of purchases of menstrual hygiene products for the lowest income households in Nielsen is limited.

[28]To put this into perspective, the 16,170 separate product purchases amounts to roughly 500k units purchased (i.e., if all products sold were a single tampon there would be 500k individual tampons sold). In other words, the average product contains roughly 31 units. This counts each product sold as its own product, that is, if someone buys two of a package it counts as two. We note that a single UPC code may identify a tampon or sanitary napkin package that contains multiple individual products. Given that we control at the UPC level, such differences in number of individual units in a product are accounted for.

Table 2: The Effect of the New Jersey Tampon Tax Repeal on Tax-Inclusive Consumer Prices

| | *ln(Tax-Inclusive Price)* | | | | |
|---|---|---|---|---|---|
| *Sample* | *All* (1) | *Low Income* (2) | *High Income* (3) | *No College* (4) | *College Grad* (5) |
| Post × Treat | −0.073[4]*** | −0.124[4]*** | −0.039[4]** | −0.111[4]*** | −0.034 |
| | (0.008) | (0.010) | (0.012) | (0.008) | (0.017) |
| **Covariates** | | | | | |
| State fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year-month fixed effects | Yes | Yes | Yes | Yes | Yes |
| Household demographics | Yes | Yes | Yes | Yes | Yes |
| UPC fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,170 | 5,643 | 10,527 | 8,226 | 7,944 |
| $R^2$ | 0.631 | 0.66 | 0.632 | 0.653 | 0.632 |

NOTE: Clustered standard errors in parentheses (by state). *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$. Household demographics include household size, marital status, income, and race. The dependent variable is the natural log of the tax-inclusive price. The interaction term Post × Treat equals 1 when the product was purchased in New Jersey (as opposed to the control states) after the tampon tax was repealed, and is the difference-in-differences estimator given in Equation (1). Each column represents one estimate for the sample identified at the top of the table.

With a handful of states recently repealing tampon taxes, we feel this is an interesting avenue for future research once data become available.

We also divide households into two different education groups. First are households where none of the head of household members have a college degree. Second are households where at least of one of the head of household members has a college degree. Table 1 shows the average prices paid by households by education. Households without a college degree pay on average $3.45 for a menstrual hygiene product, which is $0.40 lower than the average price of $3.85 for menstrual hygiene products purchased by households with a college degree. Herein, we will use the term household and consumers interchangeably.

### *D. Results*

We estimate the specification in Equation (1). Table 2 reports the results. Column 1 reports the main results for the pass through rate among all consumers in the sample. We find that the pass through rate is −0.073. This means that, relative to tax-inclusive prices in the control states, tax-inclusive prices in New Jersey decreased by 7.3 percent after menstrual hygiene products were excluded from the sales tax base, just slightly higher than the tax of 6.9 percent. Given that the point estimates are close to full pass through and that the standard error overlaps with full pass through, the results provide evidence that the tax benefit was roughly fully obtained by consumers.[29] Columns 2 and 3 report the tax pass through rate for low-income and high-income consumers, respectively. Following an

[29]Table A1 in the Appendix provides four sets of point estimates that vary by the set of controls used.

approach that has been used in the literature (Harding et al. 2012), these estimates are from separate regressions that restrict the sample to those in the indicated group. The estimated coefficient for low-income consumers is −0.124. The standard errors do not cover −0.069, meaning that the repeal of the taxes decreased prices for low-income consumers by more than the size of the tax. The implied tax pass through rate is 1.80 (−0.124/−0.069). The estimated coefficient for high-income consumers is −0.039. The standard errors also do not cover −0.069, meaning that the repeal of the taxes decreased prices for high-income consumers by less than the size of the tax. The implied tax pass through rate is 0.56 (−0.039/−0.069). In other words, the tax benefit of the repeal was roughly shared between high-income consumers and the producers of menstrual hygiene products.

Columns 4 and 5 of Table 2 report the tax pass through rates for consumers without and with a college education, respectively. The estimates are again from separate regressions that restrict the sample to those in the indicated group. Because income and education are highly correlated, one might expect the differences in the tax pass through rate between low- and high-income consumers to carry over to consumers with and without a college education. That is indeed what we find, but to a lesser degree. The tax pass through rate for consumers without a college education is −0.111, but −0.034 for consumers with a college degree.

Under certain assumptions, the tax pass through rates are sufficient statistics for the tax burden (see, e.g., Weyl & Fabinger 2013). However, an ideal tax incidence analysis characterizes the effect of a tax change on the utility levels of consumers, which also incorporates any other costs associated with changes in behavior on other margins. We want to understand the true difference in cost of the products after the tax repeal, which incorporates any opportunity cost to achieve the prices actually paid. One potentially important opportunity cost is that associated with consumer price search. For example, if the cost of consumer price search increased after the tax repeal, the tax pass through results would overstate the true benefits obtained by consumers.

We investigate the extent that New Jersey consumers respond to the tax repeal by changing their use of coupons when purchasing menstrual hygiene products. Because the opportunity cost of using a coupon is likely to be independent of the value of the coupon, here we focus on whether a coupon was used rather than the value of the coupon. Below, we will ask the separate question of whether changes in coupon use can explain the differential tax pass through rates by income and education, which incorporates the value of the coupon.

The use of coupons is an equilibrium concept, where the availability of coupons and the size of the discount offered could respond to the tax repeal. Changes in the availability and size of offered coupons in turn influence not only consumers' decisions to use coupons but also retail prices. As a result, we might expect differential coupon responses by income and education. For example, if low-income consumers purchase different products than high-income consumers and the availability and size of the offered coupons differ by product type, one might expect coupon use to change differentially by income. Moreover, if low-income consumers are more or less likely to upgrade to higher-quality menstrual hygiene products after the tax repeal and coupons differ by product, one might expect coupon use to change differentially by income. Finally, manufactures

Table 3: Repeal of Tampon Taxes and Coupon Use

| | *Used Coupon in Purchase* | | | | |
|---|---|---|---|---|---|
| *Sample* | *All* (1) | *Low Income* (2) | *High Income* (3) | *No College* (4) | *College Grad* (5) |
| Post × Treat | 0.002 | 0.042[5]** | −0.030[5]** | 0.003 | 0.008 |
| | (0.010) | (0.013) | (0.009) | (0.013) | (0.018) |
| **Covariates** | | | | | |
| State fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year-month fixed effects | Yes | Yes | Yes | Yes | Yes |
| Household demographics | Yes | Yes | Yes | Yes | Yes |
| UPC fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,170 | 5,643 | 10,527 | 8,226 | 7,944 |
| $R^2$ | 0.181 | 0.304 | 0.176 | 0.237 | 0.199 |
| Dependent variable mean | 0.22 | 0.21 | 0.23 | 0.21 | 0.23 |

NOTE: Clustered standard errors in parentheses (by state). *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Household demographics include household size, marital status, income, and race. The dependent variable is an indicator variable for whether the purchase used a coupon. The interaction term Post × Treat equals 1 when the product was purchased in New Jersey (as opposed to the control states) after the tampon tax was repealed, and is the difference-in-differences estimator given in Equation (1). Each column represents one estimate for the sample identified at the top of the table.

might attempt to prevent product substitution of some menstrual hygiene products by offering larger coupons on the products. Unfortunately, we do not observe the offered discounts, so cannot shed light on why any differential coupon responses might be occurring.

Over the sample as a whole, 22 percent of purchases used a coupon. In New Jersey, 27 percent of purchases used a coupon. In the control states, 20 percent of purchases used a coupon. To assess whether and how coupon use changed after the tax repeal, we estimate Equation (1), but where the outcome variable takes the value of 0 if no coupon was used for a purchase and a value of 1 if a coupon was used. The coefficient of interest is again β, which estimates the effect of the tax repeal on the probability that a purchase uses a coupon. We estimate the five different specifications seen in Table 2. Table 3 reports the results. We find no evidence that overall coupon use responded to the tax repeal. However, we find an increase in coupon use for low-income consumers and a decrease in coupon use for high-income consumers. In particular, whereas coupon use for high-income women decreased by 4 percent of menstrual hygiene purchases following the tax repeal, coupon use for low-income women increased by 5 percent of menstrual hygiene purchases following the tax repeal. Relative to the baseline rate at which coupons are used, these are large effects. The differential changes in coupon use by income suggests that the opportunity cost of consumer price search increased for low-income consumers but decreased for high-income consumers. This provides evidence that the tax pass through results overstate the true differential tax benefits from the tax repeal between these low-income and high-income consumers. These findings are consistent with evidence that cigarette taxes are shifted to prices for consumers who engage in more price search at lower rates than for consumers who search less (DeCicca et al.

2013). We find no evidence that coupon use changed between consumers with and without a college degree, but these coefficients are imprecisely estimated.

## IV. Mechanisms

In this section, we explore the extent that the differential tax pass through results by income and education can be explained by differential between-product and within-product pass through.

### *A. Differential Pass Through by Product*

Above, we saw overall price differences between consumers by income and education, which could reflect both differences in product quality and differences in prices for the same product. If low-income consumers purchase different types of menstrual hygiene products than high-income consumers and if there are differences in tax pass through between menstrual hygiene products, such product differences could contribute to the differences in tax pass through by income.

To test for differences in pass through between products purchased by high-income and low-income consumers, we estimate the tax pass through rate separately for each product, and compare the tax pass through rates for the products purchased by high-income and low-income consumers. Because UPCs make very fine distinctions between products, we use courser product information in Nielsen at the brand level, for example, Always Pantyliners, Tampax, and Stayfree Maxi Pads. After excluding product categories with very few purchases,[30] we are left with 37 brands. To account for differences in prices by UPC within a brand, we estimate separate pass through rates for each brand but use UPC fixed effects. Then, we match these tax pass through rates to each purchase of New Jersey consumers after the tax repeal and calculate the average tax pass through rate for each consumer. The consumer's average tax pass through rate indicates how much prices decreased on average after the tax repeal using prices in other states as a control group. By focusing only on purchases after the tax repeal, we hold constant the product bundle, an issue we will explore next.

We find no evidence that the tax pass through rates between products are different for New Jersey consumers by income or education. In particular, we find the average tax pass through rate to be −0.069 for low-income consumers and −0.068 for high-income consumers; we find the average tax pass through rate to be −0.076 for consumers without a college degree and −0.063 for consumers with a college degree. The differences in means are not statistically significant at conventional levels, providing no evidence that the differences in tax pass through by income and education are explained by differential tax pass through by product.

[30]We include products with at least 50 purchases but the results are not highly sensitive to the cutoff used.

Next, we relax the constant product bundle assumption and investigate any effects of product substitution. Theoretical work on tax incidence shows that the tax pass through rate is a function of supply and demand elasticities (e.g., Weyl & Fabinger 2013), and elasticities incorporate substitution patterns between products. In addition to shedding light on tax incidence, changes in the types of products purchased has important policy implications because one of the advocated reasons to eliminate tampon taxes is to make menstrual hygiene products more affordable. We investigate whether consumers respond to the tax repeal by changing the quality of menstrual hygiene products they purchase. To do so, we construct a quality metric for each product that is the average retail price of the product over the entire sample period. The quality metric is constant for a UPC across time. To construct the UPC-level quality metric for this analysis, we use data from Nielsen for all states in the United States from 2004 to 2006.

We then consider how this quality metric changes for purchases of consumers in New Jersey compared to consumers in the control states. We calculate the mean per-unit price of menstrual hygiene products purchased by a consumer before and after the change in law. This analysis therefore restricts the sample to consumers who made purchases in the pre- and post-tax change period. The unit of observation is a consumer pre/post period. We then estimate Equation (1) where the dependent variable is the quality metric. There are 1,360 observations in the regression. Standard errors are again clustered at the state level. Because this analysis is restricted to consumers who purchased menstrual hygiene products before and after the tax repeal, the estimates are based on a relatively small sample size and therefore should be viewed with some caution. We find that, relative to consumers in the control states, consumers in New Jersey upgrade the quality of their product by roughly 3 percent after the tampon tax repeal (by \$0.11 from a baseline average price of \$3.55). The point estimate is significant at a $p < 0.053$ level (standard error of 0.042). We considered whether low-income consumers change product quality after the tax repeal differently than high-income consumers (and similarly by education), but found that we do not have the statistical power to say anything. Future research should explore the change in quality by income or education after tampon taxes are repealed.

### *B. Differential Within-Product Pass Through*

The differential between-product pass through analysis assumed that tax pass through was constant within each product. However, there is not a single price for a given product across the market and between consumers. For example, prices for a given product differ between stores, and different consumers shop at different stores; sellers can price discriminate by offering different types of discounts and coupons. Taxes could be passed through to prices of the same product differently across stores. Moreover, taxes could be passed through to prices of the same product differently across consumers if consumers respond differently by searching for better prices through shopping at different stores. Even within a store, taxes could be passed through to prices of the same product differently across consumers if consumers respond differently by using more or less discounts (e.g., coupons) or if sellers can price discriminate between consumers by offering

different discounts (e.g., directed mail). Differential pass through within product could contribute to difference in tax pass through by income and education.

To test for whether there is differential pass through within given products, we assess whether product-level changes in prices in New Jersey from before to after the tax change are different for low-income and high-income consumers. To do so, we calculate (1) the change in prices in New Jersey of a brand purchased by high-income consumers from before to after the tax change, and (2) the change in prices in New Jersey of the same brand purchased by low-income consumers from before to after the tax change. For any given brand, the difference between (2) and (1) indicates how much more the price changed for low-income consumers than for high-income consumers. A difference of zero indicates that brand-level prices changed by the same amount for low- and high-income consumers in New Jersey. A nonzero finding would provide evidence that differential within-product pass through explains part of the differential pass through by income.

We find that prices of a brand decrease on average by \$0.057 more for low-income consumers than for high-income consumers. Relative to the average price in New Jersey before the tax repeal (\$3.47), the findings suggest that 0.017 percentage points of the gap between the tax pass through rates by income is driven by differences in within-product pass through. To put this in perspective, note that the gap in the tax pass through rates between low- and high-income consumers is 0.085 (the difference between −0.124 for low-income consumers and −0.039 for high-income consumers; see Table 2). The evidence therefore suggests that differential within-product pass through explains one-fifth of the differences in pass through by income (0.018/0.085). We repeat this exercise by education and find that differential within-product pass through explains 0.031 percentage points of the 0.077 gap between tax pass through for college and non-college consumers.

We next assess the extent that changes in coupon use are driving the differential tax pass through rates by income. Coupon usage is related to consumer price search, but it is not exactly equivalent to price search because it is likely driven both by consumers seeking out coupons and by producers offering more or better coupons. Over the sample as a whole, coupons lowered the price of purchases by an average of \$0.33. For the 22 percent of purchases made that used a coupon, the average coupon decreased posted prices by just over 40 percent. Figure A1 in the Appendix reports the distribution of coupon values. Most coupons are priced in a discrete space, where over half of all coupons used are exactly \$0.5, \$1, \$2, or \$3.

We estimate Equation (1) but where the outcome is the offered, pre-coupon retail price, where the sales tax is applied to the offered price. In doing so, we invoke the unrealistic assumption that offered retail prices would not respond to the elimination of coupons and apply the relevant state sales tax rate to the offered retail price. This implies that the results here are purely descriptive. That is, this is a counterfactual analysis where we assume that retail prices would not adjust if coupons were no longer available. This is similar to the "static" assumption used in empirical studies of tax expenditures (e.g., Cole et al. 2011). Table 4 reports the results. Although above we find no evidence of an overall response in the use of coupons (see Table 3), the value of discounts used could have changed. Overall and for each subgroup, we find that taxes are undershifted to these

Table 4: The Effect of the New Jersey Tampon Tax Repeal on Counterfactual Tax-Inclusive Posted Prices

| | *ln(Counterfactual Tax-Inclusive Offered Price)* | | | | |
|---|---|---|---|---|---|
| *Sample* | *All* (1) | *Low Income* (2) | *High Income* (3) | *No College* (4) | *College Grad* (5) |
| Post × Treat | −0.053[6]*** | −0.045[6]*** | −0.054[6]*** | −0.060[6]*** | −0.048[6]** |
| | (0.004) | (0.005) | (0.005) | (0.002) | (0.011) |
| **Covariates** | | | | | |
| State fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year-month fixed effects | Yes | Yes | Yes | Yes | Yes |
| Household demographics | Yes | Yes | Yes | Yes | Yes |
| UPC fixed effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 16,170 | 5,643 | 10,527 | 8,226 | 7,944 |
| $R^2$ | 0.904 | 0.916 | 0.904 | 0.914 | 0.911 |

NOTE: Clustered standard errors in parentheses (by state). *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$. Household demographics include household size, marital status, income, and race. The dependent variable is the natural log of the counterfactual tax-inclusive offered price. The interaction term Post × Treat equals 1 when the product was purchased in New Jersey (as opposed to the control states) after the tampon tax was repealed, and is the difference-in-differences estimator given in Equation (1). Each column represents one estimate for the sample identified at the top of the table.

counterfactual prices. The tax pass through rate for the entire sample is −0.053. The standard errors for all but Column 5 do not encompass −0.069 at conventional levels, providing evidence that the taxes were not fully shifted to these counterfactual prices. These results provide some evidence that the tax pass through estimates are in part driven by changes in coupons.

## V. CONCLUSION

This article investigated the economic incidence of the 2005 elimination of menstrual hygiene products from the sales tax base in New Jersey. We found that the tax break is fully shifted to consumers, but that the tax break was not distributed equally. We found that the tax break was overshifted to prices for low-income consumers and consumers without a college degree but undershifted to prices for high-income consumers and consumers with a college degree. However, we also found that coupon use increased for low-income consumers after the repeal but decreased for high-income consumers, suggesting that the differential tax pass through by income overstated the true differences in tax benefits from the tax repeal by income.

The findings have implications for state policymakers. As of this writing, 17 states have pending legislation to repeal tampon taxes. Although understanding the economic incidence of tampon tax repeals will be important for state policymakers, we do not downplay the importance of the expressive value of repealing tampon taxes: even if the economic benefits of the tax repeal were not borne by consumers, repealing tampon taxes could promote women's health and gender equality by changing attitudes and

removing stigmas (McAdams 2015). The symbolism of the tax may itself partly be the goal of advocates for a tampon tax repeal (e.g., Alstott 1996).

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## Appendix

*Appendix for State Statutes*

In 2016, 12 states and the District of Columbia considered proposals to exempt menstrual hygiene products from the sales tax base.[31] Three states—Connecticut, Illinois, and New York—and DC adopted the proposals. These states joined 10 other states that did not tax menstrual hygiene products before 2016. Five states—Alaska, Delaware, New Hampshire, Montana, and Oregon—do not have sales tax. Five states specifically exempt menstrual hygiene products—Maryland, Massachusetts, Minnesota, New Jersey, and Pennsylvania. In Maryland and Massachusetts, menstrual hygiene products are exempt because they are considered medical products.[32] Other states just explicitly exempt such products, including Pennsylvania.[33] The statutory language includes most menstrual hygiene products.

[31]These states are California, see A.B. 1561 Sales and use taxes: exemption: sanitary napkins: tampons: menstrual sponges and menstrual cups (2016), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1561; Connecticut, see S.B. 502 (2016), https://www.cga.ct.gov/2016/ACT/pa/2016PA-00003-R00SB-00502SS1-PA.htm; Illinois, see S.B. 2746 (2016), Use/Occ Tx-Feminine Hygiene; Michigan, see H.B. 5234 (2016), http://legislature.mi.gov/doc.aspx?2016-HB-5234, Mississippi, see S.B. 2053 (2016), https://legiscan.com/MS/bill/SB2053/2016; New York, see S.B. 7838 (2016), http://legislation.nysenate.gov/pdf/bills/2015/S7838; Ohio, see H.B. 272, Exempts feminine hygiene products from sales tax (2016), https://www.legislature.ohio.gov/legislation/legislation-summary?id=GA131-HB-272; Rhode Island, see H.B. 5377, Relating to Taxation—Sales and Use Taxes—Liability and Computation (2016), http://webserver.rilin.state.ri.us/BillText/BillText17/HouseText17/H5377.pdf; Tennessee, see H.B. 2059, Taxes, Sales (2016), https://legiscan.com/TN/bill/HB2059/2015; Utah, see H.B. 202 Hygiene Tax Act (2016), https://le.utah.gov/~2016/bills/static/HB0202.html; Virginia, see H.B. 952 Retail Sales and Use Tax; exemption for tampons and sanitary napkins (2016), https://lis.virginia.gov/cgi-bin/legp604.exe?161+sum+HB952; and Wisconsin, A.B. 949, An Act to create 77.54 (63) of the statutes; Relating to: a sales and use tax exemption for feminine hygiene products (2016), http://docs.legis.wisconsin.gov/2015/proposals/ab949. Id. The District of Columbia proposed a similar exclusion as well. See B. 21-0696—Feminine Hygiene and Diapers Sales Tax Exemption Amendment Act of 2016, http://lims.dccouncil.us/Legislation/B21-0696?FromSearchResults=true.

[32]Comptroller of Md, Taxability of Medical Equipment, Bulletin 01-1, Mar. 2001, http://taxes.marylandtaxes.com/Resource_Library/.Tax_Publications/Tax_Bulletins/Sales_and_Use_Tax_Bulletins/su_bul01-1.pdf; Mass. Dep't of Rev., "A Guide to Sales and Use Tax," http://www.mass.gov/dor/individuals/taxpayer-help-and-resources/tax-guides/salesuse-tax-guide.html#home.

[33]Penn. Code, P.L. 97 No. 22 § 9.2(4).

In 2017, 15 states—Arizona,[34] California,[35] Colorado,[36] Florida,[37] Louisiana,[38] Maine,[39] Michigan,[40] Missouri,[41] Ohio,[42] Rhode Island,[43] Tennessee,[44] Texas,[45] Utah,[46] Vermont,[47] and Virginia[48]—introduced legislation targeting the tampon tax, with Florida subsequently passing its tampon tax exemption. Bills have even been introduced at the federal level to provide a refundable tax credit for low-income women for menstrual hygiene product purchases.[49] The goals of this legislation are similar to those of the tampon tax repeal efforts.

### *Appendix: Cross-Border Shopping*

There is a concern that changes in cross-border shopping could bias the results. The main concern is that New Jersey consumers who previously purchased menstrual hygiene products in a different state because of the New Jersey sales tax on menstrual hygiene products respond to tax repeal by purchasing menstrual hygiene products in New Jersey.

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[34]H.B. 2418, 53d Leg., 1st Sess. (Ariz. 2017).

[35]A.B. 9, 2017-18 Reg. Sess. (Cal. 2017).

[36]H.B. 17-1127, 2017 Reg. Sess. (Col. 2017).

[37]H.B. 7109, 2017 Reg. Sess. (Fla. 2017).

[38]S.B. 24, 2017 Reg. Sess. (La. 2017).

[39]L.D. 206, 128th Leg., 1st Sess. (Me. 2017).

[40]H.B. 4129, 2017-18 Leg. Sess. (Mich. 2017).

[41]H.B. 841, 2017-18 Reg. Sess. (Mo. 2017).

[42]H.B. 61, 132d G.A. (Ohio 2017).

[43]H. 5377, 2017 Leg. Sess. (R.I. 2017).

[44]H.B. 804, 110th G.A. (Tenn. 2017).

[45]H.B. 716, 85th Leg., Reg. Sess. (Tex. 2017).

[46]H.B. 171, 2017 Gen. Sess. (Utah 2017).

[47]H.B. 43, 2017-18 G.A. (Vt. 2017).

[48]H.B. 1593, 2017 Reg. Sess. (Va. 2017).

[49]Fund Essential Menstruation Products Act of 2015, H.R. 3117, 114th Cong. (2015); Menstrual Products Tax Credit Act of 2016, H.R. 5917, 114th Cong. (2016); Menstrual Products for Employees Act of 2016, H.R. 5915, 114th Cong. (2016).

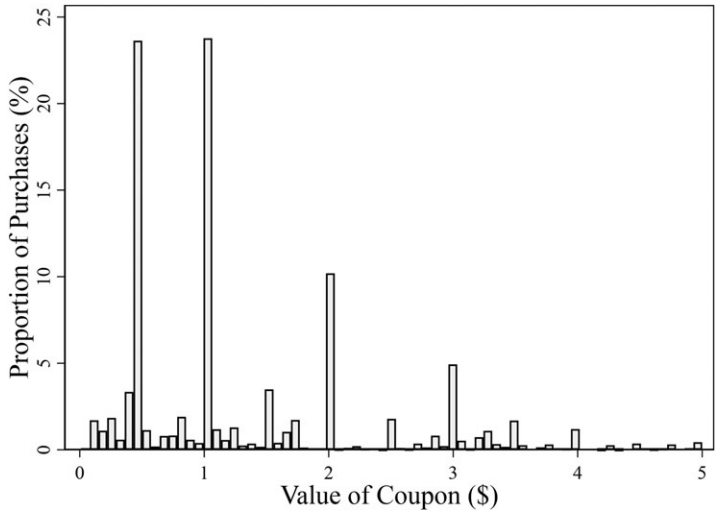
Table A1: Sensitivity of Tax Pass Through Rate with Respect to the Controls

| | *ln(Tax Inclusive Price)* | | | |
|---|---|---|---|---|
| *Sample* | *(1)* | *(2)* | *(3)* | *(4)* |
| Post × Treat | −0.112** | −0.124*** | −0.073*** | −0.055** |
| | (0.025) | (0.018) | (0.008) | (0.014) |
| **Covariates** | | | | |
| State fixed effects | Yes | Yes | Yes | Yes |
| Year-month fixed effects | Yes | Yes | Yes | Yes |
| Household demographics | No | Yes | Yes | Yes |
| UPC fixed effects | No | No | Yes | Yes |
| State time trends | No | No | No | Yes |
| Observations | 16,170 | 16,170 | 16,170 | 16,170 |
| $R^2$ | 0.023 | 0.07 | 0.631 | 0.631 |

NOTE: Clustered standard errors in parentheses (by state). *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$. Household demographics include household size, marital status, income, and race. The dependent variable is the natural log of the tax-inclusive price. The interaction term Post × Treat equals 1 when the product was purchased in New Jersey (as opposed to the control states) after the tampon tax was repealed, and is the difference-in-differences estimator given in Equation (1). Each column represents one estimate for the set of controls indicated in the middle of the table.

We assess the potential bias in a number of ways. First, we use information on the zip code of the store where the product was purchased to investigate whether cross-border shopping in New Jersey changed after the tax change. In New Jersey, over the entire

*Figure A1:* Distribution of coupon value.




NOTE: Excludes the 2.7 percent of coupons above $5.

Table A2: Sensitivity of Tax Pass Through Rate with Respect to Cross-Border Shopping

| | *ln(Tax Inclusive Price)* | | |
|---|---|---|---|
| | *(1)* | *(2)* | *(3)* |
| Post × Treat | −0.073** | −0.078*** | −0.071*** |
| | (0.018) | (0.010) | (0.009) |
| **Covariates** | | | |
| State fixed effects | Yes | Yes | Yes |
| Year-month fixed effects | Yes | Yes | Yes |
| Household demographics | No | Yes | Yes |
| UPC fixed effects | No | No | Yes |
| Observations | 15,442 | 7,532 | 19,661 |
| $R^2$ | 0.637 | 0.631 | 0.638 |

NOTE: Clustered standard errors in parentheses (by state). *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$. Household demographics include household size, marital status, income, and race. The dependent variable is the natural log of the tax-inclusive price. The interaction term Post × Treat equals 1 if the product was purchased in New Jersey (as opposed to the control states) after the tampon tax was repealed, and is the difference-in-differences estimator given in Equation (1).

sample, only 0.55 percent of menstrual hygiene products were purchased in a different state. Before the tax change, 0.53 percent of menstrual hygiene products were purchased in another state. After the tax change, 0.60 percent of menstrual hygiene products were purchased in another state. This 0.07 percentage point increase in cross-border shopping is not statistically significant ($p < 0.36$).

Second, we restrict the sample to purchases made in the consumer's state of residence and reestimate the main specification.[50] We find no evidence that the tax pass through rates change down to the third digit, which is unsurprising because only 0.5 percent of purchases are dropped.

Third, we use data on the zip codes bordering another state and the particular state it borders and reestimate the tax pass through rate after excluding from the sample (1) consumers living in New Jersey in zip codes bordering another state, and (2) consumers living in a zip code that borders New Jersey.[51] The results are reported in Column 1 of Table A2.

Fourth, we restrict the control group to states not bordering New Jersey. In Column 2 of Table A2, we restrict the control group in the main sample of the article to the two states that do not border New Jersey (Maryland and Connecticut). In Column 3, we expand the control group by adding other surrounding states that do not border New Jersey. In particular, we added Massachusetts, Rhode Island, and North Carolina. Note that both Ohio and Virginia changed sales tax rates between 2004 and

[50]Note that we treat missing store zip codes as being purchased within New Jersey. However, if we drop missing observations from the sample, the results are very similar.

[51]These data are from the replication materials in Agarwal et al. (2017).

2006 so we do not include them as an additional control group for this robustness check.

Table A2 provides no evidence that the tax pass through rates change with these different samples in a statistical sense. In sum, we find no evidence that spillovers bias the results.