

Reservation Prices:

An Economic Analysis of Cigarette Purchases on Indian Reservations¹

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ABSTRACT

The special legal status of Indian tribes in the U.S. means that state excise taxes are not necessarily collected on cigarette purchases on Indian reservations. We focus on two understudied but basic empirical economic questions this raises. Using novel data from national and New York surveys that asked directly about cigarette prices and purchases from reservations, we first ask: What is the economic incidence of the tax break? In national data, we find evidence that the tax break is often approximately fully shifted to the consumer. However, the patterns are complex due to the variety of approaches different states have taken towards taxing reservation purchases. In data from New York over a period when the state did not attempt to collect taxes on reservation purchases, our estimates suggest that the tax break is usually fully shifted to the consumer. The notable exception is on one reservation where a tribal monopoly captures almost half of the tax break. Second, we ask: Has the tax break increased consumer demand for low-quality cigarettes relative to high-quality cigarettes? New York's cigarette tax is a fixed amount per pack, providing an opportunity to test the Alchian and Allen substitution theorem. We find some support for the prediction that the tax break increases consumer demand for lower-quality cigarettes.

1. Introduction

As ‘domestic dependent nations,’ federally recognized Indian tribes in the U.S. have limited sovereignty over their members and territory. Supreme Court decisions have established that while the individual states do not have the authority to collect taxes on cigarettes sold to tribal members on Indian reservations, they can collect state cigarette taxes on reservation sales to non-members.² Over the years, in many states cigarette sales on Indian reservations have been substantial. In its 1994 decision upholding New York’s taxation scheme, the Supreme Court cited evidence that “the volume of tax exempt cigarettes sold on New York reservations in 1987 - 1988 would, if consumed exclusively by tax immune Indians, correspond to a consumption rate 20 times higher than that of the average New York resident...” (*Department of Taxation and Finance of New York v. Milhelm Attea & Bros, Inc.* 1994). Until very recently, reservation cigarette sales continued to flourish in New York. A report for the New York State Department of Health estimates that reservation sales resulted in between \$254 million and \$329 million of lost tax revenues in 2004 (Davis *et al.* 2006). This corresponds to reservation sales of between 169 million and 219 million packs, which is around one-quarter to one-third as large as the tax-paid sales of 648 million packs that year (Orzechowski and Walker 2008).

Collecting cigarette taxes on reservation sales has repeatedly been advocated as a way to address New York’s and other states’ budget problems, but has often been strongly opposed by

²Fredericks (1989), Folster (1998) and EchoHawk (2003 - 2004) provide detailed discussion of the legal status of Indian tribes and States’ taxation authority. We follow the court cases and the federal government and use the term “Indian” to refer to descendants of the indigenous peoples of the Americas. Another term in common usage is “Native American.” Most style guides describe the terms as inter-changeable. In data from a 1995 supplement to the Current Population Survey, 50 percent of members of this ethnic/racial group prefer the term Indian, and 37 percent prefer the term Native American (Tucker, Kojetin, and Harrison, 1995).

the affected Indian tribes. The most dramatic opposition took place in 1997 in response to New York Governor Pataki's attempt to enforce the tax collection scheme ruled constitutional in the 1994 Supreme Court's *Milhelm Attea & Bros* decision. On April 20, 1997 a protest against cigarette tax collection shut down highways near reservations and resulted in 11 arrests and 12 damaged police cars, and sent a dozen New York State Troopers to the hospital (Folster 1998, pp. 707 - 708). A month later, Governor Pataki announced that the state would abandon efforts to collect cigarettes on reservations. Literally a generation after a reservation tax collection scheme was proposed by Governor Mario Cuomo in 1988, in June 2011 Governor Andrew Cuomo's administration began enforcing tax collection on New York Indian reservations (Associated Press 2011).

State taxation of cigarette sales on Indian reservations raises interesting legal questions and has implications for state revenues and public health. However, in this paper we focus on two under-studied but basic empirical economic questions raised by the unusual tax situation.

First, we ask: What is the economic incidence of the tax break given to cigarette purchases on Indian reservations? On the one hand, the strong opposition from the Indian tribes suggests that part of the tax break might be shifted back to them as monopoly profits. On the other hand, most previous empirical studies suggest that cigarette excise taxes are usually fully shifted to consumer prices. At least part of the tax break must be shifted to lower consumer prices, to induce non-residents to travel to the reservations. We analyze novel data from national and New York State surveys that asked directly about cigarette prices and purchases from Indian reservations. In Section 2 we analyze national data to get a broad picture of reservation purchases and to explore variation across states that have taken different approaches towards

taxing reservation purchases. In data from the May 2010 Tobacco Use Supplement to the Current Population Survey we find evidence that the tax break often tends to be shifted to consumers. However, we find substantial heterogeneity across states which is broadly consistent with different states' approaches towards taxing reservation sales.

We then narrow our focus in Section 3 and analyze data from the New York State Adult Tobacco Survey from 2003 - 2009. Over this period, New York did not attempt to collect taxes on reservation sales. Using ordinary least squares and instrumental variables models, we estimate that New York consumers who purchase cigarettes on Indian reservations on average pay about \$1.70 less per pack, almost exactly the average size of the New York cigarette excise tax over our study period. In a notable exception, our results suggest that the tax break is not fully shifted to consumers who purchase cigarettes on the Onondoga reservation: the tribe appears to capture a substantial portion of the tax break. Unlike other reservations where multiple, competitive vendors are the norm, on the Onondoga reservation there is a single tribal-run shop.

Second, we use the New York data to explore a prediction from the economic model of the consumer: Has the tax break increased consumer demand for low-quality cigarettes relative to high-quality cigarettes? New York's cigarette tax, like virtually all current excise taxes, is not *ad valorem* but instead is a per unit tax, i.e. a fixed amount per pack. As a result, the tax break on reservation sales sharply reduces the relative price of low-quality cigarettes compared to high-quality cigarettes. In section 4 we test the prediction that the tax break should therefore shift demand towards low-quality cigarettes. In models that treat reservation purchases as exogenous, we find that consumers who purchase their cigarettes on New York Indian

reservations are almost 20 percentage points more likely to purchase low-quality generic/ other brands, and about 15 percentage points less likely to purchase high-quality premium brands. However, based on our instrumental variables results we can not rule out the possibility that these patterns reflect unobserved heterogeneity between reservation and off-reservation purchasers, rather than the predicted substitution effect.

Our study contributes to a growing body of empirical studies that use finer-level data to study questions related to tax incidence and consumer behavior. Lacking finer-level data, many previous tax incidence studies compare prices across markets with different tax rates, observing a single price (e.g. the average price) in each market (e.g. Keeler et al. 1996, Besley and Rosen 1999, Delipalla and O'Donnell 2001, Alm, Senoga, and Skidmore 2009). A series of recent studies use finer-level data on prices across retailers (Kenkel 2005, Hanson and Sullivan 2009), store-level transactions (Chiou and Muehlegger 2010, Espinosa and Evans 2011), individual consumers (DeCicca et al forthcoming), and individual-level transactions (Harding et al 2012). With finer-level data, these studies move beyond estimating the average rate of tax shifting to explore heterogeneous responses along several dimensions. The recent empirical focus on heterogeneous responses is consistent with theoretical predictions that a range of tax shifting outcomes are possible under different market conditions (Katz and Rosen 1985, Stern 1987, Besley 1989). We explore tax shifting and its implication for consumer behavior in a novel and policy-relevant context: the shifting of a complete break on some of the highest excise taxes in place in the U.S.

2. Incidence of the Tax Break on Reservation Purchases: Evidence from National Data

Data

In this section we use national data from the May 2010 Tobacco Use Supplement (TUS) to the Current Population Survey (CPS). The TUS is sponsored by the National Cancer Institute and is administered as part of the CPS, the U.S. Census Bureau's continuing labor force survey (Hartman et al. 2002, US Department of Commerce, Census Bureau 2006). Starting in 1992 - 1993, there have been eight cycles of the TUS. The 2010 - 2011 cycle is the first to explicitly ask about cigarette purchases from Indian reservations. The May 2010 TUS provides a national sample of almost 9,000 current smokers, and representative state sub-samples.³

Overall, about five percent of current smokers in the TUS report that their last cigarette purchase was from an Indian reservation. The prevalence of reservation purchases is much higher in certain states where many reservations are located: 35 percent of smokers in Oklahoma and 24 percent of smokers in New Mexico report their last purchase was from a reservation; and between 12 to 17 percent of smokers report such purchases in Arizona, Idaho, Nevada, New York, North Dakota, South Dakota, and Washington. However, 34 States have one or more federally recognized Indian reservations within their borders (U.S. Census Bureau 1994), and in many of the other States with reservations purchases are not that common. For example, although California has the largest Indian population and the most reservations (99), less than two percent of California smokers report that their last cigarette purchase was from a

³Of the 2010 - 2011 TUS, at this time only the data from surveys completed in May 2010 are available.

reservation.⁴ Similarly, although in the past reservation sales have been a source of contention between Michigan and the Indian tribes on the 8 reservations within its borders, in 2010 only slightly more than one percent of Michigan smokers reported that their last cigarette purchase was from a reservation.

Empirical Model

The TUS also asks smokers about the price they paid the last time they purchased cigarettes. We use responses to this question as the dependent variable and estimate a tax-break incidence equation that shows the price paid by consumer i as a function of a 0-1 indicator of whether the purchase was on an Indian reservation, a vector of control variables X , and an error term:

$$(1) \quad P_i = \beta_0 + \beta_1 (\text{Indian reservation purchase})_i + \beta_2 X_i + \epsilon_i$$

The vector X includes sex, age, race/ethnicity, sex, schooling, income, marital status, and employment status; we include an indicator for whether the last purchase was by the pack or carton (10 packs) as an additional control variable. Table 1 provides the descriptive statistics for the variables included in equation (1).

Our empirical approach to study tax incidence in equation (1) is similar to Poterba (1996) and Besley and Rosen (1999). These studies estimate reduced-form equations that show the price of the taxed good as a function of the applicable tax and a vector of demand- and supply-shifters. The basic prediction to be tested is whether the estimated coefficient β_1 shows one-for-one shifting of the tax break to consumer prices. Evidence of one-for-one shifting is consistent

⁴Moreover, many California reservations are near major population centers. For example, there are 18 reservations within San Diego county.

with the competitive paradigm. Different models of imperfect competition can predict either under- or over-shifting. In this situation, as Poterba (1996, p. 168) observes, the degree of tax shifting is “primarily an empirical issue.”

Our analysis of the TUS data is limited by incomplete information about the applicable tax on Indian reservations in different states. As will be discussed in more detail below, different approaches to the taxation of reservation purchases range from no collection to full collection of the state cigarette excise tax, as well as collection rates in-between. In states that do not attempt to collect state taxes on Indian reservations, the indicator for a reservation purchase in equation (1) shows whether the relevant state cigarette tax is applicable. In these states, comparing the estimated β_1 to the state’s tax rate provides a test of whether the tax break is fully shifted. In other states, the estimated β_1 reflects both the degree of tax shifting and the (partly unknown) rate of tax collection. Finally, we note that like standard tax incidence studies our approach is descriptive: we describe how in equilibrium the price paid varies across different tax regimes. However, in our case the applicable tax regime – whether the purchase is made on- or off-reservation – is a consumer choice variable. This raises a potential endogeneity problem that we will address in the next section through the use of instrumental variables.

Results

We estimate equation (1) for the national sample and we also estimate state-specific regressions. Table 2 provides the estimates of β_1 for the national sample and for ten states where many Indian reservations are located. In the national sample, an Indian reservation purchase on average is associated with a price reduction of about \$1.08 per pack of cigarettes, or about 20 percent of the national average price paid of \$5.10 per pack. As expected because of different

state cigarette taxes, the price reduction associated with a reservation purchase varies substantially across states. Of the estimated coefficients that are statistically different from zero, a reservation purchase is associated with a price reduction that ranges from \$0.53 in Oklahoma to \$2.32 in New York.

Comparing our estimates of β_1 to the size of the state excise tax provides our first evidence on the incidence of the tax break. We find evidence that the tax break for cigarette purchases on reservations is mainly shifted to consumer prices. At the national level, the estimate of β_1 is statistically significantly smaller than the average state tax, implying that on average about 80 percent of the tax break is shifted to consumer price reductions. From the state-specific regressions estimated for Idaho, New Mexico, New York, and North Dakota the estimates of β_1 are not statistically significantly different than the relevant state excise taxes. While we can not reject the hypothesis that in these states the tax break on reservation purchases is shifted one-for-one to consumer price reductions, the point estimates correspond to rates of tax shifting ranging from 0.7 in North Dakota to 1.3 in Idaho. The estimates of β_1 for Arizona and Oklahoma suggest that reservation purchases are associated with statistically significantly price reductions, but the price reductions are also statistically significantly smaller than the corresponding state taxes and imply tax shift rates of less than one. Of the remaining state estimates, it is notable that in California and Michigan there is no evidence that reservation purchases are associated with price reductions, even though cigarette taxes are fairly high in these two states.⁵

⁵The point estimates imply that the tax break is associated with higher prices (negative tax shifting) in California and Michigan. But it should be kept in mind that the prevalence of reservation purchases is very low in these two states: there were only 8 California respondents

As noted above, the relevance of the state-specific estimates of β_1 to the incidence of the tax break depends on whether or not the state in question actually attempts to collect state taxes on purchases made on Indian reservations. Although the Supreme Court has established that states have the authority to collect taxes on purchases by non-tribal members, states have taken a variety of approaches towards taxing reservation purchases. The policy challenge is to design regulations to allow Indians to purchase cigarettes tax-free while still collecting taxes on Indian sales to non-tribal members. One common approach is to provide Indian tribes with a quota of tax-exemption coupons that allow purchases of untaxed cigarettes from wholesalers, where the quota is based on the number of tribal members.⁶ A similar approach is to refund to the tribes some portion of the state tax revenues collected on the reservations. Alternatively, tribes may agree to impose a tribal tax that is equal to the state cigarette tax. Finally, especially where there is strong tribal opposition, taxes on reservation cigarette sales to non-Indians are simply not collected.

The variety of approaches taken towards collecting state taxes on reservation purchases probably helps explain the range of results in Table 2. At one extreme, for many years including May 2010 when the TUS was administered, New York did not attempt to collect taxes on reservation purchases. At the other extreme, California and Michigan have negotiated

and 3 Michigan respondents who made reservation purchases.

⁶This approach is consistent with U.S. Supreme Court decisions about systems to tax reservation sales in Montana (*Moe v. Confederated Salish & Kootnai Tribes of the Flathead Reservation* 1976), Washington (*Washington v. Confederated Tribes of the Colville Indian Reservation* 1980), Oklahoma (*Oklahoma Tax Commission v. Citizen Band Potawatomi Tribe* 1991), and New York (*Department of Taxation and Finance of New York v. Milhelm Attea & Bros, Inc.* 1994).

arrangements that have virtually eliminated the tax break and result in full collection of state taxes on reservation purchases. In between these extremes, the compacts negotiated between Oklahoma and different Indian tribes within its borders are complicated but are generally consistent with collecting substantially less than 100 percent of the Oklahoma cigarette tax. The details of these compacts probably help explain our estimate that the price reduction associated with a reservation purchase is substantially below the full Oklahoma tax.⁷ Given the relatively high prevalence of reservation purchases in Arizona, Idaho, New Mexico, Nevada, and North and South Dakota, we speculate that taxes are often uncollected on purchases on reservations within these states. If these states collect taxes on reservation purchases at about 100 percent, our estimates in Table 2 suggest that the rate of tax shifting varies across states.

More complete analysis of the TUS data to explore why tax shifting varies across states is beyond the scope of this paper. More complete analysis poses two challenges. First, it is very difficult to measure the applicable tax rate on Indian reservations. The applicable tax rate varies not only across states, but possibly within states and over time. Across the U.S., there are 310 federally recognized reservations, containing a total of 494 federally recognized tribes, each capable of independent tax negotiations with the government of the relevant state. Footnote 7 provides details about the complex results of the negotiations in Oklahoma. Second, the

⁷Tribal vendors in Oklahoma pay different cigarette tax rates depending upon whether the tribe holds a compact with the state government or not, the date of the tribal compact, and whether they qualify for special rates because they are near the Kansas or Arkansas border. Many of the tribes have compacts that allow tribal vendors to purchase cigarettes from wholesalers and pay only 25 percent of the state tax (\$0.26); tribal vendors without a compact are required to pay 75 percent of the state tax (\$0.77); and tribes that entered into a compact after January 1, 2003 must pay a tax of \$0.86 per pack. Although it would be very difficult or impossible to determine the shares of reservation sales under different compacts, the Table 2 estimate of a \$0.53 price reduction is broadly consistent with the compacts that provide tax breaks ranging from \$0.26 to \$0.86.

complex tax negotiations also make it challenging to measure and model the relevant factors determining the extent of tax shifting, such as population density, distance to different reservations with different tax treatments, and so on. To avoid these complications, and to allow more nuanced consideration of the institutional context, for the rest of this study we focus on New York, where the state’s approach to tax collection on reservations is known and stable for many years.

3. Incidence of the Tax Break on Reservation Purchases: Evidence from New York

Background on Cigarette Sales on New York Indian Reservations

In this section we focus on the incidence of the reservation tax break in New York. There are nine New York Indian reservations with “smoke shops” that sell cigarettes to non-tribal members. Two of the reservations – the Poospatucks and the Shinnecoeks – are on Long Island. Four of the reservations – Allegany, Cattaraugus, Tonawanda and Tuscarora – are in western New York, near Buffalo. Two of the reservations – the Oneidas and the Onondogas – are in central New York, near Syracuse. The St. Regis Mohawk Tribe reservation is in the far northeast of the state and spans the border between U.S. and Canada. In addition, since 2003 members of the Cayuga Nation have operated smoke shops in Seneca Falls and Union Springs in central New York. However, the Cayuga Nation’s claims of Indian sovereignty are currently disputed because the shops are not on officially recognized reservation land.⁸

By statute, the incidence of the New York excise tax on cigarettes “shall be upon the

⁸The smoke shops are located within the area of the original reservation established by the Treaty of Canandaigua in 1794, but the Cayuga land claim is under dispute. On November 25, 2008, county law enforcement agencies raided the Cayuga smoke shops and seized more than 1.5 million untaxed cigarettes. The case is currently in the courts (State of New York Court of Appeals, 2010).

consumer” (New York Tax Law Section 471 (1)). In practice, the tax is pre-paid by wholesalers who purchase tax stamps and attach them to the cigarette packages. Until June 2011, Indian retailers were allowed to purchase unstamped cigarettes from wholesalers. The New York cigarette tax was uncollected whenever these unstamped cigarettes were sold to non-tribal members. Because the sales were not taxed or centrally recorded, the volume of cigarette sales on Indian reservations to non-tribal members is hard to know.

The tax break on reservation cigarette sales offers an opportunity to empirically study tax incidence in an unique market context. Regardless of the wording of the New York statute, a basic insight from public finance is that the behavior of buyers and sellers in markets determines the incidence of a tax (Fullerton and Metcalf 2002). Because of the unique demand and supply conditions of reservation cigarette sales, it is an open question the extent to which the incidence of the tax break on the sales is enjoyed by consumers as lower prices, or by the Indian retailers as monopoly profits.

Three sources of competition might prevent Indian retailers from earning monopoly profits from their tax advantage: competition from other retailers on the same reservation; competition from other reservations; and competition from other sources of low- and un-taxed cigarettes. Perhaps surprisingly, news reports and web searches suggest that on most reservations, multiple smoke shops compete with each other.⁹ Low entry costs and low overhead help stimulate competition. For example, anecdotal news reports describe some of the smoke shops on the Long Island Poospatuck reservation as “one-room trailers with a single sales clerk working behind a Formica counter.” (Saul 2008). The main exception to within-

⁹Unfortunately for our study, to the best of our knowledge there is no registry of establishments that sell cigarettes on Indian land.

reservation competition appears to be on the Onondagas reservation. In the early 1990s, Onondagas tribal members agreed to shut down a number of private smoke shops and replaced them with a single tribal-run shop.¹⁰ According to the Onondogas' general council Joe Heat: "On other nations... there are dozens of stores, and none of the profit goes to benefit the general welfare....We don't have ten different stores cutting their prices to compete with each other and driving the price down, so our price isn't that problematic. It's closer to the price on the off-territory." (as quoted in Cole 2009).

In addition to within-reservation competition, retailers on most reservations also face competition from smoke shops on other nearby reservations. The four reservations in western New York are all within 50 miles of each other and the city of Buffalo, the second most populous city in the state. There are two reservations on Long Island, and two in central New York, but the Poospatucks on Long Island and the Onondagas in central New York have some potential for local monopoly power because they are closer to New York City and Syracuse, respectively, than their neighboring reservations. Retailers on the geographically isolated St. Regis Mohawk Tribe reservation might seem to have the most local monopoly power, but they are also quite distant from any major city.¹¹

¹⁰Within-reservation competition can also be limited by private, illegal means. For example, federal prosecutors charged that Rodney Morrison, the owner of Peace Pipe Smoke Shop on the Poospatuck Reservation on Long Island, "orchestrated the 2003 murder of an associate who opened a competing store, robbed another rival of thousands of dollars, and set fire to the car of a third competitor." (Caruso, 2008). In 2008 Morrison was convicted for racketeering and the illegal possession of a firearm, but the racketeering conviction was vacated in April 2010 (Associated Press, 2010).

¹¹Although the St. Regis Mohawk reservation is probably not a major source of cigarette sales to New York state residents, its position on the U.S. - Canada border raises other opportunities. Because of its potential role in smuggling not only cigarettes but also illegal drugs, liquor, and illegal immigrants between U.S. and Canada, a United States Customs agent

Finally, Indian retailers in New York also face potential competition from low-taxed cigarettes from other states and Canada and from other untaxed sources such as duty-free shops and sales over the internet. Currently, purchases of cigarettes across state borders is the most common form of consumer tax avoidance (DeCicca, Kenkel and Liu 2010). While New York's cigarette tax was relatively high during our study period, so were the taxes in most of its border states and Canada.¹² New York Indian reservations face some competition from cigarettes smuggled in over longer distances from very low-tax states such as North Carolina and Virginia. For example, Chernick and Merriman (2009) find that 14 percent of littered cigarette packs in New York City have tax stamps from other states, with Virginia being the most common non-New York source. During our study period, brick-and-mortar Indian smoke shops also faced competition from mail order and internet sales. However, in TUS data over this period less than one percent of smokers report purchasing cigarettes over the internet (DeCicca, Kenkel and Liu forthcoming).

Data and Empirical Model

We use repeated cross sections from the fourth quarter of 2003 through the fourth quarter of 2009 of the New York State Adult Tobacco Survey (NYS-ATS). The NYS-ATS, conducted by the New York State Department of Health, is a random-digit dial telephone survey designed

called the St. Regis Mohawk reservation "one of the most controversial pieces of real estate" in northern New York (Zielbauer 1999).

¹²We use data from the fourth quarter of 2003 through the fourth quarter of 2009; New York's tax rate was \$1.50 per pack until June 2008, when it was increased to \$2.75 per pack. By comparison, over this time period the tax rates in its border states were: \$1.51 / \$2.00 (July 1, 2008) in Connecticut; \$1.51 / \$2.51 (July 1, 2008) in Massachusetts; \$2.05/ \$2.40 (July 1, 2004)/ \$2.575 (July 1, 2006)/ \$2.70 (July 1, 2009) in New Jersey; \$1.00/ \$1.35 (July 1, 2004) in Pennsylvania; and \$1.79/ \$2.24 (July 1, 2009) in Vermont.

to yield a representative sample of New York residents over age 18. After dropping observations with missing or invalid responses on the key variables of interest, our sample consists of 6,539 current smokers. Table 3 contains descriptive statistics for the dependent and independent variables used in the empirical models below.

To study the incidence of the tax break, we use the NYS-ATS data to estimate a version of the tax-break incidence equation (1). The variables in the NYS-ATS version of equation (1) parallel the measures used in our analysis of the national data. The dependent variable is based on smokers' responses to the NYS-ATS question about how much they paid for the last pack of cigarettes they purchased. On average, respondents report paying about \$4.50 per pack for their last purchase of cigarettes. This is very similar to the average cigarette prices reported by New York respondents to the 2003 and 2006 - 2007 Tobacco Use Supplements of the Current Population Survey (TUS-CPS) (DeCicca, et al forthcoming, Appendix table).¹³ The key explanatory variable – whether the purchase was made on a reservation – is based on smokers' responses to a series of NYS-ATS questions about their purchases of cigarettes for their own use in the past 12 months. Smokers were asked whether they made purchases from Indian reservations “all the time,” “sometimes,” “rarely,” or “never.” About 19 percent of NYS-ATS respondents report that they “always” purchase cigarettes on Indian reservations, which we use as our main measure of a reservation purchase. This is somewhat higher than the 13 percent of smokers in the New York sub-sample of the May 2010 TUS-CPS who reported that their last

¹³Both the NYS-ATS and TUS-CPS average prices are about \$1 per pack lower than the New York average cigarette price reported in the *Tax Burden on Tobacco (TBOT)*, a standard source. DeCicca, Kenkel and Liu (forthcoming) find that the *TBOT* average prices are consistently higher across all 50 states and D.C. Because the methodology for the *TBOT* price series is undocumented, DeCicca, Kenkel and Liu can only speculate about the causes of the systematic difference.

purchase was on a reservation; we speculate that some NYS-ATS respondents exaggerate when they claim to “always” purchase cigarettes on reservations.

When we estimate the NYS-ATS tax-break incidence equation, we include a vector of control variables that includes sex, age, race/ethnicity, sex, schooling, income, marital status, employment status, and car ownership. We also include indicators for regions within New York (New York - Visitors Network 2010) and a set of indicators for years (defined as starting in July of each year). The region and year indicators help control for differences in market conditions across the state and for time trends. We report robust standard errors that account for clustering within counties.

Results

Table 4 presents our NYS-ATS estimates of the impact of the tax break for reservation purchases on the price paid for cigarettes. The results suggest that the tax break is about fully shifted to consumer prices. In column 1, the ordinary least squares (OLS) estimate is that always purchasing cigarettes on a reservation is associated with a price savings of \$1.74 per pack. For most of our sample period, the New York tax was \$1.50; in June 2008, the tax increased to \$2.75. Weighting by the number of observations in our data pre- and post-2008, the average New York tax for our sample is \$1.73.¹⁴ Not surprisingly, we can not reject the hypothesis that the OLS estimate of $\beta_1 = -1.73$, consistent with one-for-one shifting of the tax break. In column 2, instead of looking at the average effect over the sample we include an

¹⁴As reported in Table 1, 13.6 percent of the observations are from NYS-ATS surveys conducted from July 2008 - June 2009 (“Year 2008”) and 4.3 percent are from NYS-ATS surveys conducted from July - December 2009 (“Year 2009”). The other 82 percent of the observations are from before the 2008 tax hike. Because we lack information on the exact month of the survey, we can not identify which observations are from June 2008, so we treat them as pre-tax hike observations.

interaction term between the indicator for a reservation purchase and an indicator for post-July 2008. For pre-July 2008 observations the estimate of $\beta_1 = -1.45$, and we can not reject the hypothesis that this equals the pre-July 2008 tax rate of \$1.50, consistent with one-for-one shifting. For post-July 2008 observations we estimate that a reservation purchase is associated with an additional \$1.50 of price savings. This estimate is statistically significantly different than the post-July 2008 tax hike of \$1.25 and implies slight over-shifting of the increase in the tax break at a rate of 1.2. We note that the estimated coefficients on the relevant year and region indicators are broadly consistent with the claims that the 2008 New York tax hike, the 2009 federal tax hike, and the New York City tax are also mainly shifted to consumer prices.¹⁵

In addition to OLS, we also estimate an instrumental variables (IV) model that treats the indicator of a reservation purchase as potentially endogenous. Unobservable heterogeneity across consumers, for example in thriftiness or the propensity to search for low prices, could bias our OLS estimate if consumers who make purchases on Indian reservations usually find lower prices on- or off-reservation. Our first stage is a linear probability model of a reservation purchase, where we use IVs based on the consumer's distance to the closest reservation.¹⁶ We use Google Maps to measure the distance from each respondent's county of residence to the zip

¹⁵In the column 1 model, the coefficient on the 2008 year indicator variable is about \$1.00 larger than the coefficient on the 2007 year indicator, consistent with about 80 percent of the \$1.25 hike in New York's tax in June 2008 being shifted to consumer prices. The coefficient on the year 2009 indicator is another \$0.54 larger, consistent with about 89 percent of the \$0.61 April 2009 federal tax hike being shifted to consumer prices. Similar comparisons of coefficients on the relevant region indicators show that prices in New York City are about \$1.12 higher than in neighboring Long Island, consistent with about 75 percent of New York City's extra \$1.50 tax being shifted to consumer prices.

¹⁶Angrist (2001) discusses the advantages of the linear probability model in this type of application.

code of the nearest Indian reservation with cigarette smoke shops.¹⁷ For NYS-ATS respondents, the average distance to a reservation is about 58 miles.¹⁸ The key identification assumption is that conditional on the other explanatory variables, distance is only related to the price paid through its effect on the probability of a reservation purchase. Because the first stage includes indicators for New York regions, the model is identified by within-region differences in distance to a reservation. The first-stage results are reported in the Appendix. As expected, longer distances significantly decrease the probability of a reservation purchase. The F-test of the joint significance of the distance variables is 17, above the standard rule of thumb that the F-statistic should be above 10 to avoid weak IV problems.

Column 3 of Table 4 presents the IV estimates of the NYS-ATS tax-break incidence equation. The IV point estimate of the effect of a reservation purchase on price paid is very close to the OLS estimate. A Hausman test fails to reject the null hypothesis that reservation purchase is econometrically exogenous. We note, however, that the untestable exclusion restriction behind the IV might not be valid. The substitution theorem implies that holding the tax break constant, higher costs of traveling to a reservation will tend to shift consumer demand towards higher-quality cigarettes. The model includes empirically important determinants of

¹⁷This includes the smoke shops operated by the Cayugas in Seneca Falls and Union Springs. We do not include the very small Oil Spring Reservation in western New York (population: 11, none Indian).

¹⁸On average, respondents who live on Long Island and in the Niagra region near Buffalo face the shortest distances to a reservation (16 and 28 miles, respectively). Respondents in the Saratoga - Capital region, the Catskills, and the Hudson Valley on average live about 100 to 150 miles away from an Indian reservation.

the demand for quality, including income and age.¹⁹ However, remaining unobserved quality differences are captured by the error term ϵ . As a result, there may be a correlation between the distance measures used as IVs and ϵ , violating the exclusion restriction.

As an alternative to the IV approach, Column 4 of Table 4 reports an OLS specification of the tax-break incidence equation that includes explicit controls for the quality of cigarette brand purchased. Questions included in the 2003 - 2007 waves of the NYS-ATS allow us to create indicators for consumers whose usual brand is a discount cigarette or a generic/other brand cigarette, with premium brands like Marlboro making up the omitted category. We discuss our measures of quality in more detail below in section 4. After controlling for quality with these measures, the estimated effect of a reservation purchase on price paid is -\$1.23, implying that the pre-2008 tax-break of \$1.50 was shifted at a rate of about 0.8. The problem with the column 4 specification is that the measures of cigarette quality could be considered endogenous outcome variables; indeed this is the approach we take in section 4.²⁰ As such, they are what Angrist and Pischke (2009, pp. 64 - 68) call “bad controls” and their inclusion gives rise to a version of selection bias. Although in principle the bias from bad controls is difficult to sign, we view the column 4 results as corroborating the IV results in column 3. Both approaches

¹⁹The models of brand choice reported below in Table 5 show that younger consumers and higher income consumers are much more likely to choose higher quality cigarettes. For example, compared to those aged 18 - 29, smokers in their 50s are 15 percentage points more likely to smoke a generic/ other brand, and 24 percentage points less likely to smoke a premium brand. There are also large differences across income groups: compared to those with household income less than \$20,000, smokers with incomes of \$50,000 - \$90,000 are 8 percentage points less likely to smoke generic/other brands, and 10 percentage points more likely to smoke premium brands.

²⁰We do not have enough IVs to treat reservation purchase and cigarette quality variables as jointly endogenous in a 2SLS model.

yield evidence that most of the tax-break is shifted to consumer prices, although perhaps at a rate less than one-for-one.

Table 4 presents results from two additional specifications that extend the OLS analysis. Column 5 presents estimates from an OLS specification that includes measures of sometimes and rarely making a reservation purchase. Consistent with the interpretation that sometimes means less than half the time, the estimated coefficient on sometimes is about one-third the size of the coefficient on always. Rarely making a reservation purchase is not significantly associated with the price respondents report paying for their last pack of cigarettes.

Column 6 of Table 4 presents estimates from an OLS specification that allows us to explore whether the incidence of the tax break varies across reservations. This specification includes a set of nine indicators for the respondents' probable reservation-of-choice for cigarette purchase.²¹ The estimated results for eight of the nine reservations are in the range of \$1.50 to \$2.00, consistent with the tax break being about fully shifted to consumer prices. The exception is that respondents presumed to have made their purchase on the Onondaga reservation are estimated to save only about \$1.00 per pack, compared to off-reservation purchases. Above we noted two relevant facts about the Onondaga reservation. First, the Onondaga reservation is located very near Syracuse, so it might not have to drop the price that much to attract a sufficient customer base. However, the western New York reservations of Allegany, Cattaraugus, Tonawanda and Tuscarora are similarly located near large customer bases, and the Table 4

²¹For example, the indicator for the Tonawanda reservation takes a value of one if the respondent reports that he or she always purchases cigarettes on a reservation and the Tonawanda reservation is the closest to the respondent's county of residence.

results show roughly full shifting of the tax break on these reservations.²² Second, in contrast to the other reservations with many competing smoke shops, the Onondaga reservation has a single tribal-run smoke shop. Although we can not rule out other explanations, our estimate that only 58 percent of the \$1.73 tax break is shifted to the consumer on the Onondaga reservation tends to suggest that their tribal monopoly, perhaps together with their locational advantage, allow them to keep some of the tax break as monopoly profits.

4. Impact of the Tax Break on Consumer Demand for Cigarette Quality

Empirical Model

In addition to providing a case study of tax (-break) incidence, we also empirically test the substitution theorem's prediction that by changing reducing the relative price of quality the tax break shifts demand to lower-quality cigarettes. To explore whether consumer demand for cigarette quality changes in response to the tax break, we use the NYS-ATS data to estimate a consumer demand function for cigarette brand quality Q :

$$(2) \quad Q_i = \delta_0 + \delta_1 (\text{Indian reservation purchase})_i + \delta_2 X_i + \zeta_i$$

The indicator for an Indian reservation purchase captures the effect of the tax break on the relative price of low- versus high-quality cigarettes.²³ We test the prediction of the substitution

²²The weste The estimate that only 58 percent of the \$1.73 tax break is shifted to the consumer in New York reservations also face potential competition from each other, which might explain why the prices are driven down despite their proximity to large population bases. To explore this, we estimated a model that allowed for the degree of tax shifting to depend on the number of nearby reservations. The results (available upon request) did not support the prediction that prices are lower on reservations that face more competition from nearby reservations. However, with only nine New York reservations we do not have too much statistical power or degrees of freedom to explore why tax shifting rates vary across reservations.

²³The tax break increased from \$1.50 per pack to \$2.75 per pack on June 3, 2008. Unfortunately, we can not exploit this additional variation. We only use data from 2003 - 2007 to estimate the models based on equation (2), because the NYS-ATS did not include the

theorem that δ_1 will be positive (negative) in the models where the dependent variable indicates a low- (high-) quality brand choice. The other explanatory variables in equation (2) are the same as in equation (1).

The prediction that the reservation tax break increases demand for low-quality cigarettes is the converse of the well-known prediction that a per unit tax shifts consumption towards higher quality goods (Barzel 1976). Barzel argues that a tax on quantity will tend to increase demand on the untaxed product attribute, quality. This prediction can also be seen an example of what has been variously termed the “Alchian and Allen substitution theorem,” the “shipping the good apples out theorem,” or even the “third law of demand” (Borcherding and Silberberg 1978, Bertonazzi, Maloney and McCormick 1993, Razzolini, Shughart and Tollison 2003, Bauman 2004). In the standard intuitive example, because per unit shipping costs decrease the relative price of high-quality apples compared to low-quality apples, a higher-proportion of high-quality apples is consumed in apple-importing areas than in apple-exporting areas: the good apples are shipped out. Conversely, the tax break on reservation sales reduces the relative price of low-quality cigarettes, so the substitution theorem predicts that cheap cigarettes will be shipped out via reservation sales to non-Indians. Although the theorem is usually traced back to Alchian and Allen’s 1964 textbook, almost three decades later Bertonazzi, Maloney and McCormick (1993) observe that “the empirical validity of the Alchian and Allen theorem rests primarily on a large volume of anecdotes and ad hoc evidence.” Most relevant to our study, Barzel (1976) and Sobel and Garrett (1997) find evidence that higher cigarette taxes lead to a relative increase in demand for high-quality cigarettes compared to discount cigarettes, although more recently Espinosa and

questions about brand choice in the 2008 and 2009 waves.

Evans (2011) do not find evidence of such a demand shift.²⁴

In sharp contrast to the prediction of the substitution theorem, public health research on “high price avoidance strategies” suggests that “many price sensitive smokers switch to discount cigarette brands when prices increase” after tax hikes (Hyland et al. 2005, see also Cummings et al. 1997, Hyland et al 2004). The intuitive argument appears to be based on the idea that consumers allocate a fixed budget towards the purchase of cigarettes and have an inelastic demand for the quantity of cigarettes smoked. The empirical evidence supporting the claim that higher taxes encourage smokers to shift to discount brands is very thin.²⁵ However, this claim in the public health research literature provides extra motivation for our empirical test of the substitution theorem’s prediction that, absent unusual income effects, the effect of taxes should be in the opposite direction.²⁶

²⁴Bertonazzi, Maloney and McCormick (1993) contribute an empirical study of the market for football tickets, and find, consistent with the substitution theorem, that the fans with high travel costs bought the best tickets. Hummels and Skiba (2004) confirm the Alchian and Allen theorem in a study of the relationship between per unit trade costs and the quality composition of trade.

²⁵The most relevant evidence is from the study by Cummings et al (1997). They use a sample of 7,081 continuing smokers who responded to surveys in 1988 and 1993. The surveys were conducted in 10 matched pairs of communities that participated in the National Cancer Institute’s Community Intervention Trial for Smoking Cessation (COMMIT). Each matched pair were from the same state, so the data are from residents of 10 states. Cummings et al. estimate a logit model of the probability of smoking a discount brand as a function of the state-average price of cigarettes in 1993, adjusted for community cost of living differences. Limitations of the analysis, including the failure to include state fixed effects and the failure to adjust standard errors for clustering, raise serious doubts about this study’s estimate that higher prices increase the probability of smoking a discount brand. The other public health studies of “high price avoidance strategies” are mainly descriptive and focus more on other behaviors, including purchases from Indian reservations, rather than on the choice of discount versus premium brands (Hyland et al 2004, 2005).

²⁶As Gould and Segall (1969) point out, with unusual income effects the standard theory of the consumer behind the Alchian and Allen substitution theorem can not rule out the

To measure brand quality, we rely on information about the brand of cigarette smoked. The cigarette market consists of higher-price premium brands like Marlboro and Camel, versus lower-price discount and deep-discount/ generic brands (Bulow and Klemperer 1998). Several New York Indian tribes produce and sell their own brands at very low prices. The NYS-ATS asked respondents about their usual brand of cigarettes; responses include about 25 specific brand names as well as “generics” and “other.” The 2008 and 2009 waves of the NYS-ATS did not include the brand choice questions, so our sample size for the section 5 models falls to 5,081. Based on the lists from Hyland *et al.* (2005), we place the usual brand into one of three categories: premium brands; discount brands; and generic/other brands. In a separate question, respondents were asked to provide the number above the UPC bar code from their cigarette package. Examining these responses confirms that the generic/other category includes the brands manufactured and sold on Indian reservations.²⁷

By these definitions of brand quality: about 71 percent of NYS-ATS respondents usually smoke premium brands; about 14 percent usually smoke discount brands; and about 15 percent usually smoke generic/other brands. The average price paid varies as expected across these categories: about \$4.70 per pack of premium brand; \$3.50 per pack of discount brand; and \$2.60 per pack of generic/ other brand.²⁸ At prevailing taxes and prices, with full shifting to the

possibility that higher taxes shift demand towards the lower-quality good, consistent with the public health researchers’ argument.

²⁷We examined UPC codes after restricting the sample to those who report always making a reservation purchase and a brand choice of “other.” For example, among the 12 digit UPC codes reported by this sub-sample, 20 percent are for the manufacturer Grand River Enterprises Six Nations Ltd., which makes the Seneca brand of cigarettes.

²⁸The market shares and price differences across market segments are consistent with data from the Euromonitor’s (2003) report on the U.S. cigarette market. The Euromonitor (2003)

consumer the reservation tax break reduces the relative price of low-quality cigarettes from about 66 percent to about 50 percent of the price of high-quality cigarettes.²⁹ This large difference in relative prices is an attractive target for an empirical study of its impact on the demand for quality; we study a much larger difference than studied in previous empirical tests.³⁰

Results

Table 5 reports our estimates of the demand for cigarette quality. In the first two columns, the dependent variable indicates whether the usual brand of cigarettes is a low-quality generic/ other brand or not. In columns 3 and 4, the dependent variable indicates whether the usual brand is a high-quality premium brand or not. For the dependent variables used in columns 1 through 4, we present results from OLS and IV linear probability models. In the IV

marketing report estimates that “standard brands” such as Marlboros account for 72 percent of the U.S. market and that discount brands account for the remaining 28 percent. The reported sales data across market segments implies that 2003 prices were about \$4.00 per pack for standard brands and \$3.00 per pack for discount brands (authors’ calculations from Euromonitor 2003). It should be kept in mind that the very low average price of generic/other brands in our data partly reflects the tax break on reservation sales. However, it is important that this segment is not defined to only include Indian-made brands that are only sold on reservations. When we restrict the sample to respondents who report never making reservation purchases, 9 percent still report a usual brand in the generic/other brand category.

²⁹One reservation’s website advertised a low-quality brand for \$13.00 per carton and Marlboros for \$27.20 per carton. So with the tax break the on-reservation price of the low-quality brand is 48 percent of the price of Marlboros. Adding the 2002 - 2008 New York tax of \$15.00 per carton to both prices, off-reservation the relative price of a carton of low-quality cigarettes increases to 66 percent of the price of a carton of Marlboros (\$28.00 compared to \$42.20).

³⁰Cigarette taxes were on average much lower in the data used by Barzel (1976) and Sobel and Garrett (1997) to test whether taxes changed the demand for cigarette quality. Using more recent data from 2001 - 2006, Espinosa and Evans (2011, p 3) argue that the size of the tax hikes in their data should help “mak[e] it easy to detect the price and quality impacts of this policy lever.” The average tax hike in their data is \$0.42 per pack, with the largest tax hike being \$0.82 per pack. By contrast, we study a tax reduction of \$1.50 per pack due to the tax break.

models, reservation purchase is treated as endogenous, using the same set of IVs used in section 4 above (based on the consumer's distance to the closest reservation). In column 5, we present estimates from an exogenous ordered probit model, where outcomes are ordered from high- to low-quality: premium brands are in the lowest category; then discount brands; then generic/other brands. The advantage of the ordered probit model is that it captures the distinctions between all three categories of cigarette brands. By contrast, to create the dichotomous dependent variables used in the linear probability models in Table 3 we have to combine the discount category (the middle category of the ordered probit model) with one of the other brand categories. The disadvantage is that our statistical software (Stata) does not include a routine to estimate an IV version of ordered probit.

The results in Table 5 support the prediction that the tax break shifts demand towards lower-quality cigarettes. The OLS results in columns 1 and 3 imply that a reservation purchase is associated with a 19 percentage point increase in the probability the consumer's usual brand is a low-quality generic/ other brand, and a 15 percentage point decrease in the probability of a high-quality premium brand. These are very large effects, compared to the sample proportions of 15 percent of smokers choosing low-quality brands and 71 percent choosing high-quality brands. The results of the ordered probit model reported in column 5 also suggest that the net impact of the tax break is to shift demand towards lower-quality brands.

In contrast, in the IV models (columns 2 and 4) the estimated effects of a reservation purchase on the demand for cigarette quality are not statistically significantly different than zero. The IV results are fairly imprecise, but results of the Hausman tests reject the null hypothesis that reservation purchase is exogenous. However, the untestable exclusion restriction behind the IV models (and the Hausman tests) might be invalid because longer distances to a reservation are

predicted to shift demand towards higher-quality cigarettes. In the column 2 model, where the dependent variable measures demand for low-quality, the distance IV might tend to be negatively correlated with the error term ζ in equation (2); and conversely for the column 4 model where the dependent variable measures demand for high quality. As a result, while the OLS results might be biased away from zero, the IV results might be biased towards zero.

To explore the potential bias in the OLS models in Table 5, we extend them to include measures of sometimes and rarely making a reservation purchase. The potential bias in the OLS models might stem from unobservable heterogeneity in brand preferences, for example if an unobserved propensity for thriftiness means that smokers who make reservation purchases are more likely to prefer low-quality cigarettes on- or off-reservation. If such heterogeneity is strongly associated with always making a reservation purchase, it seems plausible that it will be moderately associated with sometimes making a reservation purchase. Recall that the results for the analogous specification in Table 4 suggest that “sometimes” can be interpreted as “about one-third of the time.” However, in the results from the re-specified Table 5 models (not reported but available upon request), the coefficients on sometimes making a reservation purchase are small and not statistically significant. For example, sometimes is associated with only a 2.5 percentage point increase in the probability of a generic/other brand choice, compared to 19 percentage points for always. This pattern is suggestive evidence against a strong role for unobserved heterogeneity. At the same time, the pattern is consistent with a causal role of reservation purchases. We measure cigarette quality using information on the brand the consumer usually smokes. It makes sense that occasional purchases on reservations do not cause

consumers to shift to lower-quality cigarettes as their usual brand.³¹

5. Discussion

Our empirical results suggest that in many states with Indian reservations and on most Indian reservations in New York State, the economic incidence of the tax break for cigarettes is about fully shifted to consumers. Aside from tribal sovereignty, the Indians' strong support for the tax break appears to be mainly based on the value of the reservation jobs created by cigarette sales, not monopoly profits. Nationally, many Indian reservations have very weak labor markets and high rates of unemployment and poverty (Gitter and Reagan 2002, Watson 2006). Evans and Kim (2008) estimate that federal legislation in 1988 that allowed Indian tribes to open casinos increased the employment and wages of low-skilled workers. In data from the 2000 Census for New York: unemployment rates ranged from 3.6 percent to 9.5 percent on the Indian reservations, compared to 4.3 percent statewide; and the fraction of families living below the federal poverty line ranged from 8.6 percent to 35.7 percent on the reservations, compared to 11.5 percent statewide.³² Perhaps because of their casinos and cigarette sales, the economic conditions for New York Indians are not as bleak as in some other states. However, the remaining high rates of poverty make tribal support for job creation easy to understand.

Recent federal and state policy initiatives might be hitting New York Indian tribes hard. At the federal level, to combat cigarette sales over the internet the 2010 Prevent All Cigarette Trafficking (PACT) Act bans the U.S. Postal Service from delivering cigarettes. Most mail

³¹Ideally, we would like to know if consumers who usually choose higher-quality brands purchase lower-quality brands on their occasional visits to reservations, but the NYS-ATS does not provide that information.

³²Authors calculations from the U.S. Census on-line tables.

order/ internet merchants are physically located on Indian reservations (Goolsbee, Lovenheim, and Slemrod 2010). The Senecas in western New York apparently dominate the national mail-order market for cigarettes (Kirkpatrick 2010). Under pressure from the New York attorney general, in 2005 private carriers including FedEx and UPS had previously agreed not to make such deliveries. By banning U.S. Postal Services deliveries too, the Senecas protested that the PACT Act could cost 1,000 jobs in their cigarette business (Kirkpatrick 2010).

At the state level, despite further legal challenges by the Indian tribes, in June 2011 New York began enforcing the collection of the state tax on cigarettes sold by Indian-operated companies (Associated Press 2011). As noted above, in practice the New York tax is pre-paid by cigarette wholesalers who purchase tax stamps and attach them to the cigarette packages. This scheme is politically expedient because it means the tax collection can be enforced off-reservation. The tribes have responded by cutting out the middle man, thus cutting out the tax collector. Instead of purchasing name-brand cigarettes with tax stamps from wholesalers, they have expanded the manufacture of their own brands of cigarettes, with at least a dozen Indian cigarette manufacturers now in operation (Kaplan 2012). Although the state of New York asserts its right to collect taxes on Indian-made cigarettes sold to non-tribal members, according to the state tax commissioner at this point there are no plans to enforce tax collection on-reservation. The Indian tribes plan to continue manufacturing cigarettes. As the Oneida's leader Ray Halbritter puts it: "We tried poverty for 200 years. We decided to try something different." (Quoted in Kaplan, 2012).

The net impact of the recent federal and state policies on the economies of New York Indian reservations is hard to predict because it depends upon how consumers respond to the new market conditions. In the 2003 - 2007 NYS - ATS data we analyze above, although we find

some evidence that the tax break shifts demand towards lower-quality cigarettes, premium name-brand cigarettes still account for about half of reservation purchases. Now that untaxed premium cigarettes are not available on reservations, smokers may respond in several ways. Especially since the New York tax was hiked further to \$4.35 per pack in 2010, some demand may shift to untaxed Indian-made cigarettes, helping the reservation economies. Tribal monopolies on manufacturing might prevent the tax break from being fully shifted to consumers and further help the tribes capture monopoly profits. However, it is unclear whether other tribes will follow the Onondaga's lead and monopolize smoke-shop sales. The political economy of tribal decisions suggests that under the market conditions that held during our study period, on the other New York reservations the political costs of a tribal monopoly must have outweighed the potential to capture monopoly profits. Whether this continues to be the case under new market conditions remains to be seen.

If smokers do not see premium and Indian-made cigarettes as good substitutes, demand may mainly shift to taxed cigarettes off-reservation, helping New York tax revenues.³³ Or, facing a price increase of \$4.35 per pack, the smokers who previously purchased untaxed premium cigarettes on reservations might quit smoking entirely, helping public health. To quantify the magnitudes of these different responses, future work could estimate the relevant cross-price and cessation elasticities for premium and Indian-made cigarettes.

Recent Canadian experience with contraband cigarettes provides a cautionary tale for the

³³The perceived quality difference between premium and Indian-made cigarettes might partly reflect the image created by advertisements for premium brands, e.g. to be like the "Marlboro Man." To the extent image is important, Indian-made cigarettes will not be a good substitute for Marlboros. However, if the quality difference depends on the taste and other attributes under the control of manufacturers, Indian manufacturers might respond to the new market conditions by launching higher-quality Indian brands.

U.S. As discussed in more detail in Gruber et al (2003), in the 1990s extensive smuggling of cigarettes from U.S. states on the border of Canada prompted the federal government and the provinces to roll back cigarette taxes. However, over the 2000s the federal Canadian cigarette tax and provincial taxes steadily increased, and the market for untaxed contraband cigarettes rebounded (Gabler and Katz 2010). Estimates suggest that untaxed contraband cigarettes now account for 20 to 30 percent of the market (Royal Canadian Mounted Police 2008, Gabler and Katz 2010, Statistics Canada 2011). With higher taxes in many U.S. states, the largest source of contraband tobacco in Canada has become cigarettes manufactured on Indian lands in Quebec and Ontario (Royal Canadian Mounted Police 2008). The cigarettes are sold in clear baggies of 200 cigarettes (equivalent to a carton) and “come from different manufacturing operations, ranging from small ad-hoc operations to fully equipped manufacturing plants involving serious organized crime groups.” (RCMP 2008, p. 13). Although the baggies are sold in other ways, the RCMP views Indian retailers’ smoke shops as “major distributors” of contraband cigarettes. The Canadian experience suggests the possibility that reservation purchases in the U.S. could increase substantially beyond the current national prevalence of about five percent. Not only would this blunt the public health benefits of higher taxes, but it could interfere with other policy initiatives, such as the Food and Drug Administration’s proposed graphic warning labels on cigarette packages, not to mention the unintended consequence of involving organized crime in the cigarette market. Further research could shed light on the policy tradeoffs by focusing not only on consumer responses, but also on the responses of legal and illegal-suppliers on- and off-reservation.

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Table 1: Descriptive statistics of the national sample

VARIABLES	Mean
Price paid for a pack of cigarettes	5.102
Cigarette tax	1.326
Purchase by carton last time	0.247
Purchase from Indian reservation last time	0.046
Male (omitted category)	0.490
Female	0.510
Age 18-29 (omitted category)	0.199
Age 30-39	0.193
Age 40-49	0.222
Age 50-59	0.225
Age 60 +	0.161
White (omitted category)	0.774
Black	0.010
Hispanic	0.069
Other races	0.057
Less than high school (omitted category)	0.172
High school	0.398
Some college	0.312
College or higher	0.119
Family income < 20k (omitted category)	0.282
Family income 20k - 30k	0.152
Family income 30k - 50k	0.232
Family income 50k - 90k	0.258
Family income 90k +	0.077
Married (omitted category)	0.406
Divorced, widowed, or separated	0.304
Never married	0.290
Employed (omitted category)	0.597
Unemployed	0.104
Retired	0.299

N=8981. Data: Current Population Survey, May 2010, Tobacco Use Supplement

Table 2: Estimated coefficient on Indian purchase for the national sample and by state

State	Number of reservations	Purchase from Indian reservations	Coefficient on Indian purchase	Coefficient is statistically significant from zero	Coefficient is statistically significant from cigarette tax	Cigarette tax per pack (2010)	Tax shifting rate	Sample size
Arizona	23	12.70%	-1.280 (0.405)	***	+	2	0.64	77
California	99	1.76%	0.102 (0.348)		++	0.87		455
Idaho	5	13.20%	-0.754 (0.234)	***		0.57	1.32	93
Michigan	8	1.27%	0.519 (0.851)		+++	2		236
Nevada	22	13.50%	-0.225 (0.258)		++	0.8		146
New Mexico	26	24.30%	-1.027 (0.314)	***		0.91	1.13	77
New York	8	12.60%	-2.316 (0.358)	***		2.75	0.84	304
North Dakota	5	17.30%	-0.308 (0.315)			0.44		143
Oklahoma	#	34.90%	-0.527 (0.158)	***	+++	1.03	0.51	194
South Dakota	9	12.10%	-0.375 (0.316)		+++	1.53		163
Washington	27	15.00%	-0.608 (0.436)		+++	3.025		148
All		4.55%	-1.080 (0.100)	***	++	1.326	0.81	8981

Data: Current Population Survey, May 2010, Tobacco Use Supplement

#: Oklahoma has tribal lands, but technically no reservations.

Standard errors in parentheses

***: statistically significant at 1% level

+++, ++, and +: statistically significant at 1%, 5%, and 10% level

Table 3: Descriptive statistics of the New York state sample

VARIABLES	Mean
Price paid for a pack of cigarettes	4.517
Usual cigarette brand is premium	0.711
Usual cigarette brand is generics in general	0.153
Distance to nearest Indian reservation	0.577
Purchase from Indian reservation all the time	0.193
Male (omitted category)	0.407
Female	0.593
Age 18-29 (omitted category)	0.157
Age 30-39	0.176
Age 40-49	0.251
Age 50-59	0.227
Age 60 +	0.190
White (omitted category)	0.753
Black	0.125
Hispanic	0.077
Other races	0.045
Less than high school (omitted category)	0.111
High school	0.386
Some college	0.287
College or higher	0.217
Family income < 20k (omitted category)	0.184
Family income 20k - 30k	0.181
Family income 30k - 50k	0.250
Family income 50k - 90k	0.200
Family income 90k +	0.096
Family income missing	0.089
Married (omitted category)	0.361
Divorced, widowed, or separated	0.303
Never married	0.336
Employed (omitted category)	0.570
Unemployed	0.100
Retired	0.139
Not in the labor force	0.191
Family owning a car	0.850
Region - Chautauqua-Allegheny (omitted category)	0.036
Region - Niagara	0.153
Region - Finger Lakes	0.151
Region - Thousand Islands	0.039
Region - Adirondacks	0.050
Region - Central Leatherstocking	0.069
Region - Saratoga-Capital	0.063

Region - Catskills	0.028
Region - Hudson Valley	0.066
Region - New York City	0.254
Region - Long Island	0.092
Year 2003 (omitted category)	0.191
Year 2004	0.162
Year 2005	0.158
Year 2006	0.175
Year 2007	0.135
Year 2008	0.136
Year 2009	0.043

N = 6539. Data: New York State Adult Tobacco Survey 2003-2009.

Table 4: Impact of reservation purchase on price paid for cigarettes

VARIABLES	1	2	3	4	5	6
	OLS	OLS	2SLS	OLS	OLS	OLS
Purchase from Indian reservation	-1.735***	-1.446***	-1.595***	-1.234***	-1.909***	
- All the time	(0.085)	(0.085)	(0.608)	(0.079)	(0.087)	
Interaction of Indian purchase and time after July 2008		-1.497***				
		(0.121)				
Usual brand of cigarettes:				-0.688***		
- discount brands				(0.058)		
Usual brand of cigarettes:				-1.172***		
- generic/other brands				(0.079)		
Purchase from Indian reservation					-0.627***	
- Sometimes					(0.082)	
Purchase from Indian reservation					-0.040	
- Rarely					(0.106)	
Purchase from Indian reservation						-2.158***
- Tonawanda						(0.055)
Purchase from Indian reservation						-1.538***
- Cattaraugus						(0.134)
Purchase from Indian reservation						-1.863***
- Allegany						(0.237)
Purchase from Indian reservation						-1.736***
- Cayuga						(0.126)
Purchase from Indian reservation						-0.991***
- Onondaga						(0.181)
Purchase from Indian reservation						-1.562***
- Oneida						(0.140)
Purchase from Indian reservation						-1.933***
- St. Regis Mohawk						(0.096)
Purchase from Indian reservation						-1.745***
- Tuscarora						(0.085)
Purchase from Indian reservation						-2.040***
- Poospatuck / Shinnecock						(0.127)
Female	-0.031	-0.040	-0.034	-0.040	-0.031	-0.028
	(0.037)	(0.037)	(0.041)	(0.044)	(0.036)	(0.037)
Age 30-39	-0.307***	-0.311***	-0.312***	-0.232***	-0.292***	-0.312***
	(0.069)	(0.068)	(0.070)	(0.069)	(0.069)	(0.069)
Age 40-49	-0.570***	-0.584***	-0.579***	-0.440***	-0.557***	-0.570***
	(0.079)	(0.079)	(0.086)	(0.093)	(0.078)	(0.079)
Age 50-59	-0.691***	-0.698***	-0.702***	-0.451***	-0.672***	-0.694***
	(0.069)	(0.069)	(0.080)	(0.091)	(0.069)	(0.067)
Age 60 +	-0.767***	-0.770***	-0.784***	-0.496***	-0.740***	-0.774***

	(0.096)	(0.101)	(0.132)	(0.126)	(0.094)	(0.093)
Black	0.655***	0.636***	0.672***	0.463***	0.621***	0.645***
	(0.080)	(0.078)	(0.115)	(0.078)	(0.083)	(0.081)
Hispanic	0.379***	0.358***	0.391***	0.239***	0.345***	0.365***
	(0.054)	(0.053)	(0.077)	(0.046)	(0.055)	(0.053)
Other races	0.082	0.078	0.081	-0.038	0.068	0.084
	(0.103)	(0.096)	(0.100)	(0.096)	(0.104)	(0.104)
High school	-0.034	-0.042	-0.034	-0.049	-0.030	-0.034
	(0.056)	(0.054)	(0.056)	(0.056)	(0.055)	(0.054)
Some college	0.060	0.061	0.064	0.030	0.050	0.057
	(0.054)	(0.051)	(0.055)	(0.048)	(0.052)	(0.053)
College or higher	0.116*	0.118*	0.121*	0.068	0.108*	0.110*
	(0.063)	(0.060)	(0.063)	(0.045)	(0.060)	(0.061)
Family income 20k - 30k	0.134*	0.137**	0.136*	0.069	0.144**	0.141**
	(0.070)	(0.067)	(0.071)	(0.060)	(0.069)	(0.068)
Family income 30k - 50k	0.171***	0.164***	0.174***	0.130**	0.170***	0.162***
	(0.054)	(0.051)	(0.057)	(0.058)	(0.054)	(0.052)
Family income 50k - 90k	0.210***	0.204***	0.213***	0.089	0.225***	0.200**
	(0.078)	(0.076)	(0.081)	(0.087)	(0.078)	(0.076)
Family income 90k +	0.336***	0.333***	0.344***	0.257**	0.335***	0.333***
	(0.098)	(0.092)	(0.109)	(0.116)	(0.096)	(0.096)
Family income missing	0.065	0.068	0.066	0.015	0.057	0.060
	(0.062)	(0.060)	(0.061)	(0.063)	(0.062)	(0.061)
Divorced, widowed, or separated	0.087*	0.086	0.087*	0.057	0.097*	0.092*
	(0.051)	(0.053)	(0.051)	(0.044)	(0.051)	(0.051)
Never married	0.078	0.086*	0.077	0.056	0.091*	0.081
	(0.051)	(0.049)	(0.051)	(0.053)	(0.050)	(0.051)
Unemployed	0.055	0.048	0.055	0.071	0.080	0.048
	(0.073)	(0.073)	(0.072)	(0.070)	(0.070)	(0.073)
Retired	-0.132	-0.125	-0.138*	-0.043	-0.131	-0.134
	(0.084)	(0.084)	(0.083)	(0.092)	(0.083)	(0.083)
Not in the labor force	-0.060	-0.065	-0.066	-0.019	-0.050	-0.056
	(0.049)	(0.050)	(0.053)	(0.056)	(0.048)	(0.049)
Family owning a car	-0.090*	-0.086*	-0.095*	-0.113*	-0.083*	-0.092*
	(0.049)	(0.050)	(0.050)	(0.061)	(0.047)	(0.050)
Region - Niagara	0.148	0.124	0.160	0.094	0.135	0.140
	(0.164)	(0.138)	(0.164)	(0.112)	(0.159)	(0.199)
Region - Finger Lakes	0.444**	0.426***	0.493**	0.395**	0.363**	0.448*
	(0.177)	(0.156)	(0.250)	(0.149)	(0.173)	(0.236)
Region - Thousand Islands	0.173	0.170	0.225	0.356***	0.076	0.194
	(0.176)	(0.149)	(0.256)	(0.131)	(0.173)	(0.232)
Region - Adirondacks	0.502***	0.470***	0.545**	0.496***	0.380**	0.548**

	(0.173)	(0.147)	(0.231)	(0.134)	(0.163)	(0.232)
Region - Central Leatherstocking	0.566***	0.570***	0.622**	0.588***	0.464***	0.540**
	(0.162)	(0.137)	(0.261)	(0.128)	(0.158)	(0.227)
Region - Saratoga-Capital	0.722***	0.710***	0.796**	0.665***	0.545***	0.735***
	(0.171)	(0.148)	(0.328)	(0.136)	(0.163)	(0.228)
Region - Catskills	0.724***	0.697***	0.798**	0.764***	0.544***	0.737***
	(0.198)	(0.179)	(0.347)	(0.146)	(0.196)	(0.251)
Region - Hudson Valley	1.077***	1.078***	1.147***	0.847***	0.885***	1.113***
	(0.180)	(0.159)	(0.323)	(0.145)	(0.178)	(0.240)
Region - New York City	2.154***	2.143***	2.220***	1.926***	1.971***	2.193***
	(0.177)	(0.153)	(0.310)	(0.144)	(0.169)	(0.232)
Region - Long Island	1.032***	1.040***	1.096***	0.805***	0.882***	1.090***
	(0.179)	(0.157)	(0.295)	(0.150)	(0.167)	(0.236)
Year 2004	0.007	0.014	0.014	-0.003	-0.014	0.006
	(0.053)	(0.053)	(0.057)	(0.043)	(0.052)	(0.053)
Year 2005	0.301***	0.290***	0.300***	0.254***	0.300***	0.301***
	(0.048)	(0.048)	(0.048)	(0.043)	(0.048)	(0.049)
Year 2006	0.354***	0.341***	0.358***	0.324***	0.344***	0.353***
	(0.046)	(0.045)	(0.050)	(0.041)	(0.048)	(0.044)
Year 2007	0.555***	0.561***	0.559***	0.452***	0.538***	0.556***
	(0.049)	(0.049)	(0.053)	(0.045)	(0.051)	(0.048)
Year 2008	1.540***	1.845***	1.540***		1.535***	1.537***
	(0.121)	(0.096)	(0.121)		(0.122)	(0.121)
Year 2009	2.083***	2.407***	2.083***		2.094***	2.093***
	(0.103)	(0.106)	(0.101)		(0.106)	(0.105)
F-statistic for IV			17.12			
R-squared	0.508	0.520	0.507	0.511	0.516	0.511

N = 6539 (N = 5081 for Column 4)

Robust standard errors (clustered at county level) in parentheses

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

For 2SLS, the Hausman test result suggests we cannot reject the null hypothesis that purchase from Indian reservation is exogenous.

Table 5: Impact of reservation purchase on quality of cigarettes purchased

VARIABLES	1	2	3	4	5
	OLS	2SLS	OLS	2SLS	Ordered probit
Purchase from Indian reservation - All the time	0.196*** (0.018)	-0.111 (0.152)	-0.146*** (0.018)	0.313 (0.195)	0.517*** (0.049)
Female	0.004 (0.011)	0.013 (0.013)	-0.008 (0.015)	-0.021 (0.018)	0.016 (0.050)
Age 30-39	0.046*** (0.014)	0.059*** (0.016)	-0.083*** (0.019)	-0.102*** (0.023)	0.372*** (0.082)
Age 40-49	0.070*** (0.016)	0.092*** (0.021)	-0.145*** (0.023)	-0.179*** (0.031)	0.570*** (0.077)
Age 50-59	0.149*** (0.019)	0.176*** (0.025)	-0.241*** (0.029)	-0.282*** (0.037)	0.892*** (0.076)
Age 60 +	0.161*** (0.023)	0.201*** (0.030)	-0.275*** (0.029)	-0.335*** (0.043)	0.952*** (0.088)
Black	-0.074*** (0.020)	-0.108*** (0.031)	0.133*** (0.027)	0.184*** (0.042)	-0.533*** (0.105)
Hispanic	-0.041*** (0.015)	-0.062*** (0.019)	0.081*** (0.022)	0.112*** (0.027)	-0.356*** (0.110)
Other races	-0.015 (0.026)	-0.008 (0.025)	0.061* (0.034)	0.051 (0.032)	-0.148 (0.125)
High school	0.026 (0.016)	0.024 (0.017)	-0.047** (0.020)	-0.044* (0.022)	0.154** (0.067)
Some college	0.008 (0.020)	-0.006 (0.023)	-0.010 (0.024)	0.010 (0.029)	0.052 (0.081)
College or higher	0.012 (0.022)	-0.003 (0.026)	-0.020 (0.031)	0.002 (0.036)	0.105 (0.107)
Family income 20k - 30k	-0.024 (0.020)	-0.028 (0.021)	0.021 (0.018)	0.027 (0.021)	-0.070 (0.060)
Family income 30k - 50k	-0.047** (0.021)	-0.052** (0.023)	0.050** (0.020)	0.056** (0.023)	-0.157** (0.067)
Family income 50k - 90k	-0.078*** (0.021)	-0.081*** (0.023)	0.096*** (0.026)	0.101*** (0.026)	-0.337*** (0.078)
Family income 90k +	-0.071** (0.029)	-0.085*** (0.031)	0.116*** (0.029)	0.137*** (0.032)	-0.401*** (0.110)
Family income missing	-0.049** (0.018)	-0.051** (0.020)	0.054** (0.027)	0.057** (0.027)	-0.203*** (0.076)
Divorced, widowed, or separated	-0.004 (0.012)	-0.003 (0.013)	-0.003 (0.014)	-0.003 (0.016)	-0.012 (0.046)
Never married	-0.014 (0.014)	-0.013 (0.014)	0.023 (0.014)	0.021 (0.014)	-0.103** (0.050)

Unemployed	0.001	-0.000	0.005	0.007	-0.028
	(0.015)	(0.015)	(0.016)	(0.016)	(0.061)
Retired	0.016	0.024	-0.031	-0.043*	0.095*
	(0.018)	(0.021)	(0.021)	(0.023)	(0.054)
Not in the labor force	0.046***	0.057***	-0.048***	-0.065***	0.166***
	(0.013)	(0.015)	(0.014)	(0.016)	(0.046)
Family owning a car	-0.033**	-0.022	0.034*	0.018	-0.189***
	(0.015)	(0.018)	(0.020)	(0.024)	(0.073)
F-statistic for IV		12.27		12.27	

N = 5081. Brand choice questions are not available in 2008 and 2009.

Robust standard errors (clustered at county level) are in parentheses.

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

For 2SLS, the Hausman test result suggests we can reject the null hypothesis that purchase from Indian reservation is exogenous.

For ordered probit, the estimated cut-off values are 0.70 and 1.26.