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RESERVATION PRICES:
AN ECONOMIC ANALYSIS OF CIGARETTE PURCHASES ON INDIAN RESERVATIONS

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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 under-studied but basic empirical economic questions this raises. Using novel data from 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 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.

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## I.    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 a few years ago, 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 it has often been strongly opposed by

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[2]Fredericks (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, 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 cigarette taxes on reservations. Literally a generation after Governor Mario Cuomo proposed in 1988 to collect taxes on reservation sales, 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. 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? We do not know of any previous studies of the incidence of this tax break, and the degree of tax shifting is difficult to predict *a priori*. 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 fully shifted or even over-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. To estimate the incidence of the tax break we analyze data from the New York State Adult Tobacco Survey (NYS-ATS) from 2003 – 2009. The NYS-ATS asked smokers directly about cigarette prices and their purchases from Indian reservations. Section II provides more background on

cigarette markets on New York Indian reservations. Section III reports results from ordinary least squares estimates of a tax-break incidence equation. We estimate that New York consumers who purchase cigarettes on Indian reservations on average pay about $1.73 less per pack, exactly the average size of the New York cigarette excise tax over our study period. To address the possible endogeneity of a reservation purchase, in section IV we propose and provide support for the use of an instrumental variable approach based on the consumer's distance to a reservation. The instrumental variable results reported in section IV are similar to the OLS results and suggest that the tax break is fully shifted to lower consumer prices.

In section V we extend the specification to test the prediction that the incidence of the tax break varies depending upon within-reservation market structure. Our OLS and instrumental variable results suggest that the tax break is not fully shifted to consumers who purchase cigarettes on the Onondaga 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 Onondaga reservation there is a single tribal-run monopoly.

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 VI 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 are about 15

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percentage points less likely to purchase high-quality premium brands. However, based on our instrumental variable results we cannot 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 2013a), 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 is 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 policy-relevant context with several novel features. First, previous research necessarily studies the shifting of tax hikes because they have been much more common. In contrast, we study the shifting of a complete break on some of the highest excise taxes in place in the U.S. Second, we exploit an unusual set of market conditions: for the same good during the same time period in the same state we can identify competitive and monopolized local markets on reservations.

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## II.    BACKGROUND ON CIGARETTE MARKETS ON NEW YORK INDIAN RESERVATIONS

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 Shinnecocks – 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 Onondagas – 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.[3]

By statute, the incidence of the New York excise tax on cigarettes "shall be upon the 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, there are no official data on the volume of cigarette sales on New York Indian reservations to non-tribal members.

The tax break on reservation cigarette sales offers an opportunity to empirically study tax incidence in a unique market context. Regardless of the wording of the New York statute, a basic

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[3]The 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.

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 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. The OLS and instrumental variable models we use next in sections III and IV provide estimates of the incidence of the tax break on average across the nine New York reservations. In section V we extend our analysis to reflect differences in within-reservation market competition.

Within-reservation competition is the most direct, but Indian retailers face several other sources of potential competition. Retailers on most reservations face competition from smoke shops on other nearby reservations. 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, aside from reservation purchases, purchasing cigarettes across state borders is the most common form of consumer tax avoidance (DeCicca, et al 2013b). 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.[4] 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. During our study period, brick-and-mortar Indian smoke shops also faced competition from mail order and internet sales. However, in national data over this period less than one percent of smokers report purchasing cigarettes over the internet

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[4]We 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.

(DeCicca et al 2013b).[5]

## III. INCIDENCE OF THE TAX BREAK ON INDIAN RESERVATIONS: OLS MODELS

### A. 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 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 1 contains descriptive statistics for the dependent and independent variables used in the empirical models below.

We use the NYS-ATS data to 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) $\qquad P_i = \beta_0 + \beta_1 \text{ (Indian reservation purchase)}_i + \beta_2 X_i + \varepsilon_i$

The vector $X$ 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), county population quintile, and a set of indicators for years (defined as starting in July of each year). The region, county population quintile and year indicators help

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[5] The low prevalence of internet purchases might seem surprising, and could reflect survey respondents' reluctance to report actions of questionable legality. Goolsbee, Lovenheim, and Slemrod (2010) point out that there is very little systematic evidence about the volume of internet cigarette sales. The Senecas in western New York apparently dominated national sales of cigarettes over the internet. Under pressure from the New York attorney general, in 2005 private carries including FedEx and UPS agreed to stop delivering cigarettes. The 2010 Prevent All Cigarette Trafficking (PACT) Act bans the U.S. Postal Service from delivering cigarettes.

control for differences in market conditions across the state and for time trends. We estimate equation (1) by OLS and report heteroskedasticity-robust standard errors that account for clustering within counties.

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 $\beta_1$ shows one-for-one shifting of the tax break to consumer prices. Evidence of one-for-one shifting is consistent with the competitive paradigm. Different models of imperfect competition can predict either under- or over-shifting, depending upon demand elasticities, the degree of market power, and firms' strategic behavior. For example, some models of imperfect competition predict that firms will raise the price by more than the tax (over-shift) to compensate for the revenue loss from decreased demand. Given the variety of theoretically possible outcomes, as Poterba (1996, p. 168) observes, the degree of tax shifting is "primarily an empirical issue."

The dependent variable in equation (1) is based on smokers' responses to the NYS-ATS question about how much they paid for the last pack of cigarettes they purchased. Most smokers make fairly frequent cigarette purchases, so self-reported data on their most recent purchases seem likely to be reasonably accurate. Many previous studies use data on cigarette prices from the Tax Burden on Tobacco (TBOT) published by Orzechowski & Walker (2008). A number of recent economic and public health studies use self-reported data on cigarette prices from the Tobacco Use Supplements to the Current Population Survey (TUS-CPS).[6] A report on alternative measures of

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[6] Recent studies that use the TUS-CPS price data include Pesko et al (2012, 2013), Vijayaraghavan et al (2013) and DeCicca, Kenkel and Liu (2013a, 2013b).

cigarette price data concludes: "The comparisons of the TUS-CPS and TBOT price measures provided in this report suggest that self-reported price data collected in population surveys can be used to construct valid measures of cigarette prices that capture the prices smokers actually face in the market ...." (Chaloupka et al 2013). Because the NYS-ATS used the same question about cigarette prices as in the TUS-CPS, this conclusion supports the accuracy of the measure we use. Scanner data on actual prices paid for cigarettes could be more accurate, but these data are just becoming available and might not include purchases on reservations. Finally, we note classical measurement error in the dependent variable will not lead to bias in our estimates of the parameters of equation (1).

On average, NYS-ATS 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 TUS-CPS (DeCicca, et al 2013a, Appendix table).

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 indicator of a reservation purchase.[7] 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 purchase was on a reservation. We speculate that some NYS-ATS respondents exaggerate when

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[7] In an alternative specification (not reported but available upon request) we include additional indicators for whether the respondent reports "sometimes" or "rarely" making a reservation purchase. The estimated coefficient on "sometimes" is about one-third the size of the coefficient on "always." "Rarely" making a reservation purchase is not statistically or practically significantly associated with the price respondents report paying for their last pack of cigarettes.

they claim to "always" purchase cigarettes on reservations. For our analysis the key issue is how respondents' reports of reservation purchases match their reports of the prices they paid. If respondents who exaggerate their reservation purchases also tend to report the price paid on the reservation, exaggeration does not necessarily create misclassification error in our indicator of a reservation purchase.[8] The possibility of misclassification suggests our estimate of $\beta_1$ might be biased towards zero (attenuation bias), as long as the error is classical.

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 through the use of instrumental variables in the analysis below in section IV.

### B. OLS Results

Table 2 presents our OLS 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

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[8]For example, the same respondent who reports in error that he "always" purchases his cigarettes on reservations because he overlooks his occasional last-minute purchases at convenience stores might also overlook those purchases when he reports the price he paid for his last pack. Because cigarette packs purchased on reservations did not have tax stamps, the study by Chernick and Merriman (2013) of cigarette packs thrown away on the street as litter provides another source of evidence on the prevalence of reservation purchases. In data collected in May 2008 the share of littered packs in New York City with no tax stamp was 15 percent. In the sub-sample of NYS-ATS respondents from New York City, about 4.5 percent of smokers report that they always purchase cigarettes from reservations. Chernick and Merriman (2013, p. 646) note that there are other sources of unstamped littered packs including Internet purchases and purchases from organized smugglers. In addition, the prevalence of reservation purchases among litterers is not necessarily representative of the prevalence among all smokers. Taking these factors into account, the two prevalence estimates are broadly consistent and do not suggest exaggeration in the NYS-ATS measure.

cigarettes on a reservation is associated with a price savings of $1.73 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.[9] The OLS estimate in column 1 is thus consistent with one-for-one shifting of the tax break on average. In column 2, instead of looking at the average effect over the sample we include an interaction term between the indicator for a reservation purchase and an indicator for post-July 2008. For pre-July 2008 observations the estimate of $\beta_1$ is - 1.44, and we cannot 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.[10]

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[9]As 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 cannot identify which observations are from June 2008, so we treat them as pre-tax hike observations.

[10]The coefficient on the 2008 year indicator variable is about $1.00 larger than the coefficient on the 2007 year indicator (not reported but available upon request). This is 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 show that prices in New York City are about $1.07 higher than in neighboring Long Island, consistent with about 71 percent of New York City's extra $1.50 tax being shifted to consumer prices.

## IV.    INSTRUMENTAL VARIABLE MODEL

### A.  Identification Strategy

In addition to OLS, we also estimate equation (1) using an instrumental variable (IV) to treat 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 of $\beta_1$ 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 an IV based on the consumer's distance to the closest reservation.[11] We use Google Maps to measure the distance from each respondent's county of residence to the zip code of the nearest Indian reservation with cigarette smoke shops.[12] For NYS-ATS respondents, the average distance to a reservation is about 58 miles.[13]

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. There are solid conceptual grounds for the claim that a consumer's distance to the closest Indian reservation is econometrically exogenous and creates a useful quasi-experiment. The locations of reservations within New York are not the result of profit-maximizing choices of suppliers, but instead trace back to the histories of the Indian tribes and their negotiations with the

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

[12]This 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).

[13]On average, respondents who live on Long Island and in the Niagara 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.

U.S. government. On the consumer's side, residential location choices are driven by factors such as employment opportunities, housing prices, school quality, crime rates, and other local public goods. Because the first stage includes indicators for New York regions, the model is identified by within-region differences in distance to a reservation. Our empirical model also includes measures of county-population to help control for general cost-of-living differences that might influence location choices. Conditional on these and the other control variables in our model, it seems unlikely that there is problematic unobservable heterogeneity in a factor such as consumer thriftiness that might invalidate the IV. That is, the availability of low-price cigarettes is unlikely to drive consumer residential location decisions. Our IV approach rests on the argument that location decisions driven by other forces create useful and valid quasi-experimental variation in cigarette consumers' distance to a reservation. This argument parallels the justification for similar IVs based on distance in a well-cited labor economics study of the effects of schooling (Card 1995) and a well-cited health economics study of the effects of heart surgery (McClellan et al 1994).[14]

To explore the validity of the distance IV, we undertake three empirical analyses (detailed results are available upon request). First, we follow standard practice and explore whether the distance IV appears to be random in terms of observable consumer characteristics. The logic is that the extent of randomness in observed characteristics is suggestive evidence about instrument exogeneity. Although we find a few more statistically significant differences than would be expected by chance, the pattern of results does not point to a common source of problematic heterogeneity. Second, we conduct an auxiliary analysis of data from the Simmons National Consumer Survey that include measures of consumer thriftiness – a potential source of

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[14] In a recent review article about the IV approach, Imbens (2014, p. 11 and p.38) uses distance as an example of an IV that is plausibly exogenous, at least after conditioning on other covariates.

problematic heterogeneity which is unobserved in the NYS-ATS data. We do not find any

evidence that the types of consumers who live near reservations are the same types of consumers

who report thrifty attitudes or behaviors in the consumer survey. Third, we use scanner price data

from yet another data set -- the Nielsen Consumer Panel Data -- to conduct falsification tests of our

IV. Here the logic is that if there is problematic heterogeneity in consumer thriftiness or market

conditions, we would find that distance predicts lower consumer prices paid in general, not just

lower cigarette prices. We do not find any evidence that the prices paid for other frequently

purchased items – bread, eggs, and milk – are systematically lower for consumers who live near

reservations. Although the exclusion restriction required for the IV is untestable, the conceptual

arguments and additional empirical analyses help rule out important threats to exogeneity and

support the claim that distance provides valid quasi-experimental variation for identification.

### B. Instrumental Variables Model: Results

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 2 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 -$1.85, very

close to the OLS estimate of -$1.73. A Hausman test fails to reject the null hypothesis that

reservation purchase is econometrically exogenous.

Although the conceptual arguments and auxiliary empirical analyses discussed above help

rule out important threats to the validity of our IV, we note that a more subtle problem might

remain. 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 the demand for quality, including

income and age.[15] However, remaining unobserved quality differences are captured by the error

term $\varepsilon$. As a result, there may be a correlation between the distance measures used as IVs and $\varepsilon$,

violating the exclusion restriction.

To address this, as an alternative to the IV approach column 4 of Table 2 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 VI.   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.[16] 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

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[15]The 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.

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

column 4 results as corroborating the IV results in column 3. Both approaches yield evidence that most of the tax-break is shifted to consumer prices, although perhaps at a rate less than one-for-one.

## V.   TAX INCIDENCE IN COMPETITIVE AND MONOPOLIZED RESERVATION CIGARETTE MARKETS

### A. Competition in Reservation Cigarette Markets

We use a combination of data on retail establishments, anecdotal evidence and the results of industrial organization research to describe the degree of competition in local cigarette markets on New York Indian reservations. We use a standard commercial source of data on retail establishments: the National Establishment Time-Series (NETS) database, a joint venture by Walls & Associates and Dun and Bradstreet. The NETS data provide the SIC code, location, and establishment and headquarters name. We identify establishments with an SIC code for "tobacco store or stand" that were located in the same zip code as an Indian reservation.[17] Using the year 2005 to illustrate, in the NETS data there are 72 establishments identified as tobacco stores and located in the same zip codes as Indian reservations. The zip codes with Indian reservations had 1.25 tobacco stores per 1,000 population, which is over five times the average in other New York zip codes. Over our study period of 2003 – 2009, across the New York zip codes that include Indian reservations the average number of tobacco stores ranged from four to almost 30. Based on the establishment and headquarter names in the NETS data, the vast majority of the Indian

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[17] To the best of our knowledge there is no registry of establishments that sell cigarettes on Indian land. We took additional steps to verify that establishments in the NETS data are tobacco stores on Indian reservations. We reviewed establishment names that might indicate Indian ownership, such as "Big Indian Smoke Shop" and "Seneca Smoke Shop." We used geographic information software to determine whether the establishment's latitude and longitude (in the NETS data) corresponds to an Indian reservation. For those locations with a Google Earth street view, we visually confirmed the presence of a tobacco store.

reservation tobacco stores are stand-alone businesses, not parts of chains. Although we could not

verify all of the establishments, we note that there might be additional tobacco stores that are not

included in the NETS data, as well as establishments in other SIC codes (e.g. convenience stores)

that might sell cigarettes. We further note anecdotal evidence that low entry costs and low

overhead help stimulate competition. For example, 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).

Industrial organization research into other markets suggests that the number of tobacco

stores on most reservations is probably sufficient to result in substantial competition. Bresnahan

and Reiss (1991) analyze data on the number of firms in five retail and professional service

industries: doctors, dentists, druggists, plumbers, and tire detailers. Although there are differences,

the markets Bresnahan and Reiss study share some similarities with reservation cigarette markets:

they intentionally limit their study to narrowly defined products and services; and they focus on

geographically isolated local markets. Their empirical results suggest that the competitive effects

of the entry occur rapidly, with most of the increase in competition coming with the entry of the

second and third firms. Berry and Reiss (2007) review the results of this line of industrial

organization research. Assuming these results broadly carry over to cigarette markets, the NETS

data showing that the number of tobacco stores on Indian reservations ranges from four to almost

30 suggest there is substantial within-reservation market competition.

The main exception to within-reservation competition is the Onondaga reservation. In the

early 1990s, Onondaga tribal members agreed to shut down a number of private smoke shops and

replaced them with a single tribal-run shop.[18] According to the Onondagas' 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).

The contrast between substantially competitive markets on most reservations versus the monopolized Onondaga market provides a unique opportunity to examine the impact of market structure on tax incidence. The standard textbook result is that: in competitive markets with constant marginal cost taxes will be shifted one-for-one to consumer prices; while in a monopolized market with linear costs and linear demand curve exactly half the tax will be shifted to consumer prices (Fullerton and Metcalf 2002). The Onondaga market does not fit the textbook example perfectly because they only have a local monopoly and might face competition from other Indian reservations. However, only the Onedia reservation is within 100 miles of the Onondaga reservation (the other reservations are from 123 miles to 311 miles away). The distance from the Onondaga reservation to Syracuse (the largest city in central New York) is one-third the distance from the Oneida reservation to Syracuse (11 miles versus 33 miles). On the assumptions that the Onondagas have some local monopoly power and face approximately linear costs and demand, the textbook results about shifting half of the tax break provides a benchmark prediction to be tested.

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[18]Within-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).

### B. Results

Column 5 of Table 2 presents estimates from an OLS specification that allows us to test the prediction that the incidence of the tax break varies depending upon within-reservation market structure. The specification includes two indicator variables for whether the respondent's probable reservation-of-choice for cigarette purchase was on one of the eight reservations with substantially competitive markets or on the Onondaga reservation's monopoly market.[19] The estimated effect of a purchase on one of the substantially competitive reservation markets is to reduce the price paid by $1.78, consistent with the tax break being about fully shifted to consumer prices. Respondents presumed to have made their purchase on the monopolized Onondaga reservation are estimated to save only about $1.04 per pack, compared to off-reservation purchases.

Column 6 of Table 2 presents IV estimates of the column 5 specification. The IVs are the consumer's distance from a reservation (discussed in detail above in section IV) and its interaction with the indicators for reservation-of-purchase. The estimated coefficients are somewhat larger than the OLS estimates: a purchase on a substantially competitive reservation reduces the price paid by $1.99, while a purchase on the monopolized reservation reduces the price paid by $1.40. The results of a Hausman test fail to reject exogeneity. Although the IV results suggest slightly greater than one-for-one shifting of the tax break on the competitive reservations, tax shifting on the monopolized Onondaga reservation is estimated at less than one-for-one.

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

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[19]For 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.

a sufficient customer base. However, the western New York reservations of Allegany, Cattaraugus, Tonawanda and Tuscarora are similarly located near large customer bases, and additional results (not reported but available upon request) show roughly full shifting of the tax break on these reservations.[20] Second, in contrast to the other reservations with many competing smoke shops, the Onondaga reservation has a single tribal-run smoke shop. Although we cannot rule out other explanations, our estimate that between 60 percent (OLS) and 81 percent (IV) 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.

## VI. IMPACT OF THE TAX BREAK ON CONSUMER DEMAND FOR CIGARETTE QUALITY

### A. 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 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:

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[20]The additional results are from an alternative specification that includes a set of nine separate indicators for each reservation. The western 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.

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

The indicator for an Indian reservation purchase captures the effect of the tax break on the relative

price of low- versus high-quality cigarettes.[21] We test the prediction of the substitution theorem

that $\delta_1$ 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 as 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). 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

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[21]The 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 questions
about brand choice in the 2008 and 2009 waves.

theorem rests primarily on a large volume of anecdotes and ad hoc evidence." Econometric studies by Nesbit (2006) and Lawson and Raymer (2006) reach opposite conclusions about whether consumer behavior in the gasoline market supports the substitution theorem's prediction. 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 Evans (2011) do not find evidence of such a demand shift.[22]

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. 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.[23] 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

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[22]Bertonazzi, 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.

[23]The 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 was 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.

in the opposite direction.[24]

## B. Data on Brand Quality

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 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. 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 self-reported data on brand choice might mean that our variables measures cigarette quality with error, but the problem does not seem to be too severe. The market shares by quality segment are broadly consistent with data from the Euromonitor's (2003) on the U.S. cigarette market. The average self-reported price paid varies as expected across the categories defined on self-reported brand choice: about $4.70 per pack of premium brand; $3.50 per pack of discount brand; and $2.60 per pack of generic/ other brand.[25] In a separate question, respondents were

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[24]As Gould and Segall (1969) point out, with unusual income effects the standard theory of the consumer behind the Alchian and Allen substitution theorem cannot rule out the possibility that higher taxes shift demand towards the lower-quality good, consistent with the public health researchers' argument.

[25]The Euromonitor (2003) marketing report estimates that "standard brands" such as

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.[26]

Ideally, to test the substitution theorem we would use data on the quality of the cigarette

brand purchased on a reservation. By contrast, our data allow us to match the quality of the brand

usually purchased to whether the consumer reports always making reservation purchases. If some

consumers' reservation purchases are not their usual brand, the resulting mismatch means we have

measured the reservation purchase in error: the observed purchase quality (their usual brand) was

not actually made on a reservation.[27] As long as the mismatches are random, this would create

attenuation bias towards zero in $\delta_1$, our estimate of the impact of a reservation purchase on the

demand for cigarette quality.

At prevailing taxes and prices, with full shifting to the consumer the reservation tax break

reduces the relative price of low-quality cigarettes from about 66 percent to about 50 percent of the

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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.

[26]We 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.

[27] If survey responses are logically consistent, if a consumer always purchases cigarettes on a reservation it must be their usual brand. Even if responses are not perfectly logical, it seems reasonable that responses about purchases made "all the time" will mainly correspond to the "usual brand."

price of high-quality cigarettes.[28] 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.[29]

## C. Results

Table 3 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 estimated marginal effects from probit and IV probit models. In the IV 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 probit models in Table 5 we have to combine the discount category (the middle category of the ordered

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[28]One 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).

[29]Cigarette 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.

probit model) with one of the other brand categories. The disadvantage is that we are unable to estimate an IV version of ordered probit.

The results in Table 3 partly support the prediction that the tax break shifts demand towards lower-quality cigarettes. The probit results in columns 1 and 3 imply that a reservation purchase is associated with a 16 percentage point increase in the probability the consumer's usual brand is a low-quality generic/ other brand, and a 14 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 at the 90 confidence level for column 2 and the 95 confidence level for column 4. 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 $\zeta$ in equation (2); and conversely for the column 4 model where the dependent variable measures demand for high quality. As a result, while the exogenous probit 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 3, 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. 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 16 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.

## VII.  DISCUSSION

We use the unusual tax situation created by cigarette purchases on Indian reservations to examine excise tax incidence and the impact of taxation on the demand for product quality. The body of empirical research on these basic questions about taxation is not very large and contains gaps that our results help fill. In general, and for cigarette taxes in particular, many previous studies necessarily focus on tax hikes because they are far more common. Consistent with previous estimates of the shifting of tax hikes, our empirical results suggest that on most Indian reservations in New York, the economic incidence of the tax break for cigarettes is about fully shifted to consumers. We continue to find full shifting in models that use distance as an IV to address the

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potential endogeneity of reservation purchases. We cannot claim that full shifting generalizes to all tax cuts, but we expect that the result generalizes to many of the tax breaks on reservations in states other than New York. In data from the 2010 TUS-CPS, the prevalence of reservation purchases nationally is about five percent, which is on par with the percentage of smokers who report crossing state borders to avoid high cigarette taxes (DeCicca, et al 2013b). The prevalence of reservation purchases is much higher in certain states: 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. Moreover, our results tend to support the neoclassical approach that treats tax hikes and tax cuts symmetrically.

Similarly, our results provide some support for the prediction that the tax break shifts consumer demand towards lower-quality cigarettes, mirroring earlier estimates that cigarette tax hikes shift demand towards higher-quality (Barzel 1976, Sobel and Garrett 1997). A behavioral economic approach might suggest reasons for asymmetric impacts of tax hikes and tax cuts. For example, Chetty et al (2009) provides evidence that some taxes are more salient to consumers. Lack of salience does not seem likely to be an issue for the reservation tax break, at least for consumers who have traveled to the reservation to obtain the tax break. Future research could explore the implications if the tax break we study is more salient than the more commonly studied tax hikes.

The different New York Indian reservations also provide a case study of the impact of market conditions on tax incidence. Although we find approximate one-for-one shifting on most reservations where cigarette markets are substantially competitive, we find evidence that less of the tax break is shifted to consumers who purchase cigarettes on the Onondaga reservation, where

there is a tribal-run monopoly smoke shop. Our OLS estimate that about only about 60 percent of the tax break is shifted to consumer prices is not that far from the textbook result that facing a linear demand curve a monopolist shifts exactly half the tax. The fact that we observe markets for the same good during the same time period in the same state provides a crisp test of the impact of market structure on tax incidence. In contrast, for example, Besley and Rosen (1999) estimate the degree of tax shifting in markets for a variety of commodities and draw broad conclusions about whether the results are consistent with the competitive paradigm or not. However, while the unusual situation we study helps us answer a basic question in tax incidence, it also makes it difficult to generalize to other markets.

Our empirical evidence that the tax break is mainly shifted to consumers suggests that the Indians' strong support for the tax break might 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). 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).

**Table 1: Descriptive Statistics**

| VARIABLES | Mean |
|---|---|
| Price paid for a pack of cigarettes | 4.517 (2.07) |
| Usual cigarette brand is premium | 0.711 |
| Usual cigarette brand is discount | 0.136 |
| Usual cigarette brand is generics | 0.153 |
| Distance to nearest reservation (units of 100 miles) | 0.577 (0.349) |
| 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 |

N = 6539. Data: New York State Adult Tobacco Survey 2003-2009.
For continuous variables, standard deviations are in ( ).

**Table 2: Impact of reservation purchase on price paid for cigarettes**

| VARIABLES | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
|  | OLS | OLS | 2SLS | OLS | OLS | 2SLS |
| Purchase from Indian reservation - All the time | -1.726*** | -1.436*** | -1.845*** | -1.230*** |  |  |
|  | (0.084) | (0.085) | (0.429) | (0.079) |  |  |
| Interaction of Indian purchase and time after July 2008 |  | -1.500*** |  |  |  |  |
|  |  | (0.120) |  |  |  |  |
| Usual brand of cigarettes: - discount brands |  |  |  | -0.688*** |  |  |
|  |  |  |  | (0.058) |  |  |
| Usual brand of cigarettes: - generic/other brands |  |  |  | -1.167*** |  |  |
|  |  |  |  | (0.080) |  |  |
| Purchase from Onondaga Indian reservation |  |  |  |  | -1.037*** | -1.398*** |
|  |  |  |  |  | (0.165) | (0.449) |
| Purchase from other Indian reservations |  |  |  |  | -1.776*** | -1.986*** |
|  |  |  |  |  | (0.074) | (0.320) |
| F-statistic for IV |  |  | 17.12 |  |  |  |
| R-squared | 0.509 | 0.521 | 0.508 | 0.512 | 0.510 | 0.508 |

N = 6539 (N = 5081 for Column 4 because brand choice questions are not available in 2008 and 2009.)

All models also include as explanatory control variables: the socio-demographic variables listed in Table 1; a set of indicators for regions within New York; a set of indicators for county population quintile; and year indicators.

Robust standard errors (clustered at county level) in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$ for the null hypothesis that the estimated coefficient equals zero

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

**Table 3: 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 | 0.156*** | -0.159 | -0.137*** | 0.638 | 0.510*** |
| | (0.014) | (0.450) | (0.017) | (0.482) | (0.046) |

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

All models also include as explanatory variables: the socio-demographic variables listed in Table 1; a set of indicators for regions within New York; a set of indicators for county population quintile; and year indicators.

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

*** p<0.01, ** p<0.05, * p<0.1 for the null hypothesis that the estimated coefficient equals zero

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 0.63 and 1.20.

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