National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

RETAIL PRICE REACTIONS TO CHANGES IN STATE AND LOCAL SALES TAXES

JAMES M. POTERBA *

Abstract *- This paper tests the hypothesis that state and local retail sales taxes are fully shifted to consumers. The empirical analysis focuses on city-specific clothing price indices for eight cities during the 1947–77 period and fourteen cities during the 1925–39 period. The results for the postwar period suggest that retail prices rise by approximately the amount of the sales tax, in contrast to other studies that reveal tax overshifting. For the Depression period, clothing prices appear to rise by only two-thirds of the amount of sales taxes. This finding accords with earlier evidence based on retailer surveys in the interwar period.*

INTRODUCTION

State and local governments currently raise slightly less than one-third of their nongrant revenue from sales taxes. In spite of their importance as a revenue source, state sales taxes have been subject to relatively little empirical analysis. There is a long and venerable literature, with notable contributions by Brown (1939), Due (1942), Rolph (1952), Musgrave (1959), and Bishop (1968), that develops incidence theory for general sales taxes as well as taxes on particular goods. This literature has recognized the important role that monetary policy can play in determining how nominal prices respond to a national sales tax and drawn attention to potential differences in the incidence of a tax applied in a single small jurisdiction and a tax applied on a national base. Applied incidence studies typically assume that sales taxes are fully reflected in consumer prices and are fully borne by consumers. This practice occurs in spite of the limited previous empirical support for full forward shifting and several studies that suggest that, with imperfect competition in product markets, consumer prices may not increase by the full amount of a retail sales tax.

The limited previous empirical work on how retail prices react to the imposition of sales taxes spans a period of six decades. Haig and Shoup (1934) interviewed retailers in three states in which sales taxes were imposed during the early 1930s. Their results varied across locations. While over 90 percent of the large retailers in Detroit and Chicago reported that they shifted all

*Department of Economics, Massachusetts Institute of Technology, Cambridge, MA 02139-4307.

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

or part of the tax to consumers, less than half of those in New York City reported any shifting. For smaller retail firms, the interviews in all three states suggested many fewer firms raising prices and shifting the tax. Haig and Shoup did not estimate the overall effect of sales tax changes on the price level, but their results appear to suggest incomplete forward shifting of sales taxes.

A second empirical study, Sidhu (1971), found evidence of sales tax overshifting. Sidhu examined the relationship between the Consumer Price Index (CPI) and the sales tax rate in a sample of seven cities between 1954–66. She focused on five product categories and, in all but one, estimated that sales taxes increased prices more than one-for-one. For food products, her estimates suggested that a one percent increase in the sales tax raised prices by 4.2 percent on average. Price changes in footwear and women's clothing were estimated to be twice as large as the tax changes. These results were attributed to potential cross-city correlation between sales tax rates and the mark-up pricing rules used by retailers.

A more recent study by Besley and Rosen (1994) examines the impact of state and local sales taxes on the prices of particular goods, such as Big Macs. This study, which is based on a larger sample of cities and a more carefully controlled definition of products than either of the earlier studies, yields substantial evidence of overshifting. The authors attribute these results to imperfect competition and cite recent work on price-cost margins, such as Hall (1988), in support of the view that retailing may be imperfectly competitive, even if some of the goods that retailers purchase are traded in competitive markets. Thus, the balance of previous empirical research seems to suggest that retail prices rise by more than the amount of retail sales taxes.

In addition to the three foregoing studies of general sales taxes, there have been other analyses of how product-specific excise taxes affect consumer prices. Due's (1954) study of the 1954 reduction in federal excise taxes on electrical appliances suggested that retail prices fell by more than the price cut (overshifting). Browlee and Perry (1967) and Woodard and Spiegelman (1967) studied the 1965 reduction in federal excise taxes and found that most manufacturers reduced prices by the full amount of the excise tax reduction, although they present some examples of less-than-complete forward shifting. Harris (1987) analyzed the change in cigarette prices that coincided with the 1983 increase in the federal cigarette excise tax and found evidence of significant overshifting. Thus, there is some empirical evidence of overshifting for specific sales taxes, although the evidence is not as strong as for general sales taxes.

This paper presents new empirical evidence on how prices respond to changes in state and local sales taxes. It analyzes two new data sets. The first is a 30-year panel data set on the prices of men's and women's clothes and personal care items in eight cities during the postwar period. The second is a 15-year panel on clothing prices in 13 cities during the late 1920s and 1930s when many states enacted, and some subsequently repealed, sales taxes.

The paper is divided into four sections. It begins by presenting a framework for analyzing how sales taxes affect prices. The next section describes the data sets that are used to estimate how tax changes affect prices and discusses

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

econometric specification. This is followed by a summary of the empirical findings from each data set. The results for the postwar period never reject the view that prices react one-for-one to tax changes. There is evidence of less-than-complete forward shifting for the 1925–39 data set, consistent with the results of Haig and Shoup (1934). A brief conclusion outlines how these results affect the analysis of sales tax incidence and suggests several directions for future work.

MODELING THE PRICE EFFECTS OF STATE SALES TAXES

Most applied incidence studies, such as Pechman and Okner (1974) and Ballard et al. (1985), assume that retail sales taxes are fully shifted to consumers. Yet this proposition is not universally accepted. One source of controversy, illustrated most recently in the exchange between Browning (1985) and Due (1986), concerns the relative sales tax burden on consumers and on those who supply factors. Browning argues that because many government transfer payments are indexed for price level changes, consumers whose income arises from transfer programs do not bear the burden of sales taxes. Due sketches several objections to this position, but controversy remains.

A second source of ambiguity in the incidence analysis of sales taxes arises from the applied theoretical literature on how sales taxes affect consumer prices in the presence of imperfect competition. Papers by Katz and Rosen (1985), Stern (1987), and Besley and Rosen (1994) conclude that full price adjustment is not a robust result. While it does obtain if product markets are perfectly competitive, in other competitive environments, price adjustment may exceed or fall below the amount of the sales tax.

Most analytical treatments of sales tax incidence assume that the tax is applied to all transactions and abstract from the problem of sales taxation in small jurisdictions. If a small jurisdiction imports everything it consumes, world prices are fixed, the retail sector is perfectly competitive, and consumers are unable to shop outside the state, then retail prices within the jurisdiction will rise by the full amount of the sales tax.[1] In the presence of imperfect competition, this result may not hold, particularly when residents of the jurisdiction can either migrate or cross borders to make purchases. Cross-border shopping may reduce demand for commercial land in jurisdictions that raise the sales tax; this may, in turn, be reflected in less-than-full retail price increases. Sidhu (1971) found evidence of smaller retail price reactions to sales tax changes in "border" cities. This would be reinforced by out-migration, both of workers and of industry, lowering the demand for land and hence goods prices in the taxing state.

The standard analysis of sales tax incidence in imperfectly competitive markets has been developed in the context of cigarette taxation by Sumner (1981), Bulow and Pfleiderer (1983), Sullivan (1985), and more generally by the other authors noted above. Consider an N-firm industry with constant marginal cost c and inverse demand function $q(X)$, where X is the total quantity produced by all firms and q is the tax-inclusive consumer price. Firm i chooses x_i to maximize

1

$$[q(X) - \delta]\, x_i - c x_i.$$

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

Let δ denote a specific tax rate on final sales. Following Sullivan, the first-order condition for profit maximization is given by

2

$$q(X) - \delta - c + x_i q'(X)(1 + \alpha_i) = 0.$$

In this expression, α_i is firm *i*'s conjectural variation, the amount by which it expects the aggregate output of all other firms to respond to a one-unit change in its output. To find the effect of a tax change on the consumer price, *q*, differentiate firm *i*'s output with respect to the sales tax rate:

3

$$\frac{\partial x_i}{\partial \delta} = \frac{1}{[1 + \alpha_i][2q'(X) + x_i q''(X)(1 + \alpha_i)]}$$

$$= 1 \Big/ q'(X)[1 + \alpha_i]\Big[2 - s_i(1 + \alpha_i)\Big\{1 + \eta - \left(\frac{X}{\eta}\right)\left(\frac{\partial \eta}{\partial X}\right)\Big\}\Big].$$

Let s_i denote firm *i*'s share in total industry output and η the elasticity of price with respect to total industry output. Note that when the elasticity of demand is constant, the denominator of 3 simplifies. The tax effect on prices is

4

$$\frac{dq}{d\delta} = q'(X)\sum_{i=1}^{N}\frac{\partial x_i}{\partial \delta}.$$

Katz and Rosen (1985) demonstrate that $dq/d\delta$ depends on industry conditions and demand elasticities. With perfect competition, $\alpha_i = -1$ for all firms, and equation 2 immediately reduces to $q = c + \delta$, so consumer prices must equal producer cost plus the full amount of the tax. More generally, measuring the degree to which sales taxes are reflected in retail prices is primarily an empirical issue.[2]

EMPIRICAL SPECIFICATION AND DATA SOURCES

The empirical framework used below to analyze retail price changes is parsimonious. Since most retail sales taxes are *ad valorem* taxes, let θ denote the sales tax rate in city *i* in period *t*. The percentage change in city-specific retail prices, $\Delta \ln q_{it} = \Delta \ln [p_{it}(1 + \theta_{it})]$, can be decomposed as follows:

5

$$\Delta \ln [p_{it}(1 + \theta_{it})] = \Delta \ln p_{it} + \Delta\theta_{it}.$$

To determine whether producer prices are affected by tax changes, or equivalently whether consumer prices change by more or less than the full amount of a tax change, it is necessary to estimate the amount by which producer prices would have changed if there had been no tax change. I assume that changes in the sales tax rate in a given city or state have a small impact on the contemporaneous *national* inflation rate for a given product. This implies that a reasonable proxy for the change in the producer price in city *i* during period *t* is the change in the national price level in period *t*.

For estimation, I replace $\Delta \ln p_{it}$ in equation 5 with a two-quarter weighted average of the national consumer price inflation rate for the commodity in question. The weights are estimated. Defining $\pi_{it} = \Delta \ln q_{it}$, where q_{it} denotes the retail price in jurisdiction *i* at time *t*, and $\pi_{US,t}$ analogously, the foregoing

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

assumptions lead to an estimating equation for each city's inflation rate:

$$\pi_{it} = \alpha_{0i} + \varphi_{1i}{*}\pi_{US,t} + \varphi_{2i}{*}\pi_{US,t-1} + \beta_{1i}{*}\Delta\theta_{it} + \beta_{2i}{*}\Delta\theta_{i,t-1} + \varepsilon_{it}. \quad (6)$$

Both current and lagged tax changes have been included to allow for adjustment lags.[3] The estimating equations also include quarterly seasonal indicator variables to allow for the possibility of seasonal behavior in inflation rates. These coefficients are typically omitted in the tables below. The inclusion of the national inflation rate controls for most of the time-series variation in inflation rates that might be captured with a full set of time effects.

Equation 6 relates price changes in city *i* to national price changes and tax changes in city *i*. When data on several cities are used to estimate this equation, the error terms for different cities in a given period may be correlated; the system of city-specific equations is therefore estimated using the seemingly unrelated regressions technique.

To estimate the effect of retail sales taxes on prices, I use two data sets based on Bureau of Labor Statistics (BLS) city-specific CPIs. One includes price information on eight cities for the period 1947–77. The sample ends in 1977 as a result of changes in the BLS price sampling procedure that make subsequent data noncomparable with those for the earlier period.[4] The BLS collects data on tax-inclusive prices, so price data correspond to consumer prices (q) in the foregoing discussion.[5]

For much of the postwar period, the BLS calculated disaggregated price indices for 28 Standard Metropolitan Statistical Areas (SMSAs), as well as the nation. I constructed a data sample of those SMSAs which (1) experienced some change in the sales tax rate between 1947–77, (2) were not on a state border where retailers within the SMSA would face different tax rules, and (3) included only one major city and surrounding suburbs. Restriction (2) is particularly onerous, since it precludes studying the effect of interstate retail competition on price reactions. Spurious results could arise from border cities, however, because when only some of the retailers surveyed are affected by the tax, the CPI may show only partial shifting of the tax, even if all affected retailers are shifting the tax completely. The three criteria excluded all but eight of the SMSAs for which disaggregated CPI data are available.

Table 1 identifies the eight SMSAs in the first database, and presents their sales tax changes during the sample period.[6] Five of the cities experienced total sales tax increases of at least four percentage points during the 1947–77 period. There are four episodes during the sample in which the sales tax rate changed by at least two percentage points; tax shocks of this magnitude are particularly valuable for studying price reactions.

The CPI suffers from several drawbacks for studying sales tax reforms. First, not all goods included in the CPI are necessarily covered by retail sales taxes. Many states exempt food and medication from the tax base, while others exclude some major durables such as autos. The overall price level in a city may therefore give unreliable results with respect to tax shifting. I therefore focus on price indices for three disaggregated commodity groups.

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

TABLE 1
SALES TAX CHANGES IN SELECTED SMSAs, 1947–77

SMSA	Tax Rate Change	Jurisdiction	Date
Atlanta	0.00–3.00	state	04/01/51
	3.00–4.00	local	02/15/72
Baltimore	0.00–2.00	state	07/01/47
	2.00–3.00	state	01/01/59
	3.00–4.00	state	06/01/69
	4.00–5.00	state	06/01/77
Chicago	1.96–2.50	state	07/01/55
	2.50–3.50	local	08/01/55
	3.50–4.00	state	07/01/59
	4.00–4.50	state	07/01/61
	4.50–5.25	state	07/01/67
	5.25–5.50	local	08/01/67
	5.50–5.75	local	09/01/67
	5.75–6.00	local	10/01/69
Cleveland	3.00–4.00	state	09/01/67
	4.00–4.50	local	09/01/69
	4.50–5.50	local	10/01/75
Detroit	3.00–4.00	state	09/01/59
	4.00–3.00	state	01/01/60
	3.00–4.00	state	01/01/61
Houston	0.00–2.00	state	09/01/61
	2.00–3.00	local	12/05/67
	3.00–4.00	state	10/02/68
	4.00–4.25	state	10/01/69
	4.25–5.00	state	07/01/71
Milwaukee	0.00–3.00	state	02/01/62
	3.00–4.00	state	09/01/69
Seattle	3.00–4.00	state	04/01/59
	4.00–4.20	state	06/01/65
	4.20–4.50	state	07/01/67
	4.50–5.00	local	04/01/70
	5.00–5.30	local	01/01/73
	5.30–5.40	state	06/01/76

Source: State tax changes are indicated in the Commerce Clearing House *State Tax Reporter*. Local tax changes were identified through interviews with local revenue officials.

Second, the need for detailed data raises a separate problem. The BLS undertakes periodic revisions in the CPI sampling base. While historical price indices at the national level and city aggregates are recomputed after each revision, this computation is not done for many of the disaggregated SMSA price indices. For most commodity groups, it is therefore impossible to obtain SMSA-specific price indices over periods of more than a decade. There are only three exceptions to this rule: boys' and men's clothes, girls' and women's clothes, and personal care items. While these three groups seem like products with relatively comparable tax treatment across jurisdictions, they unfortunately accounted for only 6.1 percent of real consumer spending in 1994, according to the National Income and Product Accounts.[7] Price indices for these commodity groups are available for all SMSAs during the entire 1947–77 period.

The final problem with SMSA-specific CPIs is that not all SMSAs are surveyed in the same month. For some cities, the survey was done in January, April, July, and October, while in others, it was done in February, May, August, and November.[8] Quarterly CPIs for each SMSA were constructed using the price index observation for the month within that quarter. Comparable series for the national price index were constructed for each SMSA using the national CPI for the city's sampling month.

Tax rate data for the 1947–77 period were drawn from two sources. For state tax reforms, the Commerce Clearing House *State Tax Reporter* provided information on the size and effective date of tax reforms. Additional information on city sales taxes was obtained by telephone interviews with reference librarians in city libraries and personnel at municipal revenue offices. These sources were also used to ensure that the retail sales tax did not provide a clothing exemption. One city that satisfied all other criteria, Boston, was excluded from our sample because of a clothing exemption.

To provide additional information on price reactions to large changes in the tax rate, I also constructed a second data set on clothing prices and sales tax changes during the 1925–39 period, when many states introduced general sales taxes. The BLS collected price data every six months during this period, so the timing of price reactions to tax

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

changes cannot be measured as accurately as with quarterly postwar data. The price subindices for this period are less detailed than for the postwar period, so the relevant commodity group is simply "clothing." Nevertheless, the additional variation in tax rates, as well as the contrast between overall price movements in the postwar and interwar periods, makes this a potentially useful data source.

Table 2 presents information on the ten SMSAs that satisfied the criteria described above for the 1925–39 period.[9] All of the sales tax changes during this period occurred at the state level. This data sample includes eight episodes of price changes of two percentage points or more and three examples of sales taxes that were enacted and then repealed during periods of 14 months or less. This data set therefore provides substantial additional variation in tax rates relative to the postwar period.

TABLE 2
SALES TAX CHANGES IN SELECTED SMSAs, 1925–39

SMSA	Tax Rate Change	Jurisdiction	Date
Baltimore	0.0–1.00	state	04/01/35
	1.0–0.00	state	03/01/36*
Birmingham (AL)	0.0–2.00	state	01/01/37
Buffalo	0.0–1.00	state	05/01/33
	1.0–0.00	state	06/30/34
Chicago	0.0–2.00	state	07/01/33
	2.0–3.00	state	07/01/35
Cleveland	0.0–3.00	state	01/26/35
Denver	0.0–2.00	state	03/01/35
Detroit	0.0–3.00	state	07/01/33
Los Angeles	0.0–2.50	state	08/01/33
	2.5–3.00	state	07/01/35
New Orleans	0.0–2.00	state	10/01/36
Pittsburgh	0.0–1.00	state	08/01/32*
	1.0–0.00	state	02/01/33*
San Francisco	0.0–2.50	state	08/01/33
	2.5–3.00	state	07/01/35
Scranton	0.0–1.00	state	08/01/32*
	1.0–0.00	state	02/01/33*
Seattle	0.0–0.50	state	08/01/33
	0.5–2.25	state	05/01/35

Source: State tax changes are reported in Jacoby (1938, ch. 3). Those changes with asterisks are ones for which information on the day when the change took effect was unavailable; they have been arbitrarily coded as taking effect at the beginning of the month.

EMPIRICAL RESULTS

Table 3 reports key coefficient estimates from equation 6 for the three sets of commodity groups during the 1947–77 period.[10] These estimates constrain the impact of sales taxes on retail prices to be equal in different cities. The table shows the coefficients on both the current and lagged values of the $\Delta\theta_{it}$ variable and also reports the sum of these coefficients and the standard error of the sum.

The point estimates for two of the three commodity groups indicate overshifting, but it is never possible to reject the null hypothesis that prices rise point-for-point with changes in the retail sales tax. Even the point estimates, however, do not suggest as much overshifting as the results in Sidhu (1971) or Besley and

TABLE 3
PRICE REACTIONS TO TAX CHANGES, 1947–77

Commodity Group	Current	Lagged	Total
Women's and girls' clothing	1.17 (0.26)	0.16 (0.26)	1.33 (0.37)
Men's and boys' clothing	0.55 (0.16)	0.29 (0.16)	0.84 (0.23)
Personal care items	0.86 (0.17)	0.31 (0.17)	1.17 (0.25)

Notes: Estimates are from constrained systems of equations corresponding to

$$\pi_{it} = \alpha_{0i} + \beta_1 * \Delta\theta_{it} + \beta_2 * \Delta\theta_{it-1} + \varphi_{1i} * \pi_{US,t} + \varphi_{2i} * \pi_{US,t-1} + \varepsilon_{it}$$

where π_{it} is the inflation rate in city *i* in period *t* for a particular commodity group, θ_{it} is the retail sales tax rate in city *i* in period *t*, and $\pi_{US,t}$ is the national inflation rate in period *t*. The coefficients in the three columns are, respectively, β_1, β_2, and $\beta_1 + \beta_2$. Standard errors are reported in parentheses. The log-likelihood values for the constrained systems corresponding to the three rows are 2597.65, 3014.03, and 2960.24, respectively.

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

Rosen (1994). For example, the latter study estimates that a one cent increase in the sales tax on boys' briefs raises the consumer price by 2.44 cents. The 95 percent confidence interval for the point estimates in Table 3 does not include this degree of overshifting.

Table 4 presents more detail on the impact of sales taxes on clothing prices and the prices of personal care products in the postwar period. The coefficients shown in Table 4 are estimated from equations similar to those in Table 3 but without the constraint that prices in all cities respond to taxes in the same way. The likelihood ratio test for the 14 coefficient restrictions that are imposed in moving from the unrestricted specification (Table 4) to the restricted one (Table 3) rejects these constraints only for one product group, personal care items. The null hypothesis that retail sales taxes are fully shifted into retail prices, i.e., $\beta_{1i} + \beta_{2i} = 1$, is rejected for only 3 of the 24 city/product group combinations in Table 4: women's clothing in Baltimore and personal care products in Baltimore and Milwaukee.

TABLE 4
PRICE REACTIONS TO TAX CHANGES, UNCONSTRAINED CITY RESPONSES

City	Women's and Girls' Clothing	Men's and Boys' Clothing	Personal Care Items
Chicago	2.10	1.29	1.29
	(1.05)	(0.56)	(0.66)
Detroit	1.54	–0.15	0.77
	(1.18)	(0.82)	(0.86)
Baltimore	2.65	1.57	2.99
	(0.80)	(0.56)	(0.59)
Milwaukee	0.87	0.45	–0.08
	(0.85)	(9.44)	(0.49)
Atlanta	–0.26	0.83	0.98
	(0.81)	(0.61)	(0.52)
Cleveland	0.96	1.11	0.73
	(1.35)	(0.98)	(0.98)
Houston	1.72	1.18	1.74
	(1.16)	(0.70)	(0.80)
Seattle	1.39	0.10	2.96
	(1.95)	(1.32)	(1.43)

Notes: Estimates are from unconstrained systems of equations corresponding to

$$\pi_{it} = \alpha_{0i} + \beta_{1i}{*}\Delta\theta_{it} + \beta_{2i}{*}\Delta\theta_{it-1} + \varphi_{1i}{*}\pi_{US,t} + \varphi_{2i}{*}\pi_{US,t-1} + \varepsilon_{it}$$

where π_{it} is the inflation rate in city *i* in period *t* for a particular commodity group, θ_{it} is the retail sales tax rate in city *i* in period *t*, and $\pi_{US,t}$ is the national inflation rate in period t. Estimates reported above correspond to $\beta_{1i} + \beta_{2i}$; standard errors are reported in parentheses. The log-likelihood values for the systems corresponding to the three columns are 2602.13, 3022.72, and 2976.00, respectively.

Table 5 presents estimates of price change models for the 1925–39 period. The estimating equations are similar to those in Tables 3 and 4, but they include only the contemporaneous value of the national inflation rate, because each observation spans a period of six months rather than three months. The table shows both constrained and unconstrained estimates, and once again, there is substantial heterogeneity in the estimated responses across cities.

The constrained estimates in Table 5 suggest incomplete shifting of taxes into retail prices. The total effect of a one percentage point *ad valorem* tax is estimated to be a 0.62 percent increase in retail prices of clothing. The null hypothesis of full shifting is rejected by these coefficient estimates, and the results therefore stand in contrast to previous empirical findings of overshifting. The likelihood ratio test of the constraint that all cities exhibit the same response patterns to changes in tax rates rejects the null hypothesis. In 9 of the 13 cities, the null hypothesis of full forward shifting, $\beta_{1i} + \beta_{2i} = 1$, is rejected at standard confidence levels. The cities for which the complete pass-through hypothesis is not rejected are

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

TABLE 5
CLOTHING PRICE REACTIONS TO TAX CHANGES, 1925–39

	Current	Lagged	Total
Constrained estimates	0.41 (0.09)	0.22 (0.09)	0.63 (0.13)
Unconstrained estimates:			
Baltimore	–1.29 (0.25)	0.90 (0.26)	–0.39 (0.37)
Birmingham	1.18 (0.13)	–0.71 (0.13)	0.47 (0.20)
Buffalo	0.61 (0.39)	1.94 (0.52)	2.54 (0.67)
Chicago	1.23 (0.43)	0.21 (0.37)	1.44 (0.54)
Cleveland	0.39 (0.15)	–0.01 (0.15)	0.39 (0.21)
Denver	0.08 (0.23)	–0.37 (0.23)	–0.30 (0.34)
Detroit	–0.81 (0.46)	–0.21 (0.37)	–1.02 (0.48)
Los Angeles	–0.34 (0.26)	0.05 (0.21)	–0.28 (0.28)
New Orleans	0.86 (0.58)	1.28 (0.59)	2.14 (0.86)
Pittsburgh	1.13 (0.47)	1.41 (0.58)	2.53 (0.97)
San Francisco	0.32 (0.31)	–0.06 (0.25)	0.26 (0.33)
Scranton	1.78 (0.53)	4.47 (0.62)	6.24 (1.06)
Seattle	0.07 (0.31)	0.54 (0.29)	0.61 (0.43)

Notes: Estimates are from the system of equations corresponding to

$$\pi_{it} = \alpha_{0i} + \beta_{1i}*\Delta\theta_{it} + \beta_{2i}*\Delta\theta_{it-1} + \varphi_{1i}*\pi_{US,t} + \varphi_{2i}*\pi_{US,t-1} + \varepsilon_{it}$$

where π_{it} is the inflation rate in city *i* in period *t* for clothing, θ_{it} is the retail sales tax rate in city *i* in period *t*, and $\pi_{US,t}$ is the national inflation rate in period *t*. Standard errors are reported in parentheses. The constrained system imposes constant values of β_{1i}, β_{2i}, φ_{1i}, and φ_{2i} for all *i*. Estimates reported above correspond to β_{1i}, β_{2i}, and $\beta_{1i} + \beta_{2i}$.

Chicago, New Orleans, Pittsburgh, and Seattle. The empirical findings suggest that estimating the effect of sales taxes on prices for any single city is difficult; the point estimates of $\beta_{1i} + \beta_{2i}$ range widely and typically have very large standard errors.

Conclusions and Future Work

This paper presents evidence that broadly supports the view that retail sales taxes are fully forward shifted, raising consumer prices by the amount of the tax increase.[11] For the two classes of consumer goods considered in this study, clothing and personal care products, data from the 1947–77 period suggest mild, if any, overshifting. For the period 1925–39, data on clothing prices suggest less-than-complete forward shifting. This finding for the interwar period is consistent with the survey evidence reported in Haig and Shoup (1934). For the postwar period, the results appear inconsistent with the findings of substantial overshifting in at least two previous studies, those by Sidhu (1971) and Besley and Rosen (1994).

The results in the present study support the often-maintained assumption that retail sales are fully shifted into retail prices. Yet the differences between the present findings and those in other studies are disturbing and should provide a warrant for further research. Many factors could explain these differences. Sidhu (1971) analyzes data for a shorter time period than the present study but considers price adjustments for a broader set of commodities. Her analysis draws on CPI information, as does the current study. Besley and Case (1994) focus on price changes for a more limited and very specific set of commodities, such as bananas, which are less prone to compositional changes than the broader price indices considered here. Their analysis is based on retail price data

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

collected by the various local affiliates of the U.S. Chamber of Commerce, however, and the price data may be subject to greater measurement error than the information collected by the BLS. Yet it is not clear why any of these differences among the three studies should lead to biases of a particular kind. If anything, noisier data should increase the likelihood of finding that sales taxes are incompletely shifted into prices; this does not appear to be the observed pattern of results. It is possible that the degree of retail sales tax shifting varies across places and over time as a result of differences in the degree of market power among retailers or other factors; this may explain the disparate findings of the various studies.

The applied theoretical literature on sales tax incidence emphasizes that consumer prices will rise by precisely the amount of the tax only under specialized circumstances, and the critical question for empirical work is whether these conditions are substantially violated with enough regularity to require revising the working assumption of full forward shifting. Further work is needed to resolve this issue. It is, in principle, possible to analyze CPI data for a longer sample than that considered in the present paper and to try linking data on the degree of market power in various industries or product markets to these data. Such work, which could provide more powerful evidence on the factors that affect the link between sales taxes and retail prices, would represent an important contribution to applied incidence analysis.

ENDNOTES

I am grateful to Rudiger Dornbusch, Julio Rotemberg, Joel Slemrod, Lawrence Summers, and three anonymous referees for helpful comments; to Craig Alexander and Marianne Bitler for excellent research assistance; and to the Center for Advanced Study in Behavioral Sciences and the National Science Foundation for financial support.

[1] In this example, a general sales tax can raise the nominal price level within the jurisdiction, as the supply of money to the small jurisdiction is effectively infinitely elastic.

[2] If "retail" sales taxes apply to some intermediate goods as well as to final sales, the sales tax will affect c. In this case, $dq/d\delta$ would equal the expression in equation 4 times $(1 + \rho)$, where ρ denotes the increase in production costs as a result of imposing a sales tax at rate δ $(\rho = dc/d\delta)$.

[3] Besley and Rosen (1994) estimate a similar dynamic model in their analysis of sales taxes and prices.

[4] The change in sampling involved the periodicity at which price information is collected. Five large SMSAs were surveyed monthly before and after 1977. Other SMSAs were surveyed four times a year prior to 1977 and bimonthly afterward. The sample is limited to 1947–77 to avoid the need to recalibrate the bimonthly data to create quarterly series.

[5] The *BLS Handbook of Methods* (1976, p. 88) indicates that "The Consumer Price Index . . . includ[es] all taxes directly associated with the purchase of an item and its continued ownership. It deals with prices actually charged to consumers, including sales and excise taxes, since these are an inherent part of the market price the consumer must pay for goods and services subject to such taxes."

[6] Due and Mikesell (1995) provide detailed information on sales tax rates throughout the postwar period.

[7] *Survey of Current Business* 76 (January/February, 1996), p. 47.

[8] There was one instance (Houston) in which the monthly sampling pattern changed, from the February to the January cycle, during the data period.

[9] An earlier draft of this paper also included data on Indianapolis, but they were excluded in the revision on the advice of a referee who described the Indianapolis tax as a European-style gross turnover tax rather than a retail sales tax.

[10] This and subsequent tables do not report coefficients on the "incidental parameters," such as constant terms and national inflation rates, since in some cases this would more than double the number of coefficients presented. See Table A-1 of the Appendix.

[11] The empirical analysis presented here applies to sales taxes enacted by relatively small jurisdictions that face effectively infinite elasticities of money supply. When an entire nation adopts a sales tax, the effect on prices may, in part, depend on the tax reform's aggregate demand effects (Poterba, Rotemberg, and Summers, 1986).

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

REFERENCES

Ballard, Charles L., Don Fullerton, John B. Shoven, and John Whalley. *A General Equilibrium Model for Tax Policy Evaluation*. Chicago: University of Chicago Press, 1985.

Besley, Timothy, and Harvey Rosen. "Sales Tax and Prices: An Empirical Analysis." Princeton University Economics Department. Mimeo, 1994.

Bishop, Robert L. "The Effects of Specific and Ad Valorem Taxes." *Quarterly Journal of Economics* 82 No. 2 (May, 1968): 198–218.

Brown, Harry G. "The Incidence of a General Output or a General Sales Tax." *Journal of Political Economy* 47 (April, 1939): 254–62.

Browning, Edgar K. "Tax Incidence, Indirect Taxes, and Transfers." *National Tax Journal* 38 No. 4 (December, 1985): 525–34.

Brownlee, Oswald, and George Perry. "The Effects of the 1965 Federal Excise Tax Reduction on Prices." *National Tax Journal* 20 No. 3 (September, 1967): 235–49.

Bulow, Jeremy, and Paul Pfleiderer. "A Note on the Effect of Cost Changes on Prices." *Journal of Political Economy* 91 No. 1 (February, 1983): 182–5.

Commerce Clearing House. *State Tax Reporter.* Chicago: Commerce Clearing House Publishers, various years.

Due, John F. *The Theory of Incidence of Sales Taxation*. New York: Kings Crown Press, 1942.

Due, John F. "The Effect of the 1954 Reduction in Federal Excise Taxes on the List Prices of Electrical Appliances." *National Tax Journal* 7 No. 3 (September, 1954): 222–6.

Due, John F. "Tax Incidence, Indirect Taxes, and Transfers—A Comment." *National Tax Journal* 39 (December, 1986): 539–40.

Due, John F., and John L. Mikesell. *Sales Taxation: State and Local Structure and Administration, Second Edition*. Washington: The Urban Institute Press, 1995.

Haig, Robert M., and Carl Shoup. *The Sales Tax in the American States*. New York: Columbia University Press, 1934.

Hall, Robert E. "The Relationship Between Price and Marginal Cost in U.S. Industry." *Journal of Political Economy* 96 (October, 1988): 921–47.

Harris, Jeffrey E. "The 1983 Increase in the Federal Cigarette Excise Tax." In *Tax Policy and the Economy, Volume 1*, edited by Lawrence H. Summers, 87–112. Cambridge: MIT Press, 1987.

Jacoby, Neil H. *Retail Sales Taxation: Relation to Business and Consumers.* New York: Commerce Clearing House, 1938.

Katz, Michael L., and Harvey S. Rosen. "Tax Analysis in an Oligopoly Model." *Public Finance Quarterly* 13 No. 1 (January, 1985): 3–21.

Musgrave, Richard A. *The Theory of Public Finance*. New York: McGraw Hill, 1959.

Pechman, Joseph A., and Benjamin A. Okner. *Who Bears the Tax Burden?* Washington, D.C.: The Brookings Institution, 1974.

Poterba, James M., Julio J. Rotemberg, and Lawrence H. Summers. "A Tax-Based Test for Nominal Rigidities." *American Economic Review* 76 No. 4 (September, 1986): 659–75.

Rolph, Earl R. "A Proposed Revision of Excise Tax Theory." *Journal of Political Economy* 60 (April, 1952): 102–16.

Sidhu, Nancy D. "The Effects of Changes in Sales Tax Rates on Retail Prices." In *Proceedings of the Sixty-Fourth Annual Conference on Taxation*, 720–33. Columbus: National Tax Association-Tax Institute of America, .

Stern, Nicholas H. "The Effects of Taxation, Price Control, and Government Contracts in Oligopoly." *Journal of Public Economics* 32 No. 2 (March, 1987): 133–58.

Sullivan, Daniel. "Testing Hypotheses About Firm Behavior in the Cigarette Industry." *Journal of Political Economy* 93 No. 3 (June, 1985): 586–99.

Sumner, Daniel. "Measurement of Monopoly Behavior: An Application to the Cigarette Industry." *Journal of Political Economy* 89 No. 5 (October, 1981): 1010–9.

U.S. Department of Labor, Bureau of Labor Statistics. *Changes in Cost of Living*. Washington, D.C.: Government Printing Office, various issues.

U.S. Department of Labor, Bureau of Labor Statistics. *BLS Handbook of Methods for Surveys and Studies*. Bulletin 1910. Washington, D.C.: Government Printing Office, 1976.

Woodard, F. O., and Harvey Siegelman. "Effects of the 1965 Excise Tax Reduction upon the Prices of Automotive Replacement Parts." *National Tax Journal* 20 No. 3 (September, 1967): 250–8.

National Tax Journal
Vol 49 no. 2 (June 1996) pp. 165-76

APPENDIX

TABLE A-1
ESTIMATED CONSTANT AND AGGREGATE INFLATION COEFFICIENTS FROM CLOTHING PRICE REGRESSIONS, 1925–39

	α_{0i}	φ_{1i}	φ_{2i}
Constrained estimates	–0.003	0.92	–0.03
	(0.036)	(0.11)	(0.11)
Unconstrained estimates:			
Baltimore	0.008	1.00	–0.02
	(0.13)	(0.05)	(0.05)
Birmingham	0.24	1.18	–0.10
	(0.16)	(0.06)	(0.06)
Buffalo	–0.20	0.97	–0.06
	(0.20)	(0.08)	(0.07)
Chicago	–0.49	0.89	0.07
	(0.23)	(0.09)	(0.09)
Cleveland	–0.06	0.80	0.01
	(0.19)	(0.06)	(0.06)
Denver	–0.21	0.81	0.15
	(0.25)	(0.09)	(0.09)
Detroit	0.21	1.18	–0.12
	(0.27)	(0.12)	(0.12)
Los Angeles	0.30	1.11	–0.02
	(0.12)	(0.05)	(0.05)
New Orleans	–0.38	0.87	–0.04
	(0.32)	(0.11)	(0.11)
Pittsburgh	–0.05	0.90	0.01
	(0.16)	(0.06)	(0.06)
San Francisco	0.37	1.10	–0.05
	(0.18)	(0.07)	(0.07)
Scranton	0.19	1.30	–0.11
	(0.26)	(0.10)	(0.09)
Seattle	0.22	0.93	–0.01
	(0.19)	(0.06)	(0.06)

Notes: Estimates are from the system of equations corresponding to

$$\pi_{it} = \alpha_{0i} + \beta_{1i}*\Delta\theta_{it} + \beta_{2i}*\Delta\theta_{it-1} + \varphi_{1i}*\pi_{US,t} + \varphi_{2i}*\pi_{US,t-1} + \varepsilon_{it}$$

where π_{it} is the inflation rate in city *i* in period *t* for clothing, θ_{it} is the retail sales tax rate in city *i* in period *t*, and $\pi_{US,t}$ is the national inflation rate in period *t*. Standard errors are reported in parentheses. The constrained system imposes constant values of β_{1i}, β_{2i}, φ_{1i}, and φ_{2i} for all *i*. Estimates reported above correspond to α_{0i}, φ_{1i}, and φ_{2i}.