Congestion Charges in Stockholm: How Have They Affected Retail Revenues?

Sven-Olov Daunfeldt*, Niklas Rudholm† and Ulf Rämme‡

Abstract

Did the introduction of congestion charges in Stockholm city reduce retail revenues? Data from 20 shopping malls - 8 within the toll area, and 12 outside the tool area - and from a sample of retail stores located along the main shopping streets was analyzed using an intervention-control approach. Favorable outcomes, such as reduced traffic, less emissions of carbon-dioxide, and perceived improvements in air quality and accessibility, do not seem to have been offset by reduced revenues for retailers located within the toll area.

Key Words: Road toll, congestion fee, congestion charge, retail revenues, retail profits.

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*The Ratio Institute, P.O. Box 3203, SE-103 64 Stockholm, Sweden.

†The Swedish Retail Institute (HUI), SE-103 29 Stockholm, Sweden; and Department of Economics, Dalarna University, SE-781 88 Borlänge, Sweden.

‡The Swedish Retail Institute (HUI), SE-103 29 Stockholm, Sweden.

1 Introduction

London, Singapore, and Stockholm have recently introduced congestion charges to increase inner-city accessibility and improve the environment. Introduction of congestion charges has also been discussed in Helsinki, Edinburgh, Liverpool, Manchester, and San Francisco. However, congestion charges are controversial, partly because they might have a negative impact on retail businesses within the toll area (Eliason et al., 2009).

Few previous studies have investigated whether the introduction of congestion charges actually reduced revenues for city retailers. Windsor-Cundell (2003) reported results from a survey by the London Chamber of Commerce and Industry following the introduction of congestion charges there in February 2003: 76% of the respondents reported reduced revenues year-by-year, which was largely blamed on the congestion charges. Quddus et al. (2006) analyzed the effects of congestion charges on total retail sales, as well as on sales data from six John Lewis stores in the London area. They found the retail sector as a whole unaffected, though the John Lewis store on Oxford Street seemed to have reduced revenues. This result was also confirmed, using more sophisticated econometric methods, by Quddus et al. (2007).

The effect of the Stockholm road-pricing trial was analyzed by Daunfeldt et al. (2009) using a comprehensive dataset, including 14 shopping malls within and outside the toll area. Retail revenues within the toll area were found to be unaffected, suggesting that congestion charges might not be a big problem for city retailers. However, the study period covered only the trial period, January 3 to July 31, 2006.

Congestion charges were introduced permanently in Stockholm in August 2007, following a referendum the previous autumn (Isaksson and Richardson, 2009, describe the political process in detail). It could be that the public did not respond to the trial period because it was seen as temporary, and that the effects of permanent congestion charges on retail revenues are different.

The effect on retail revenues of the introduction of permanent congestion charges in Stockholm was studied using a monthly data-set covering 20 shopping malls, 8 within the toll area and 12 outside, from January 2004 to September 2008 (57 months). The study-period thus covers the experimental period, a period before and after with no congestion charges, and the introduction of permanent charges. This makes it possible to study whether the change in retail revenues was different after the permanent introduction of congestion charges than during the experimental period.

Overall, congestion charges were found not to have negatively affected retail revenues. Thus, favorable outcomes following the introduction of congestion charges, such as reduced traffic and greater accessability, less carbon-dioxide emissions, and improved air quality (Eliason et al., 2009), do not seem to have been counterbalanced by reduced retail revenues.

The next section describes the introduction of congestion charges in detail, and disscuses the expected impact on retail revenues. Section 3 contains the empirical analysis, presenting the data, the empirical method, and the results. The last section summarizes and draws concusions.

2 Congestion charges in Stockholm

Experimental congestion charges, introduced January 3, 2006 for the following sevent months,were intended to reduce traffic 10-15% during rush hours, as well as more generally. The charges were thus differentiated depending upon time of day. The highest fee (SEK 20) was charged during 7.30-7.59 in the morning, and 16.00-16.29 in the afternoon.[1] A fee of SEK 10 was charged during non rush hours (9.00-15.29). No fee was charged during weekends, on holidays, or on the day before holidays. Equal fees were charged in both directions, and the maximum fee per car and day was 60 SEK. Exemptions were made for environmentally friendly vehicles, vehicles owned by disabled drivers, motorcycles, taxis, buses, and other essential vehicles (military, police, fire etc), as well as bypass traffic to and from the island of Lidingö, and the Essinge bypass for north-south transit through the toll zone. In addition, 16 new bus routes were introduced, and underground and train lines were reinforced in order to provide effective public transport alternatives.

This was followed about two months later by a referendum in the city of Stockholm and in those neighboring municipalities (about half) which also choosed to vote on the issue. A majority (53%) of those in the city wanted to keep the charges, whereas approximately 60% in the neighboring municipalities voted against them. The newly elected liberal/conservative national government then decided to introduce permanent congestion charges starting in August 2007. The rules are essentially the same, except that no charges are applied during July, and the exemption for taxis has been abol-

[1] 1 EURO is equal to 11.17 SEK, exchange rate 2009-04-08.

ished.

The question addressed in this paper is how congestion charges affect retail revenues. Car-borne shoppers can choose to pay the fee and do their shopping during the hours when the fee is charged. Smidfeldt-Rosqvist et al. (2006) investigated and found that travel for shopping decreased by 17% during these hours. But this might not reduce retail revenues, since car-borne shoppers could make fewer trips, spending more each time. Alternatively they might adapt to the congestion charges by changing their time of travel, their mode of travel, or their destination. If they change their destination, this would likely reduce retail revenues for shopping malls and stores within the toll-zone. However, changing time or mode of travel would not necessarily reduce retail revenues. In Sweden, where most establishments are open late in the evenings and on weekends, there are ample opportunities for car-borne shoppers to adapt by shopping when no fee is charged. Thus there might not be any impact of congestion charges on retail revenues.

3 Empirical analysis

We used monthly revenue data from 20 shopping malls in the Stockholm area (8 within the toll area, 12 outside) as well as an aggregated revenue measure from a sample of shops in the inner city. The data, collected by the Swedish Retail Institute (HUI), covers the period January 2004 through September 2008. Descriptive statistics are presented in Table 1 by period: before. during, and after the trial period, and when permanent.

Table 1 about here

Regardless of period, mean revenues were higher for shopping malls within the toll area than for those outside. A small decrease is observed during the trial period for retailers both inside and outside the toll area. Mean revenues increased during the period after the trial and remained at approximately the same level after permanent congestion charges were introduced.

Figure 1 (inside) and Figure 2 (outside) show the data in more detail. A clear calender-effect is observable, with revenues much higher during December.

Figures 1 and 2 about here

We adopted an intervention-control approach to estimating the impact of congestion charges on retail revenues. The intervention group consists of 8 shopping malls and the sample of stores from the large shopping streets within the Stockholm toll area during the trial period and after permanent congestion charges were introduced. The control group, on the other hand, consists of those same malls and stores during other periods, plus 12 other shopping malls located 5 kilometers or more outside the toll area, but still within the general Stockholm region. We chose to exclude 3 shopping malls less than 5 kilometers from the toll area in order to reduce the risk of spillover effects, i.e., that the malls close to the toll area might have increased their revenues because of the congestion charges.

The empirical model to be estimated can be written as

$$\ln R_{it} = \alpha_i + \alpha_t + \beta_1 RP_{it} + \varepsilon_{it}, \tag{1}$$

where R_{it} measures the revenue for shopping unit i in month t in SEK[2]; α_i is a shopping unit-specific fixed-effect capturing time-invariant heterogeneity between units (i.e., location, opening hours if unchanged, etc.); and α_t is a time-specific fixed-effect capturing time-variant heterogeneity (i.e., seasonal variation, Christmas shopping, business-cycle movements, time-trends in retail revenues, etc.).

The effect of congestion charges is captured by the indicator variable RP_{it} which is given the value one during the trial and permanent periods for units within the toll area, and zero otherwise. Hence, its coefficient compares retail revenues for units within the toll area when congestion charges were in effect to those when congestion charges were not in effect, including those of the control group outside the toll area. If, after controlling for other factors as we have done, revenues within the toll area decreased during periods with congestion charges, β_1 will be negative. Finally, ε_{it} is a random-error term assumed to have zero mean and constant variance.[3]

Estimations were also made using separate indicator-variables for the trial and permanent periods. This model can be written as

$$\ln R_{it} = \mu_i + \mu_t + \lambda_1 RPT_{it} + \lambda_2 RPP_{it} + \epsilon_{it}, \tag{2}$$

[2] R_{it} is deflated using the Swedish consumer price index with January 2004 as the base period.

[3] Initial estimate of Equations (1) and (2) revealed first-order serial correlation in the error terms. Therefore, Equations (1) and (2) were re-estimated using a Prais-Winsten (1954) estimator with White (1980) heteroskedasticity robust standard errors.

where the effect during the trial period is captured by the indicator variable RPT_{it}, given the value one during the trial period for the units within the toll area, and zero otherwise. Similarly the indicator variable RPP_{it} was given the value one during the permanent period for units within the toll area, and zero otherwise. This setup will reveal possible heterogeneity in the effects, i.e., if λ_1 and λ_2 are different.

Equation (1) was first estimated using the complete panel-data set, giving us an estimate of the effect of congestion charges on total retail revenues inside the toll area (Table 2, all units). Then, in order to also study heterogeneity among the units within the toll area, the estimations were also performed separately, comparing each unit within the toll area to the units outside.

The results presented in Table 2 include 95% confidence intervals. [4]

Table 2 about here

Congestion charges do not seem to have had any affect on aggregated retail revenues inside the toll area. This result was also confirmed for seven of the nine units estimated individually. Only PUB was affected negatively by the introduction of congestion charges, whereas a positive effect was found for Fältöversten.

Results from estimation of Equation (2), distinguishing the effects of the trial (λ_1) and the permanent introduction of congestion charges (λ_2) are presented in Table 3.

[4] Parameter estimates for the time and unit-specific fixed-effects have been suppressed to save space, but are available on request.

Table 3 about here

Again the units located within the toll area were in general unaffected by congestion charges. A statistically significant negative effect during the trial period was found for PUB and Åhlens City, and for PUB after permanent congestion charges were introduced, but not for Åhlens City.

To further investigate whether the negative parameter estimates for PUB are due to congestion charges, we re-estimated Equation (2) including also a dummy variable equal to one for the whole period after the beginning of the trial, using a dataset covering only this period. Again revenues were found to be lower during the periods when congestion charges were in effect, though the results were not statistically significant.

Another interesting question is whether the effect of congestion charges was different during the trial period than after permanent congestion charges were introduced. It could be argued, for example, that shopping behavior is primarily determined by habits that change slowly, and that the trial period was too short to capture any effect. Thus, we also F-tested whether λ_2 is statistically different from λ_1, finding statistically significant differences (at the 5% level) for Fältöversten (λ_2 - λ_1= 0.074), for Åhlens City (0.093), and for the selection of shops (-0.065). Although statistically significant, the differences for the two shopping malls were positive, indicating that the effect was less negative (or more positive) after permanent congestion charges were introduced than during the trial. A possible explanation for this result is that the congestion charge in real terms was somewhat lower during the permanent period due to inflation, reducing the potential impact

of these charges on retail revenues.

4 Summary and conclusions

We investigated whether the introduction of congestion charges in Stockholm decreased revenues for shopping malls and shops located inside the toll area. This is important since many cities around the world are discussing whether to introduce congestion charges to improve both accesibility and air quality, and to reduce carbon emissions. Congestion charges are controversial, however. One concern is that they might hurt retail businesses in the toll area.

The introduction of congestion charges in Stockholm has been hailed as a success in the literature. According to Eliason et al. (2009), not only were congestion reduced and mobility improved within the city, but also carbon emissions were lowered and perceived air-quality was improved. The results here indicate that congestion charges had no negative effect on retail businesses, probably because in Sweden most stores and shopping malls are open evenings and weekends, making it easy to avoid congestion charges by shopping at another time or by using public transport, which is plentiful. As parking is quite expensive in Stockholm, it may also be that car-borne shoppers are high-income earners who are less sensitive to congestion charges.

Nevertheless, retail businesses might be affected negatively by the introduction of congestion charges even though we found no effect on revenues. For example, it is possible that congestion charges increased labor costs by shifting shopping towards evenings and weekends when salaries are higher.

Thus, congestion charges might have a negative effect on retailers' profits though not directly on their revenues. Unfortunately, the available data did not allow us to investigate this issue, but the question may be a fruitful area for further research.

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Table 1: Monthly revenues inside and outside the toll area (TSEK).

Period	*Inside toll area*	*Outside toll area*
	Mean (Std Err)	Mean (Std Err)
Before trial period (1/04-12/05)	103864 (141179)	49198 (40876)
During trial period (1/06-7/06)	102835 (138336)	47095 (37299)
After trial period (8/06-7/07)	114156 (152234)	54411 (45731)
When permanent (8/07-9/08)	114760 (152212)	54399 (44310)

Table 2: Impacts of congestion charges on retail revenues inside the toll area, Equation (1).

Shopping units	*Estimate of* β_1		*95% C.I.*	*NOBS*
PUB	−0.104	−0.174	−0.034	741
NK	−0.012	−0.134	0.110	741
Åhlens city	−0.051	−0.100	−0.000	741
Västermalmsgallerian	0.066	−0.031	0.163	741
Ringengallerian	0.095	0.033	0.156	741
Fältöversten	0.049	−0.007	0.105	741
Debenhams	−0.011	−0.125	0.104	741
Gallerian	0.021	−0.016	0.058	741
Selection of shops	0.054	−0.073	0.180	741
All units	0.014	−0.026	0.054	1197

Note: NOBS is the number of observations in the estimation of equation (1).

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Table 3: Impacts of congestion charges on retail revenues inside the toll area, Equation (2).

Shopping mall	*Estimate of* λ_1		*95% C.I.*	*NOBS*
PUB	−0.086*	−0.151	−0.021	741
NK	0.007	−0.168	0.182	741
Åhlens city	−0.084*	−0.123	−0.046	741
Västermalmsgallerian	0.044	−0.094	0.182	741
Ringengallerian	0.081	−0.003	0.164	741
Fältöversten	0.022	−0.040	0.083	741
Debenhams	−0.006	−0.179	0.168	741
Gallerian	0.018	−0.031	0.067	741
Selection of shops	0.116	−0.016	0.247	741
All shopping malls	0.014	−0.041	0.068	1197

Shopping mall	*Estimate of* λ_2		*95% C.I.*	*NOBS*
PUB	−0.137*	−0.250	−0.025	741
NK	−0.044	−0.111	0.024	741
Åhlens city	0.009	−0.036	0.053	741
Västermalmsgallerian	0.103*	0.026	0.181	741
Ringengallerian	0.119*	0.051	0.187	741
Fältöversten	0.096*	0.053	0.140	741
Debenhams	−0.019	−0.105	0.066	741
Gallerian	0.026	−0.019	0.072	741
Selection of shops	−0.051	−0.113	0.011	741
All shopping malls	0.014	−0.042	0.070	1197

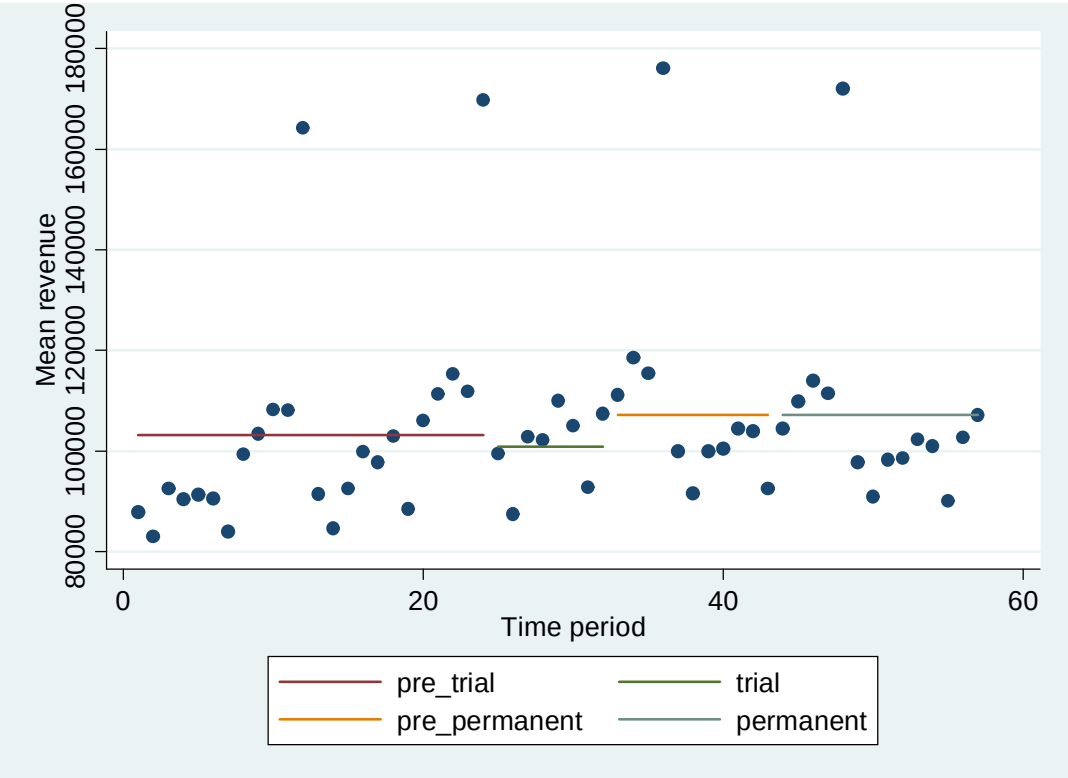

Figure 1: Mean monthly revenues of malls within the toll area

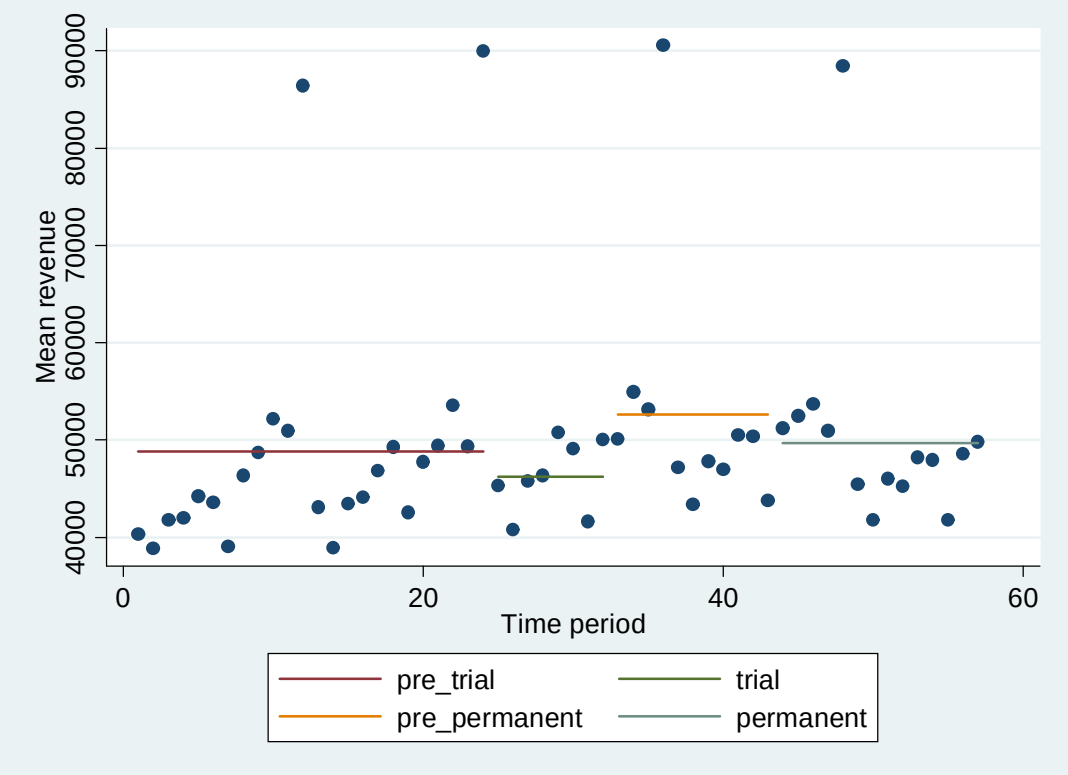

Figure 2: Mean monthly revenues of malls within the toll area