APPENDIX

A: Sample-selection model results

We estimate the parameters from a full information maximum likelihood (FIML) selection correction model that accounts for those households with zero gasoline expenditure. West and Williams (2004) take a similar approach to estimating gasoline price elasticity of demand using a similar national survey dataset from the US. The dependent variable in the selection equation is a dummy variable that takes on a value of zero if the household had zero expenditure on gasoline and a value of one if the household had positive gasoline expenditure. We include the province-level Consumer Price Index for new vehicles and the Consumer Price Index for leased vehicles as exclusion restrictions in the selection equation. Similar to Kayser (2000), we expect that these variables influence the choice to purchase or lease a vehicle but should not directly influence expenditures on gasoline once the vehicle is purchased or leased. The FIML estimation allows for the use of survey weights and for cluster-robust standard errors (as in the baseline regressions reported in the manuscript).

Our full sample is comprised of 134,731 households. Of the total households in the sample, 18,291 do not consume gasoline and are considered censored observations in the selection correction model. An additional 3,263 households consume gasoline but do not own a vehicle. These households are included as uncensored observations in the selection correction model, but are excluded in the regressions reported in the article. Inclusion of the 3,263 households with positive gasoline consumption but no car in the selection correction model provides a robustness check on the results excluding them as presented in the article.

The results of the sample selection model are reported in Table A1 below. Similar to results presented in the article, the results in Table A1 suggest that a one cent increase in the carbon tax

educed gasoline expenditures by between 1.7% and 1.8%. This is only slightly higher than the baseline results presented in Table 2. The coefficients on the regional prices suggest that the price semi-elasticity of gasoline demand ranges from -0.04 in BC to -0.08 in Quebec, once again similar to results in the baseline models. Note also that several of the price semi-elasticities of gasoline demand are less precisely estimated in the sample selection models. Finally, we find that $\hat{\rho} = -0.007$, with a standard error of -0.02, which suggests that the correlation between the errors of the two equations are not statistically different from zero. This implies that we cannot reject the hypothesis that the two equations are independent.

Table A1: Estimates of gasoline price and carbon tax semi-elasticities from full information maximum likelihood (FIML) sample selection model

	Log-linear model		Log-log model	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
Carbon tax	-0.017***	0.006	-0.018**	0.007
Price:				
Maritimes	-0.004*	0.002	-0.005**	0.002
Quebec	-0.007***	0.002	-0.008***	0.002
Ontario	-0.006**	0.002	-0.007***	0.002
Manitoba-Saskatchewan	-0.003	0.003	-0.004*	0.002
Alberta	-0.002	0.003	-0.003	0.003
BC	-0.004	0.002	-0.004*	0.002
Number of household persons:				
0-3	0.026**	0.011	0.026**	0.011
4-14	0.061***	0.007	0.061***	0.007
15-24	0.089***	0.006	0.089***	0.006
25-64	0.190***	0.009	0.191***	0.009
>65	0.166***	0.009	0.166***	0.009
Number full-time members	0.119***	0.011	0.119***	0.011
Number part-time members	0.081***	0.009	0.081***	0.008
Major income source:				
Self-employed	-0.148***	0.018	-0.148***	0.013
Investment	-0.060*	0.031	-0.060*	0.031
Government transfers	-0.236***	0.022	-0.236***	0.022
Other	-0.029*	0.016	-0.030*	0.016
Real income	0.027***	0.003	0.027***	0.003
$(\text{Real income})^2$	-9.84xE^{-5}***	0.000	-9.84xE^{-5}***	0.000
Dwelling type:				
Semi-detached	-0.158***	0.012	-0.158***	0.011
Apartment	-0.312***	0.020	-0.312***	0.019
Other	0.012	0.023	0.012	0.023
Rho (ρ)	-0.007	0.020	-0.007	0.020
Number of observations	134,731		134,731	
Censored observations	18,291		18,291	
Uncensored observations	116,440		116,440	
Log pseudolikelihood	$-1.99\ \text{xE}^{8}$		$-1.99\ \text{xE}^{8}$	

Notes: All specifications include year fixed effects, census division fixed effects, transit expansion dummy variables, and collection month dummy variables for 2010-2012. Standard errors are adjusted for census division clusters. Coefficients on dummy variables are adjusted following Kennedy (1981). The coefficient estimates for the carbon tax and price in the log-log model are calculated from $\alpha_2\left(\frac{1}{p+\tau}\right)$ and $\left(\frac{1}{p}\right)\left\{\beta_{2BC}-\alpha_2\left(\frac{\tau}{p+\tau}\right)\right\}$, respectively. Real income is included in $10,000 increments.

***Statistical significance at 1%; ** Statistical significance at 5%; * Statistical significance at 10%.