

APPENDIX: SUPPLEMENTARY MATERIAL

to Steininger, Friedl and Gebetsroither. Sustainability Impacts of Car Road Pricing: A Computable General Equilibrium Analysis for Austria. Ecological Economics

Sensitivity Analysis of Transport Elasticities of Substitution and Transport Sector Investment

Cutting the elasticity of substitution between private car and public transport in half implies hardly any difference in macroeconomic impacts relative to those found in section 4 of the main text, but implies a significant change in public transport demand (which now declines). On the other hand, raising elasticity leads to a more pronounced impact on both private car and public transport demand, and thus environmental impacts.

We further find that model results are not strongly sensitive to changing the elasticity of substitution between transport and other goods in consumption; results hardly change at all.

In testing the sensitivity of labour market results with the model, we find that these react strongest to revenue use, particularly to the way road infrastructure investments are carried out. The larger the share that is devoted to road maintenance, which is more labour intensive, the stronger the net overall increase in labour demand. If road infrastructure investment, on the other hand, is assumed to follow the average production structure of the overall construction sector, employment decreases in all scenarios. Model results presented in the main text assume a 50% share for maintenance within road infrastructure investment, since much of the secondary road network is of poor quality and requires maintenance.

Variables

Factor demand

L total labour demand

K total capital demand

Production

X_j gross production of sector j

K_j capital input in sector j

L_j labour input in sector j

H_j factor aggregate in sector j

A_j, a_{ij} Leontief-input-output-coefficients in sector j

d_j CES-distribution parameter in sector j

s_j elasticity of substitution in production between labour and capital in sector j

Transport

T^p Private car passenger transport

T^{pf} Private car passenger transport production fixed input

T^{pv} Private car passenger transport production variable input (mileage dependent)

T^u Public passenger transport

$A^{pf}, A^{pv}, A_i^{pf}, A_i^{pv}$ Leontief-input-output-coefficients in private car passenger transport

A^{kmp} kilometre input coefficient in private car passenger transport

A_i^u Leontief-input-output-coefficients in public transport

km^p vehicle kilometres driven in private car transport

Foreign trade

EX_j	export of sector j
M_j	import of sector j
P_j	production price of goods aggregate X in sector j
P_j^W	world market price of goods aggregate M in sector j
EX^0, M^0	export and import quantities in sector j in the reference year
e_j	foreign trade price elasticity of demand in sector j

Labour Market

w	nominal wage rate
$\overline{w_{low}}$	lower bound on the real wage rate
p_p	Paasche index of the aggregate price level
u	rate of unemployment

Consumption

C_h	Total Consumption of household type h
X_h^c	Consumption of non-transport goods of household h
T_h	Transport consumption of household h
d_h^C	CES-distribution parameter in consumption for household h
d_h^T	CES-distribution parameter in transport demand for household h
$d_{h,i}^X$	CES-distribution parameter in non-transport consumption for household h
s^C	elasticity of substitution between transport and non-transport consumption
s^T	elasticity of substitution between car transport and public transport demand
s^X	elasticity of substitution between non-transport goods in household h consumption

List of Core Model Equations

Production

$$(1) X_j = \min(H_j/A_j, X_{ij}/a_{ij}) \quad \text{for } i, j = 1, \dots, 35$$

$$(2) H_j = \left(\mathbf{d}_j L_j^{(s_j-1)/s_j} + (1-\mathbf{d}_j) K_j^{(s_j-1)/s_j} \right)^{s_j/(s_j-1)} \quad \text{for } i, j = 1, \dots, 35$$

Transport

$$(3) T^P = \min(T^{pf}/A^{pf}, T^{pv}/A^{pv})$$

$$(4) T^{pf} = \min(X_i/A^{pf}) \quad i = 1, \dots, 35$$

$$(5) T^{pv} = \min(X_i/A^{pv}, km^p/A^{kmp}) \quad i = 1, \dots, 35$$

$$(6) T^u = \min(X_i/A^u) \quad i = 1, \dots, 35$$

Foreign Trade

$$(7) EX_j = EX_j^0 (P_j^w / P_j)^{e_j} \quad \text{for } j = 1, \dots, 35$$

$$(8) M_j = M_j^0 (P_j^w / P_j)^{e_j} \quad \text{for } j = 1, \dots, 35$$

Labour Market

$$(9) \frac{w}{p_P} \geq \overline{w_{low}} \quad \perp u$$

Household Demand

$$(10) C_h = \left(\mathbf{d}_h^C X_h^c^{(s^C-1)/s^C} + (1-\mathbf{d}_h^C) T_h^{(s^C-1)/s^C} \right)^{s^C/(s^C-1)} \quad \text{for } h = h_1, \dots, h_4$$

$$(11) X_h^c = \left[\sum_i \left(\mathbf{d}_{h,i}^X X_{h,i}^c \right)^{(\mathbf{s}^X - 1) / \mathbf{s}^X} \right]^{\mathbf{s}^X / (\mathbf{s}^X - 1)} \quad \text{with } \sum_i \left(\mathbf{d}_{h,i}^X \right) = 1 \quad \text{for } h = h_1, \dots, h_4$$

$$(12) T_h = \left(\mathbf{d}_h^T T_h^p + (1 - \mathbf{d}_h^T) T_h^u \right)^{\mathbf{s}^T / (\mathbf{s}^T - 1)} \quad \text{for } h = h_1, \dots, h_4$$