Congestion, commuting and the tax treatment of company cars

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Overview

- Introduction on fringe benefits and basic tax theory
- Optimal taxation of company cars, labour and commuting trips: theory analysis
- Some numerical results
- Some econometric evidence
  - Who gets a company car, and why?
  - How do company cars affect car ownership?
- Policy implications

Background literature

- Taxation of fringe benefits (Katz and Mankiw (NTJ 1985), Dale-Olsen (LabEcs 2004), Parry and Bento (JEEM 2000), Royalty (JPubEc 2000))
- Evidence on company car provision (van Ommeren et al. (JRS 2006), Wuyts (PhD 2009))
- Fiscal treatment of company cars (Guttierez-i-Puigarnau and van Ommeren (2007), De Borger and Wuyts (2009)
- Company cars, congestion and optimal taxation (De Borger and Wuyts (2009))

Why do we have fringe benefits?

- Productivity increase associated with fringes
- Fringe is worth no more, and probably less, to employee than the retail price of similar items
- Employer may be able to provide fringe at a cost less than the retail price
- Tax avoidance
  - Fringe taxed at less than value to workers, substitute fringe insteat of cash
  - If fringes taxed at more, then shift away from fringes

Criteria for valuing fringes

- Fair market price
  - But employee not free to sell
- Willingness to pay
  - But subjective and unobservable
- Cost to employer
  - Probably easiest to administer

Taxation of fringe benefits: the very basic theory (Katz-Mankiw)

- Firms

$$\max_{w,F} \quad R(F)-w-C(F) \qquad s.t. \quad u\left[w-t(w+\rho F),F\right]\geq u^*$$

- Condition

$$R'+\frac{u_F}{u_w}+\frac{t}{1-t}\left(\frac{u_F}{u_w}-\rho\right)=C'$$

- Set MR plus marginal savings on wages plus tax saving on fringe equal to marginal cost to the firm

Interpretation

- If tax system undervalues the true benefit to the employee, then there is a tax saving on fringes

$$\rho < \frac{u_F}{u_w}$$

- Induce firm to provide more fringe relative to wage
- If the opposite holds, then tax penalty on fringes
- Induce firm away from fringes, despite productivity increase due to fringes

Neutral taxation of fringe

- Reconsider

$$R' + \frac{u_F}{u_w} + \frac{t}{1-t}\left(\frac{u_F}{u_w} - \rho\right) = C'$$

- Neutral tax treatment if

$$\left(\frac{u_F}{u_w} - \rho\right) = 0$$

- Imputed value equals value of fringe to employee
- Alternatively, imputed value equals net cost to the firm

$$\rho = C' - R'$$

- Implication: compensatory component should be taxed, productive element should not be taxed

Implications

- Fringes that may benefit employer
  - Business trips: neutral tax would exclude only benefits to employer (standard hotel OK, luxury for employee not)
- Fringes that do not benefit employer
  - Tax the marginal benefit for employee or tax marginal cost to employer (equal by FOC)
  - Parking: should be taxed
  - Travel tickets for airline employees: tax at long run marginal cost
  - Company cars: tax at cost to the firm, unless productivity effect

Why are company cars worth studying?

- Company cars represent a very large share of new car sales in some countries (Belgium 60%, Netherlands 45%, etc.)
- General belief that most company cars are not productive, neither to the firm nor to the economy
- Relation with transport policies and congestion
- Tax avoidance?
- Status good?
- Fatigue reduction due to better car?

Why do European employers give company cars

- They do not generate the same value to workers as equivalent cash
- Firms can give them at lower cost than workers would pay in the market
- Both firm and worker better off
- Tax system favors fringes
  – Cost of providing fringe lower than providing wage increase
  – Benefit for worker higher than equivalent gross wage increase

Tax treatment of company cars: international overview of criteria

	B	G	F	I	UK	NL
Distance commute (d) **Kms private use(k)**	* d>25km then k=7500 d<25km then k=5000	*				* k<500km (0) k>500km (22% of cat. price)
Horsepower	*		*			
Car price (cat. value)		*		*	*	*
CO2	*		*		*	
Kms reimbursed by firm			*	*		

The tax treatment of company cars in Belgium (2008): employees

- Employees are taxed according to
  - Commuting distance
    - <25 km: assume 5000 km per year
    - >25 km: assume 7500 km per year
  - Fiscal horsepower of the car: assumed benefit in kind rises in fiscal horsepower
- Kilometers assumed times benefit in kind per kilometer for the car yield annual taxable income, added to wage income

Horsepower and benefit in kind

Fiscal horsepower	Benefit per kilometre (€)
4	0,1682
5	0,1975
6	0,2182
7	0,2414
8	0,2633
9	0,2865
10	0,3169
11	0,3474
12	0,3681
13	0,3913
14	0,4059
15	0,423
16	0,4352
17	0,4437
18	0,4547
19 and more	0,4632

The tax treatment of company cars in Belgium (2008): firms

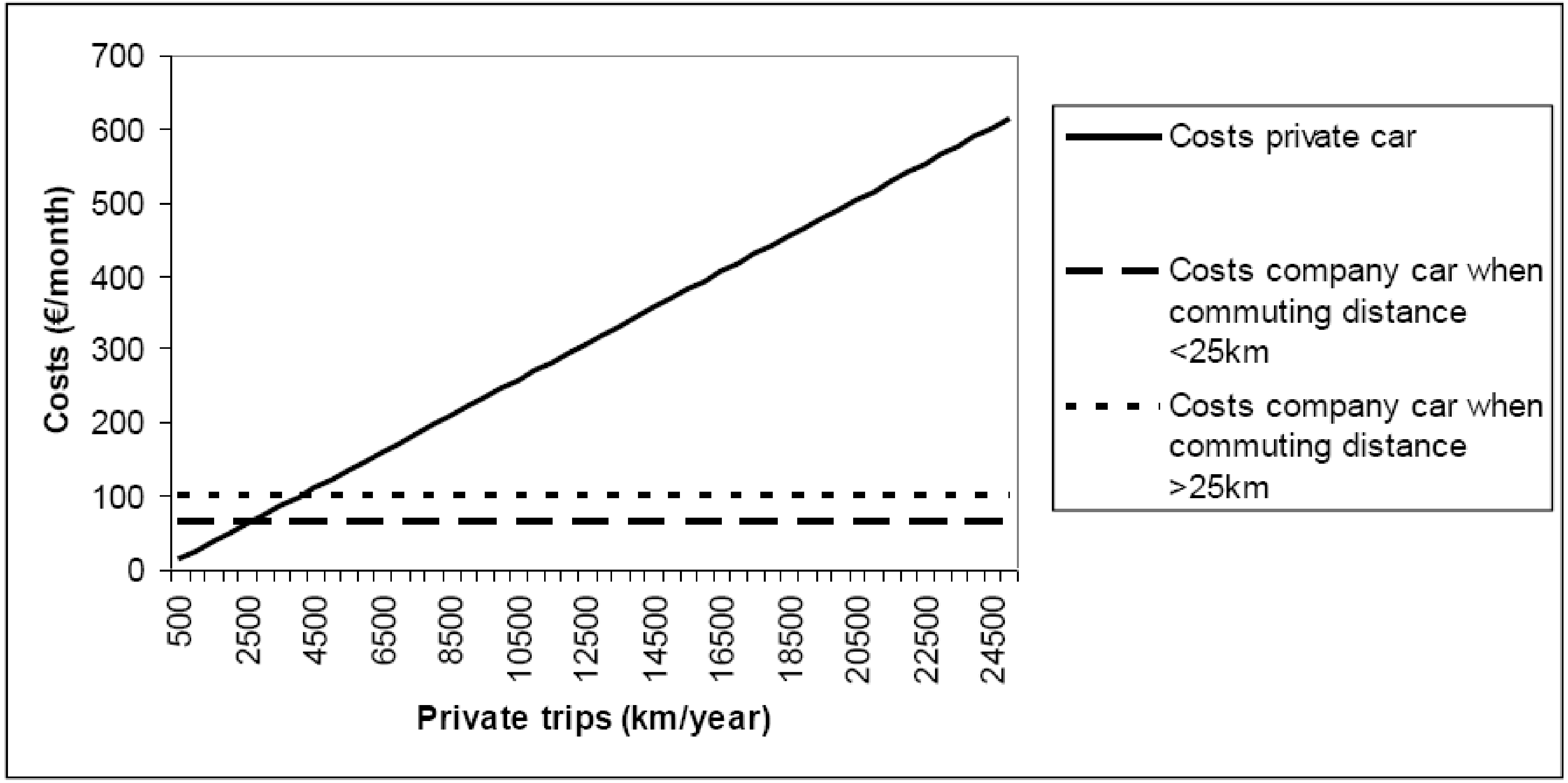
- Financing expenses (leasing, loans, ...) and fuel costs for professional use are 100% deductible
- Costs of insurance, parking, maintenance etc are 75% deductible
- Costs of company cars to the firm when car is for private purposes is fully tax deductible for the firm
- Cars partially used for private purposes are subject to social security taxes, depending on CO2 emissions

Social security contributions

Engine type	Monthly CO_2-contribution (€)
Gasoline	$CO_2 * 9 - 768 \ /12$
Diesel	$CO_2 * 9 - 600 \ /12$
LPG	$CO_2 * 9 - 990 \ /12$
Electrical	20,83€/month
where CO_2 is the CO_2-emission in g/km	

Advantages for employees

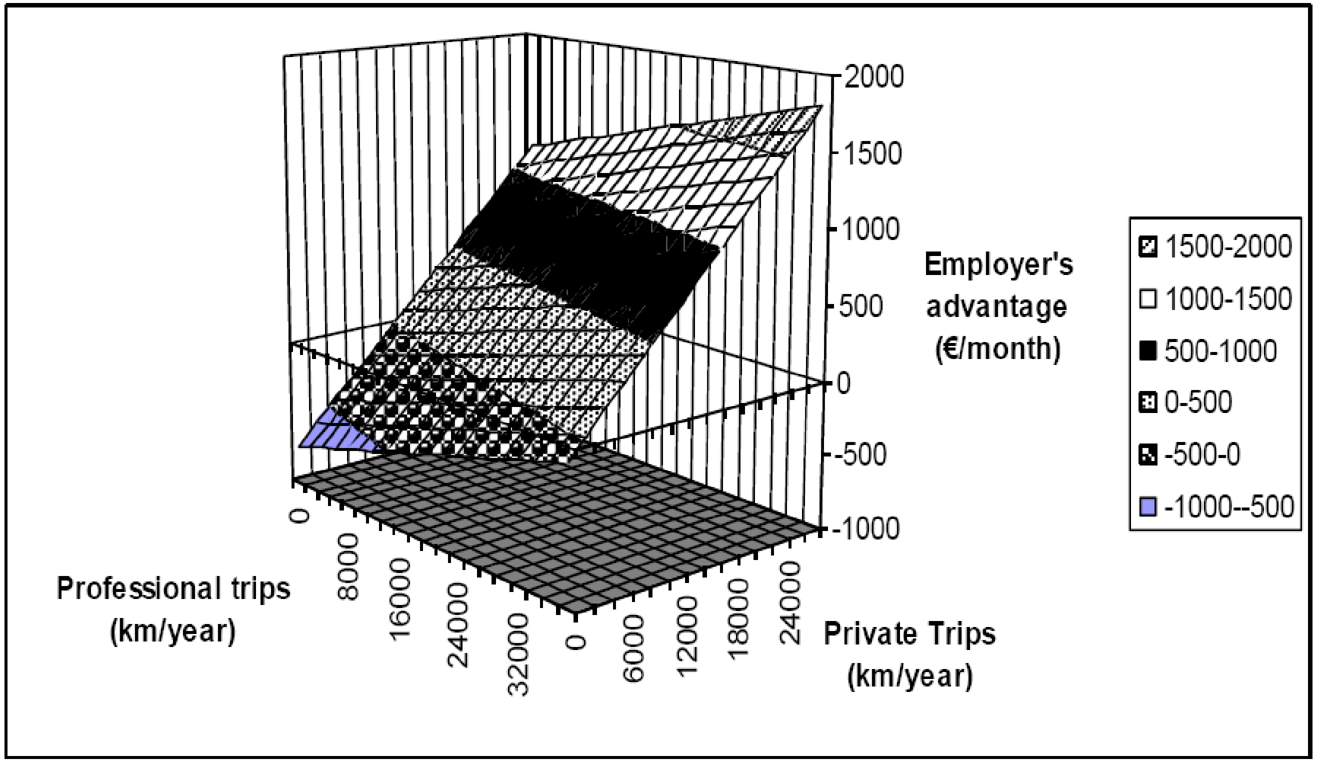
Figure B.3.1: The impact of private trip kilometres on the employee's costs of company cars and private cars



Advantages for employers

Figure B.3.2: The employer's advantage of providing a company car relatively to a monetary equivalent

PANEL A: Surface chart



Part I: Optimal taxation of company cars and commuting trips

- Motivation and literature
- A simple bargaining model of wages and company car provision
- An optimal tax model: wages, transport services and company cars
  - First-best
  - Various second-best exercises
- Numerical illustration with Belgian data
- Policy implications and conclusions

Motivation

- There are strong links between congestion, congestion policies and the labour market
  - Congestion and commuting
  - Remuneration packages (wages, company cars and other fringe benefits) and tax policies
- In Europe, increasing number of company cars as part of renumeration packages

Research questions

- What is the optimal fiscal treatment of wages, commuting transport, and company cars?
- How do optimal congestion taxes depend on the fiscal treatment of company cars?
- How is the optimal fiscal treatment of company cars affected by suboptimal congestion taxes?
- How should we reinterpret optimal tax results on transport derived in models ignoring company cars?

A simple bargaining model (De Borger-Wuyts (2009)): assumptions

- Individual bargaining between employer and employee
- Employees have same reservation utility
- Firm is interested in profit but also in hiring the employee
- Company cars potentially raise worker productivity
- Productivity of company car is observable to the firm
- Worker preference for company car differs between individuals according to a known distribution

A simple bargaining model: assumptions II

- Transport services considered: car, public transport
  - Everyone commutes
  - All employees that recieve company car use it for commuting and they all receive a fuel card
  - Other employees choose between car and public transport
  - Public transport uncongested (rail)
- Tax policy variables considered: labour tax, transport tax, the tax imputed value of company cars

The firm

- The firm compares the profit contribution of worker with and without company car to decide who to offer a company car

$$MP_{nc} = \frac{\partial f(n)}{\partial n} - w_{nc} \qquad MP_c = \frac{\partial f(n)}{\partial n} + m - w_c - \beta$$

- Company car is provided if:

$$MP_c > MP_{nc}$$

$$\Leftrightarrow w_{nc} - w_c - \beta + m > 0$$

- Depends on relative wages offered, productivity of the company car (*m*), and the cost of providing the car (β)

Workers I (no company car)

- Workers not receiving a company car care about consumer good (C), trips by car (T) and public transport (P), and leisure (l)
- Their problem is to

$$\underset{C,T,P,l}{Max}\ U = C + u(T,P) + v(l)$$

$$\begin{aligned} s.t. \quad & w_{nc}(1-t) = C + (\tau + f_T)T + pP \\ & D = l + (1+a)T + (1+\phi)P \\ & T + P = 1 \end{aligned}$$

Impact of taxes and congestion on wages

- Given reservation wage, indirect utility implies:

$$\frac{\partial w_{nc}}{\partial t} = \frac{w_{nc}}{1-t}; \frac{\partial w_{nc}}{\partial \tau} = \frac{T}{1-t}; \frac{\partial w_{nc}}{\partial p} = \frac{P}{1-t}; \frac{\partial w_{nc}}{\partial a} = \frac{T}{1-t}(VOT)$$

- Labour tax, transport tax, public transport fare and congestion all have negative effect on negotiated wage

Workers II (company car)

- Workers receiving a company car care about consumption and leisure

$$\max_{C,l} U = C + v(l) + z + \varepsilon$$

  - ε captures the worker's preference for a company car

- Since all commuting trips are by car by assumption, constraints are

$$w_c - t(w_c + \rho) = C + \tau$$
$$D = l + 1 + a$$

  - ρ is tax imputed value of the company car

Impact of taxes and congestion on wages

- Given reservation utility, we have

$$\frac{\partial w_c}{\partial t} = \frac{w_c + \rho}{1-t}; \frac{\partial w_c}{\partial \tau} = \frac{1}{1-t}; \frac{\partial w_c}{\partial p} = 0; \frac{\partial w_c}{\partial \rho} = \frac{t}{1-t}; \frac{\partial w_c}{\partial a} = \frac{VOT}{1-t}$$

- Labour tax, transport tax and congestion raise wage
- Impact of a labour tax increase rises at higher imputed value of company car
- No effect of public transport fare
- Higher imputed company car value raises wage

Number of workers receiving car I

- Decision rule of the firm can be rewritten

$$MP_c > MP_{nc}$$
$$\Leftrightarrow \varepsilon > \mu$$

- Here $\mu = \left(w_c^{'} - w_{nc} + \beta - m\right)\left(1 - t\right)$
- $w_c^{'}$ is the wage for 'mean company car preference' $\varepsilon = 0$
- Assume a uniform distribution for preferences for company cars over interval (-b, +b)
- Hence density and distribution function are

$$g(\varepsilon) = \frac{1}{2b}; \quad G(\varepsilon) = \frac{\varepsilon + b}{2b}$$

Number of workers receiving car II

- The fraction F of employees that receive a company car

$$F = \frac{1}{2}\left(1 - \frac{\mu}{b}\right)$$

- Show

$$\frac{\partial F}{\partial t} = -\frac{\rho - \beta + m}{2b};\ \frac{\partial F}{\partial \tau} = -\frac{P}{2b};\ \frac{\partial F}{\partial p} = \frac{P}{2b};\ \frac{\partial F}{\partial a} = -\frac{P(VOT)}{2b}$$

$$\frac{\partial F}{\partial \rho} = -\frac{t}{2b};\frac{\partial F}{\partial \beta} = -\frac{1-t}{2b};\frac{\partial F}{\partial m} = \frac{1-t}{2b}$$

- Impact of labour tax depends on tax treatment company car; if preferential treatment higher labour tax raises F
- Less favorable tax treatment company cars, congestion, and car tax have negative effect
- Higher productivity company car and higher public transport fares have positive effect
- Fraction company cars does not depend on employment

Employment I

- Firm solves

$$\underset{n}{Max} \quad f(n) - n\hat{w}$$

- Here $\hat{w} = \left\{(1-F)w_{nc} + F\left[E(w_c) + (\beta - m)\right]\right\}$ is the average net labour cost per employee
- The mean wage for people receiving a company car is given by

$$E(w_c) = w_c^{'} - \frac{1}{1-t}E(\varepsilon \mid \varepsilon > \mu) = w_c^{'} - \frac{\mu + b}{2(1-t)}$$

Employment II

- First order condition implies:

$$f'(n) = \hat{w}; \qquad \frac{\partial n}{\partial \hat{w}} = \frac{1}{f''} < 0$$

- We further easily show

$$\frac{\partial \hat{w}}{\partial t} = \frac{\tilde{w}}{1-t}; \quad \frac{\partial \hat{w}}{\partial \tau} = \frac{T_{tot}}{n(1-t)}; \quad \frac{\partial \hat{w}}{\partial \rho} = \frac{tF}{1-t}$$

- Hence
  - Higher toll reduces employment
  - Higher labour tax reduces employment
  - Higher taxable basis company cars reduces employment (it raises wages)

Optimal taxation

- The government is assumed to maximize welfare, taking account of workers (utility) and firms (profit)
- It faces an exogenous budget restriction
- It has four instruments:
  - labour tax t
  - car transport tax τ
  - public transport fare p
  - the imputed value of company cars for fiscal purposes ρ
- Note: in this simple model, not all four are independent!

The optimal tax problem

- Given exogenous reservation utilities, problem is to chose tax instruments so as to

$$Max \quad f(n) - n\hat{w} \quad s.t. \quad t(n\tilde{w}) + \tau(T_{tot}) + (p - c_P)P_{tot} = \overline{R}$$

- Definitions are

$$\hat{w} = F\left[E(w_c) + \beta - m\right] + (1 - F)w_{nc}$$

$$\tilde{w} = F\left[E(w_c) + \rho\right] + (1 - F)w_{nc}$$

$$T_{tot} = n\left[F + (1 - F)T\right]$$

$$P_{tot} = n - T_{tot}$$

- Note that the difference between the average taxable income for the worker and the average net labour cost to the firm is:

$$\tilde{w} - \hat{w} = F(\rho - \beta + m)$$

First-best optimal tax structure

- If a lump sum tax instrument is available, it easily follows from the first order conditions that the solution is

$$t = 0; \quad \tau = MEC; \quad p = c_P$$

$$MEC = (a')*n*(VOT)*\left[F + (1-F)T\right]$$

- Tax car transport and public transport at marginal external cost
- The labour tax is zero; consequently, the tax imputed value of the company car is undetermined

Overview of second best analyses

- Combinations of three out of four instruments
- Combinations of two instruments
  - What is the impact of a given fiscal treatment of company cars on optimal labour and transport taxes (I)
  - Optimal tax treatment of labour compensation (labour, company car) for given transport policies (II)
  - Optimal transport policies (transport tax, public transport fare) for given labour market policies (III)

Three instruments: summary of results

Tax instruments	**case A: public transport fare is fixed**	**case B: transport tax is fixed**	**case C: labour tax is fixed**
p	p	$c_P + \tau - MEC$	$c_P - t\tilde{w} + \frac{1-\eta}{\eta} \frac{1}{\frac{\partial n}{\partial \hat{w}} \frac{1}{n}}$
τ	$(p - c_P) + MEC$	τ	$MEC - t\tilde{w} + \frac{1-\eta}{\eta} \frac{1}{\frac{\partial n}{\partial \hat{w}} \frac{1}{n}}$
t	$-\frac{(p - c_P)}{\tilde{w}} + \frac{1-\eta}{\eta} \frac{1}{\frac{\partial n}{\partial \hat{w}} \frac{\tilde{w}}{n}}$	$\frac{MEC - \tau}{\tilde{w}} + \frac{1-\eta}{\eta} \frac{1}{\frac{\partial n}{\partial \hat{w}} \frac{\tilde{w}}{n}}$	t
ρ	$\beta - m$	$\beta - m$	$\beta - m$

Three instruments: interpretation

- In all cases, optimal fiscal treatment of company cars requires setting the imputed value equal to the ‘net cost’ of the company car to the firm
- Inefficient taxes on labour, road transport or public transport corrected via two remaining instruments (but not via fiscal treatment company cars)
- Example: toll below MEC implies subsidized public transport and a higher tax on labour

Two instruments I: The effect of a favorable tax treatment of company cars

- Let $\left[\rho-(\beta-m)\right]<0$
- Moreover, for simplicity public transport fare fixed at marginal cost
- Optimal tax rules are

$$\tau = MEC - \frac{t\left[\rho-(\beta-m)\right]}{P + Z\dfrac{\partial T}{\partial \tau}} \quad (Z<0 \rightarrow (\tau > MEC))$$

$$t = \frac{1-\eta}{\eta}\frac{1}{\dfrac{\partial n}{\partial \hat{w}}\dfrac{\tilde{w}}{n}} + \frac{t\left[\rho-(\beta-m)\right]}{\tilde{w}}\left[\frac{T_{TOT}/n}{P} + \frac{\partial T}{\partial \tau}Y\right] \qquad (Y>0)$$

- A more favorable treatment of company cars <u>raises</u> the optimal congestion tax, and it plausibly <u>reduces</u> optimal labour tax

Two instruments II: optimal taxation of worker compensation

- Optimal taxation of (wage, company car) for given transport policies (road tax, public fare=0)
- Optimal tax rules imply (public tax zero):

$$t = \frac{1-\eta}{\eta}\frac{1}{\frac{\partial n}{\partial \hat{w}}\frac{\tilde{w}}{n}} - \frac{[\tau - MEC]}{\tilde{w}}\left[\frac{T_{TOT}/n}{1-\frac{\partial T}{\partial a}a'n(1-F)}\right] \qquad \rho = (\beta - m) - \left(\frac{\tau - MEC}{t}\right)\left(\frac{P}{1-\frac{\partial T}{\partial a}a'n(1-F)}\right)$$

- Too low congestion tax <u>raises</u> optimal labour tax
- Too low congestion taxes <u>raise</u> the optimal imputed tax value of company cars

Two instruments III: optimal transport taxes

- Optimal car and public transport taxes for given labour market policies (labour tax, company car treatment)
- Optimal tax rules:

$$\tau = MEC - \tilde{w}\left[t - \frac{1-\eta}{\eta}\frac{1}{\frac{\partial n}{\partial \hat{w}}\frac{\tilde{w}}{n}}\right] - t(\rho - \beta + m)\left[\frac{(P_{tot}/n)}{P + (1-F)\left(\frac{\partial T}{\partial \tau}/\frac{\partial F}{\partial \tau}\right)}\right]$$

$$p = c_P - \tilde{w}\left[t - \frac{1-\eta}{\eta}\frac{1}{\frac{\partial n}{\partial \hat{w}}\frac{\tilde{w}}{n}}\right] + t(\rho - \beta + m)\left[\frac{(T_{tot}/n)}{P + (1-F)\left(\frac{\partial T}{\partial \tau}/\frac{\partial F}{\partial \tau}\right)}\right]$$

- Preferential tax treatment of company cars:
  - Raises congestion taxes
  - Unambiguously offers an argument for larger public transport subsidies

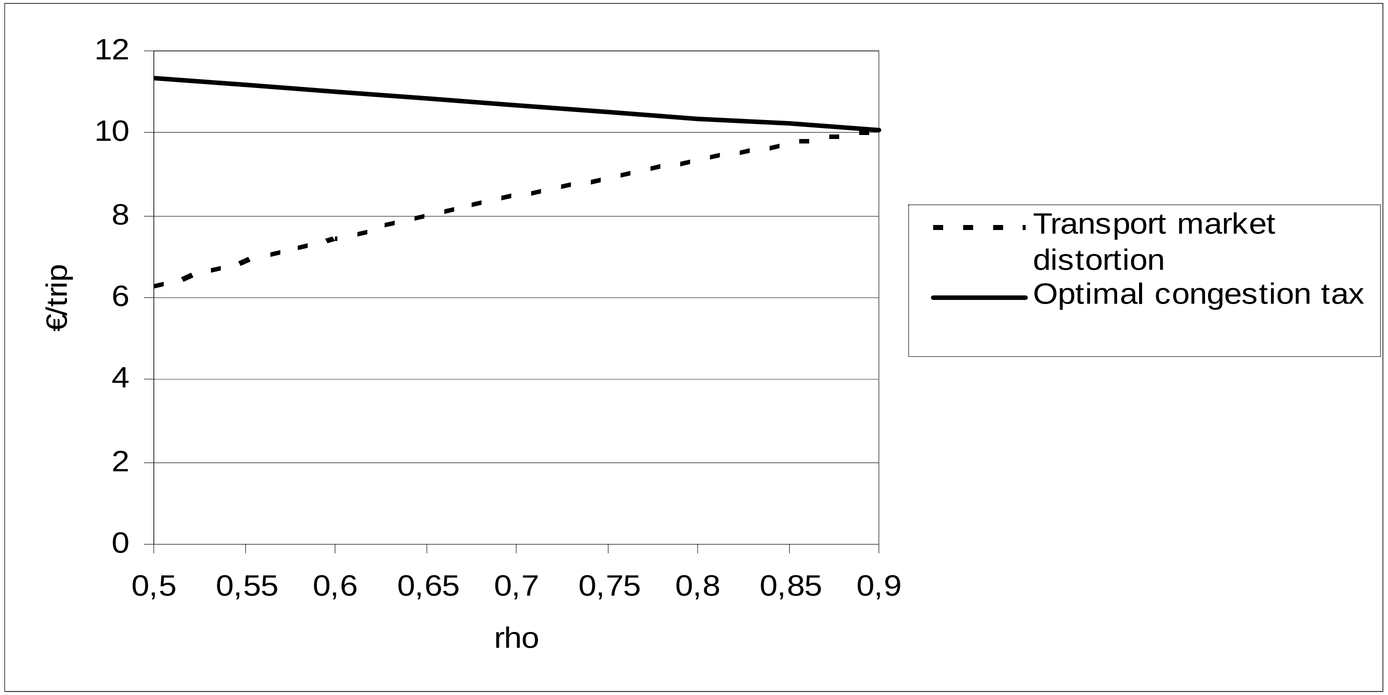
Numerical illustration

- Construct numerical version of the model
- Reference calibration based on
  - Standard one-way commuting trip of 20 km
  - Value of time 7.5 euro/hour
  - Price elasticity car transport demand -.33
  - All employees with company car receive a fuel card
  - Labour cost elasticity -0.6
  - Tax imputed value company car 60%
  - Labour tax 40%
  - Pure congestion toll=0
- Data sources:
  - Belgian official statistics
  - Congestion function Mayeres et al. (2001)

Optimal labour and transport taxes

	Reference	Optimal labour and transport taxes
Welfare (Index)	100	102.05
Congestion tax (Euro/trip)	0.00	11.02
Labour tax (%)	40	34.67
Company cars (%)	20.9	9.05
MEC (Euro/trip)	30.68	9.04

Impact treatment company cars on congestion tax



The fiscal treatment of company cars and congestion

	Reference	**Optimal taxation of labour and company cars**
Welfare (Index)	100	101.33
Tax imputed value of company car	0.60	1.18
Labour tax (%)	40	39.60
Company cars (%)	20.9	0.00
MEC (Euro/trip)	30.68	19.43

Optimal transport policies for given fiscal treatment of company cars

	Reference	Optimal taxation of car transport and public transport
Welfare (Index)	100	100.98
Congestion tax (euro/trip)	0.00	1.04
Public transport fare (euro/trip)	2.07	0
Company cars (%)	20.9	18.49
MEC (Euro/trip)	30.68	22.63

Implications I

- Setting the imputed value for income tax purposes at the real net cost of the car to the firm is optimal under wide variety of circumstances
- A favorable tax treatment of company cars raises second-best optimal congestion tolls
- Previous optimal tax models that ignored the presence of company cars may have strongly underestimated optimal congestion tolls

Implications II

- The absence of congestion tolls implies that the favorable tax treatment of company cars is completely unwarranted
- Adjusting fiscal treatment of company cars alone would have substantial effect on congestion and welfare (about half of optimal congestion tolls at current company car tax treatment)
- Current fiscal treatment of company cars is a convincing extra argument for public transport subsidies

Part II. Wages and company cars: some econometric evidence

- Theoretical setting: extending previous model
- Data on company cars and wages in Belgium
- Empirical specification
- Empirical results
- Implications
- Conclusions
- Based on Wuyts (2009)

Assumptions of the theoretical model

- Jointly model wages, company car provision and ‘type’ of company car
- No productivity effect of company car, but people differ in ability or intrinsic productivity
- Focus on on-the-job trips and commuting transport, ignore non-commuting trips
- Firms and employees negotiate on wages and company car provision
- Introducing randomness, the probability of receiving a company car is obtained by a standard logit or probit model

Wages and spending on company cars, conditional on providing one

- The firm

$$\underset{w_c, G}{Max} \quad \pi_c = f(p) - w_c - \beta G - (d_1 + \gamma_c d_2)k$$

$$s.t. \quad w_c - t(w_c, G, \rho) + Z(G, d_1 + d_2) - (1 - \gamma_c) d_2 k = U(p)$$

- The parameter *p* captures ability or productivity
- The *d*'s capture distances for on-the-job trips (1) and commuting trips (2)
- *k* is the variable cost per trip
- The parameter γ_c gives the fraction of commuting costs paid by the firm
- The parameter ρ reflects the tax treatment of company cars
- The tax function captures potential tax progressivity
- Z(.) is money metric utility of a company car to the individual

Wages and company cars: comparative static results

- Conditional wages rise and spending on a company car declines if the cost of providing a company car of given value rises, and if the tax treatment of company cars for employees becomes less favorable
- Impact of all other parameters is ambiguous and depends on the progressivity of the tax function, the intrinsic value of the company car to the individual and the fiscal treatment of the company car relative to the wage
- Consider, for example, an increase in commuting distance
  - This may raise the intrinsic utility of a larger company car, leading to a better company car and lower wage
  - But it also raises the intrinsic utility of a given company car, requiring less overall compensation; depending on the progressivity of the income tax and the preferential treatment of company cars this may increase or decrease wages and spending on company cars

Wages, conditional on not providing a company car

- Problem is

$$\underset{w_{nc}}{Max} \quad \pi_{nc} = f(p) - w_{nc} - \gamma_{nc} d_2 k$$

$$s.t. \quad w_{nc} - t(w_{nc}) - (1-\gamma_{nc}) d_2 k = U(p)$$

- Solution results in optimal conditional profit contribution

$$\pi_{nc}(p, \gamma_{nc}, d_2, k, t(.))$$

- Partials depend on tax structure

The probability of receiving a company car

- Provide company car if

$$\pi_c(p, d_1, d_2, ...) > \pi_{nc}(p, d_2, ...)$$

- Introduce randomness in, e.g., intrinsic utility company car
- Assuming logistic random term, probability of receiving a company car is

$$F = \frac{e^{\pi_c}}{e^{\pi_c} + e^{\pi_{nc}}}$$

- If company cars taxed preferentially and progressive income taxes then

$$\frac{\partial F}{\partial \beta} < 0; \frac{\partial F}{\partial d_1} > 0; \frac{\partial F}{\partial d_2} > 0; \frac{\partial F}{\partial \rho} < 0$$

Empirical predictions of the model in a cross-section setting

- Probability of receiving company car, type of company car and wages are simultaneously determined
- Important determinants include
  - Progressivity of the income tax (average, marginal tax rates)
  - Commuting distance
  - Employee characteristics
  - Firm characteristics

Company cars in Belgium: summary statistics large survey 2006

- Sample size about 65000
- About 20.9% have a company car, 79.1% do not
- Information on relations between
  - Wages
  - Company cars: incidence and type of car
  - Commuting distances
  - Position in the firm
- Information on sector characterisics, private versus public sector, etc.

Company cars and position in firm

	Yes (%)	No (%)
Top management	55.1	44.9
Middle management	39.4	60.6
Professional	25.3	74.7
Lower staff	9.6	90.4
Administrative	2.8	97.2
total	20.9	79.1

Company cars (%) and labour category

Worker	5,8
Employee private sector	15,6
Management private sector	33,6
Public sector	2,9

Company cars and wages

	Yes	No
Mean gross wage (euro/month)	3773	2503
Median gross wage (euro/month)	3421	2278

Company cars and commuting distance

	Yes	No
Mean distance	36,34	22,87
Median distance	27,34	15,20

Mean wages and type of company car

No company car	2503
Small car (low fiscal HP)	2818
Medium car (medium fiscal HP)	3829
Large car (high fiscal HP)	5046

Commuting distance and type of company car

No company car	22,87
Small	34,38
Medium	38,14
Large	38,15

Commuting distance, position in firm and % company cars

Distance	Top Mgmt	Middle Mgmt	Profess.	Staff	Admin.
0-10	42	28	18	5	2
10-20	52	34	20	8	3
20-30	58	41	27	9	3
30-40	61	42	29	13	4
>40	69	51	35	22	5

Mean wages and commuting distance

Distance	Top Mgmt	Middle Mgmt	Profess.	Staff	Admin.
0-10	4549	3324	2834	2218	2125
10-20	4769	3405	2813	2299	2153
20-30	4866	3515	2879	2344	2204
30-40	5101	3539	2933	2360	2175
>40	5410	3705	3031	2460	2210

Empirical model

- Two models estimated
  - Simultaneous equation model of wages and the probability of having a company car
  - Tobit single equation model of the share of the value of the company car in total compensation
- Explanatory factors
  - Personal attributes: sex, education, age, level in the firm
  - Firm attributes: sector, private or public, size
  - Transport attributes: commuting distance

Wages and company car provision

Table 3: Simultaneous estimation of cash income and company car probability

Adj. R^2 of the first stage OLS =	0,4466	Pseudo R^2 of the first stage Probit =	0,4250
Adj. R^2 of the second stage OLS =	0,4466	Pseudo R^2 of the second stage Probit =	0,4245

Independent variables	Dependent variable = CASH	Dependent variable = CAR
CAR	-44,147**	
CASH		0,000754**
DISTANCE	1,730**	0,004933**
SEX	167,153**	0,322539**
EDUCATION		
highschool 3 years	128,338**	
highschool 4 years	234,979**	
University	374,837**	
omitted: secundary		
AGE	25,922**	-0,013797**
PUBLIC		-0,959107**
SECTOR		
Agricultural sector	98,450*	0,400979**
industrial sector	95,257**	0,431103**
service sector	44,248**	0,757340**
omitted: non-profit sector		
SIZE		
50<employees<500	28,685**	-0,145522**
500<employees	85,763**	-0,441054**
omitted: Employees<50		
HIERARCHY		
top&middlemanagement	481,885**	1,115608**
professional collaborator	141,293**	0,863618**
staff carrying out the work	34,968**	0,597925**
omitted: Administrative personnel		
FULL	403,587**	
OTHER_FRINGES		
pension advantages	118,792**	0,316440**
health insurance	62,752**	0,270406**
travel benefits	-122,694**	-1,35269**
CONSTANT	-198,637**	-2,609967**

Note that significance at the 0,01 and 0,1 level is denoted by ** and *, respectively

Interpretation I: Interaction wages-company cars

- Workers with a company car receive lower wages
  - Consistent with simple theoretical story
- Higher wage implies higher probability of receiving a company car
  - Higher wage leads to substitution in compensation package
  - But progressive taxes and preferential treatment company cars makes fringe more attractive

Interpretation II: Effect of exogenous factors

- Commuting distance raises probability of company car and raises wages
- Men have higher wages and receive more company cars than women
- Wages rise in education and age; older people get fewer company cars
- Wages and company car provision rises in hierarchy in the firm
- Other fringes raise probability of a company car, except travel benefits
- Larger firms pay more but have smaller probability of providing workers with a company car

Share of company cars in compensation

Table 4: Tobit regression of the share of the company car in the compensation mix

Log likelihood= -8860,67

Number of observations = 48151
Left-censored observations = 35657
Prob> χ^2 = 0,000
Pseudo R² = 0,517

	Coeff.	Std. err.	t	P>|t|	95% conf. interval		VIF
ATR	0,305299	0,022904	13,33	0,000	0,260407	0,350190	1,51
DISTANCE	0,000988	0,000056	17,64	0,000	0,000878	0,001098	1,07
SEX	0,083614	0,004130	20,25	0,000	0,075520	0,091708	1,27
EDUCATION							
highschool 3 years	0,006091	0,004973	1,22	0,221	-0,003656	0,015837	1,68
highschool 4 years	0,011717	0,006005	1,95	0,051	-0,000053	0,023488	1,51
University	0,007555	0,005404	1,40	0,162	-0,003037	0,018147	1,87
omitted: secundary							
AGE	-0,001169	0,000230	-5,07	0,000	-0,001620	-0,000717	1,25
STATUS (occupational status)							
White collar	0,187493	0,015336	12,23	0,000	0,157434	0,217551	4,13
blue collar	0,078995	0,017682	4,47	0,000	0,044338	0,113652	3,20
public service, statutary	0,031227	0,019036	1,64	0,101	-0,006084	0,068539	2,16
omitted: public service, contractual							
SECTOR							
Agricultural sector	0,010370	0,036264	2,86	0,004	0,032625	0,174780	1,02
industrial sector	0,117992	0,006914	17,06	0,000	0,104440	0,131544	2,29
service sector	0,166834	0,006494	25,69	0,000	0,154105	0,179563	2,28
omitted: non-profit sector							
SIZE							
50<employees<500	-0,035648	0,004442	-8,03	0,000	-0,044354	-0,026941	1,59
500<employees	-0,080351	0,004740	-16,95	0,000	-0,089641	-0,071061	1,79
omitted: Employees<50							
HIERARCHY							
top&middlemanagement	0,285486	0,010495	27,20	0,000	0,264916	0,306057	3,16
professional collaborator	0,219371	0,010434	21,03	0,000	0,198921	0,239821	2,90
staff carrying out the work	0,160437	0,010339	15,52	0,000	0,140173	0,180700	3,02
omitted: administrative personnel							
FULL	0,032123	0,008895	3,61	0,000	0,014688	0,049558	1,18
OTHER_FRINGES							
pension advantages	0,063086	0,004822	13,08	0,000	0,053635	0,072538	1,81
health insurance	0,045615	0,004686	9,73	0,000	0,036430	0,054800	1,58
travel benefits	-0,262245	0,003874	-67,69	0,000	-0,269838	-0,254652	1,08
CONSTANT	-0,782821	0,022385	-34,97	0,000	-0,826695	-0,738946	

Interpretation

- Commuting distance increases share
- Share higher for males and higher educated workers
- Share lower for large firms
- Share higher for more other fringes, except travel benefits
- Share higher for higher average tax rates

Part III. Company cars: distortions on car ownership

- Based on Guttierez-i-Puigarnau and Van Ommeren (2007)
- Assumptions of the model
- Simple theoretical model
- Empirical implementation
- Empirical results
- Estimates of the welfare cost of company cars

Assumptions I

- Competitive labour and car markets
- Market value car is units car times price per unit
- Maximum one company car per household
- Company car has more units than other household cars (empirically checked)
- Focus on deadweight loss taxation via change in household demand for the most valuable car in household

Assumptions II

- Company cars raise private car travel demand
- These welfare losses are relatively small compared to changes due to ownership, hence ignore
- Linear income tax, constant marginal tax rate
- Income tax on company car is a function of purchase price of the car
- Initially ignore VAT, so firm and worker would pay the same price for car

Theory

- Exogenous price *p* per car unit *x*
- Utility $U(x, m(1-\tau) - px)$
- Pre tax income *m*, tax rate τ
- Consider competitive firm; it offers x^c, m^c
- If car unit is valued at ρ by the tax system, problem is to

$$\underset{x^c, m^c}{Max} \quad R(x^c) - (m^c + px^c)$$

$$s.t. \quad U(x^c, m^c - \tau(m^c + \rho x^c)) = U(x, m(1-\tau) - px)$$

Implications

- Optimal wage and car units satisfy

$$mrs_{x,y} = p - R_{x^c} - \tau(p - \rho - R_{x^c})$$

- This is not distortionary, for a given income tax rate, if

$$\rho = p - R_{x^c}$$

- Data for European countries suggests it is distortionary in many countries
- Estimate impact on car ownership

Estimating the distortion in car ownership

- Ignore impact on car use
- Demand for car units derived from utility maximizing behavior
- Depends on price per car unit, after tax income and household characteristics

$$x_i = f(p_i, m_i; s_i)$$

- Here

$$p_i = p$$
$$p_i = p - \tau(p - \rho)$$

for standard private car and company car, respectively

Demand specification

- Let demand be additively separable as follows

$$x_i = h(p_i) + k(m_i) + j(s_i)$$

- The difference in car units for people without company cars relative to others is:

$$\Delta x_i = x_i - x_i^c = h(p) - h(p^c) + k(m_i) - k(m_i^c) = \Delta\overline{x} + k(m_i) - k(m_i^c)$$

- First term is ‘average’ change in demand for car units, when controlling for income changes

Welfare effects

- Assume no other distortions, so measure change in consumer surplus, assuming changes in car demand are proportional to changes in car value

$$\Delta W = \frac{1}{2}(\Delta p)(\Delta x) = \frac{1}{2}(\frac{\Delta p}{p})(\alpha \Delta V), \quad \Delta V = \alpha p(\Delta x)$$

- Econometrically estimate average tax induced change in the market value of the first car in the household, ΔV
- Use calculated averages for other inputs in welfare formula

$$\frac{\Delta p}{p} = \frac{\tau(p-\rho)}{p} = 0.35; \quad \alpha = 0.4$$

Table 3. *Effects on the Value of the Most Expensive Car in the Household (1990–1993 PAP)*

Variables	[1] *Employees*	[2] *Employees*	[3] *Employees + self-employed*
Company car	7,112 (590.6)**	3,933 (616.3)**	
Company car × employee			3,589 (635.4)**
Self-employed			3,502 (253.0)**
Car used for business purposes		366.3 (250.6)	–46.83 (232.5)
(Business km)/1,000		228.8 (35.80)**	304.6 (27.97)**
(Business km)²/100,000,000		–69.13 (69.68)	–181.1 (49.64)**
Car ownership time spell in log/10	–49.24 (20.26)**	–50.19 (19.81)**	–54.80 (18.60)**
Income in log	2,335 (198.0)**	1,918 (197.1)**	2,510 (183.0)**
Income – unknown	1,889 (256.2)**	1,796 (251.1)**	1,962 (235.7)**
Work > 38 hours/week	113.0 (223.4)	42.53 (218.7)	
Female	781.3 (218.5)**	825.1 (213.9)*	895.7 (196.0)**
Age 25–30	–377.3 (350.5)	–325.2 (343.4)	–640.3 (350.5)*
Age 30–40	–294.6 (327.3)	–297.7 (320.9)	–594.6 (324.6)*
Age 40–50	1,061 (335.8)**	971.6 (329.2)**	751.1 (331.2)**
Age 50–60	2,268 (368.6)**	2,200 (361.3)**	1,895 (359.2)**
Age 60– 65	3,453 (857.2)**	3,518 (839.7)**	2,577 (653.6)**
Age >65	3,218 (2,331)	3,475 (2,281)	1,850 (954.5)**
Constant	–13,344 (1,987)**	–9,495 (1,974)**	–15,252 (1,880)**
Year controls (4)	Included	Included	Included
Residence province controls (12)	Included	Included	Included
Work province controls (12)	Included	Included	Included
Wald-statistic (β_ company car × employee – β_ self-employed)			0.366
Chi-squared(1)			0.545
Log likelihood	–12,739	–12,597	–14,481
No. observations	8,203	8,203	9,593

Notes: Value of the most expensive car in euros; number of business kilometres per year; time spell of car ownership in years. The reference category for age is '18–25'. **, * – indicate that estimates are significantly different from zero at 0.05 and 0.10 level. Standard errors are in parentheses.

Results

Table C4. *Marginal Effects on Household Total Value of Cars (1995–2006 DNB)*

Variables	Fixed-effects model
Company car	14,066 (1,196)**
Children 1	2,729 (766.8)**
Children 2	–773.5 (1,024)
Children ≥ 3	–4,632 (1,426)**
Net household income in log	1,173 (300.5)**
Head permanently employed	–1,055 (1,117)
Head working hours	440.0 (185.4)**
(Head working hours)^2	–7.099 (3.321)**
Head working hours unknown	2,597 (2,831)
(Head job duration)	–61.07 (82.12)
(Head job duration)^2	6.026 (2.224)
Head job duration unknown	6,487 (2,550)**
(Head employment duration)	–100.83 (70.20)
(Head employment duration)^2	3.345 (1.547)**
Ownership of residence	3,994 (1,267)**
Residence density – very low	2,234 (3,269)
Residence density – low	4,419 (3,333)
Residence density – moderate	2,272 (3,220)
Residence density – high	535.4 (3,545)
Two-earner household	689.5 (613.9)
Head female works full-time	1,667 (3,766)
Year controls (12)	Included
Residence region controls (5)	Included
Adjusted R-squared	0.82
No. observations	5,293
No. households	1,187

Notes: Value of total value of cars in euros; number of working hours per week according to the contract; current job duration (in years); employment duration in the labour market (in years). The reference category for residence density is 'very high'. **, * – indicate that estimates are significantly different from zero at 0.05 and 0.10 level. Standard errors are in parentheses.

Results

- Company car increases the value of the car of about 10000 euro
- Annual welfare cost per company car is about 700 euro, some 8% of the annual cost of the company car

Overall conclusions

- The preferential tax treatment of company cars implies major distortions
  - On commuting transport market
  - On the car market
- Preferential tax treatment cannot be justified given current transport policies