Price regulation between responsibility and moral. The road urban pricing example

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Summary

The interest in the pricing tool, which is associated with the resistance to the pricing regulation, leads us to test whether a road urban pricing is perceived as unfair and if compensation, and what kind of compensation, received a better support.

As we have previously studied in the case of a scarce seats in a train and in a car park, we will test different allocation principles by quantity, queuing to evaluate if they received more support than a pur pricing regulation mechanism. We also test different principle of compensation. We use an ordered probit model.

Our results show that regulation by means of price or quantity are judged as unfair but the urban road pricing is perceived as less unfair if it allows to make people responsible to pollution or to build new road. Our result underline that compensation can be moral or ethic and can be dissociated to the other form of compensation and takes the role of a reference transaction. They also provide with lights on the socioeconomics impact on the fairness perception of the regulation or compensation principles.

Key-words : justice, behaviour, urban pricing.

Classification J.E.L. : D63, D78, L91.

Introduction

To fight against congestion, since almost three years, the city of Stockholm has experimented a urban road pricing system to enter to the city centre (Eliasson and Mattsson, 2006). Since the work of Dupuit, (1849), Pigou, (1920), Vickrey, 1963), transport economics has established that price is an efficient means of allocating a scarce good or service.

This use of prices to eliminate excess demand can however be perceived as unfair when the exchange fails to take account of the "reference transaction" defined by Kahneman, Knestsch, and Thaler (1986), and detailed by Vaidyanathan and Aggarwal (2003) and Bolton and *al.* (2003).

In the transport sector, the reference transaction can be a moral rule, which gives a car park or train seat priority for person with a weak mobility and a traffic regulation by a queuing rule Raux and al. (2009).

These authors have also pointed out the compensation impact on the perception of the fairness of the new pricing measure. Compensation can be used to increase the new measure fairness. Nevertheless, Young (1995) notices that this method applicability is quite complicate. Furthermore, Zajac (1995) and Konow (2003) show that compensation must be design in relation with economic efficiency.

Nevertheless, Frey and Oberholzer-Gee (1996) critic both compensation and pricing regulation. For example, they show that direct transfer can be associate to a bribe. Frey, Oberholzer-Gee and Eichenberger (1996) point out the incompleteness of the compensation mechanism because it neglects moral principle influence.

The interest in the pricing tool, which is associated with the resistance to the pricing regulation, leads us to test whether a road urban pricing is perceived as unfair and whether compensation, and what kind of compensation, received a better support.

Is allocation of scarce goods by the means of prices always perceived as unfair by the population, and if so, to what extent? Analysing how these fairness judgements develop is particularly important in order to get an understanding of how the public attitudes may evolve within the framework of a public decision-making process regarding the regulation of scarce resources. These attitudes are an unavoidable part of this decision process and influence the final political outcomes.

With an ordered probit model, we will test different allocation principles by quantity, queuing to evaluate if they received more support than a pur pricing regulation mechanism. We will also test different principle of compensation.

Our results show that regulation by pricing or quantity are perceived as unfair but the urban road pricing is less unfair if it allows to make people responsible to pollution or build new roads. They also point out a « moral » or « ethic » dimension of compensation which is strongly different from the other and which becomes a reference transaction. Our results provide further lights on the impact of personal characteristics on fairness perception of pricing allocation rules and compensation.

Based on a survey of the literature, a series of questions are formulated, which are later expressed in a questionnaire. The methodology used in the study is then presented, with a survey, which relates to situations in which the supply of city centre access is scarce. Last, the main findings are presented and discussed.

Literature survey and hypotheses

Frey and Pommerehne (1993) show that pricing allocation rules are perceived less fair than an administrative procedure where the administration made the allocation based on its own judgement but fairer than the allocation procedure by lottery.

On the opposite, Taylor et al. (2003) found that in the absence of a system of pricing, the lottery is generally more socially acceptable than queues. According to the economic theory of bureaucracy (Niskanen 1971) the bureaucratic procedure is considered to be intrinsically particularly unfair.

Raux and *al.* (2009) moderate the perception differences between these tools and show that regulation by price remains massively rejected.

So the first question relates to the persistence of the rejection of the use of price to allocate scarce resources.

Question 1 : allocation by quantity, by lottery or by the administration, are they perceived as fairer than the allocation by price to solve a problem of exceed demand?

Vaidyanathan and Aggarwal (2003) and Bolton and *al.* (2003) results show that an additional supply which justifies the price increase can modify negative attitudes to allocation by prices.

Raux and *al.* (2009) display that accompanying a price increase with an additional service or infrastructure may reduce opposition in the case of some goods in the same way as the right to influence the use of revenue.

Question 2: can providing additional supply, which is related to the price increase, makes this increase more acceptable?

The question of compensation naturally arises. It has been established since the work of Hicks (1939) and Kaldor (1939) that in the context of a standard cost-benefit analysis, hypothetical compensation can justify a policy as long as the benefits accruing to the winners exceed the losses borne by the losers. So, in principle, effective compensation could counterbalance the rejection of the mechanism of allocation by pricing. Moreover according to Zajac (1995) the individuals expect to be insured by society against economic loss brought about by economic changes.

Frey and Oberholzer-Gee (1996) critic both compensation and pricing regulations. They identify four rejection reasons: direct transfer is assimilate with a local bribe; compensation can be a signal of the facilities risk; compensation can be seen as the acceptance of the *statu quo* even if the measure is unfair; compensation underestimates that people want to do their social duty.

Frey, Oberholzer-Gee and Eichenberger (1996) point out the incompleteness of the compensation mechanism because it neglects moral principle influence. When public moral takes advantage, monetary compensation has a weaker level of acceptance for the nuclear waste facilities because the monetary reward deprives individual of altruist feelings.

Question 3: does offering compensation which belongs to the same "dimension" to those whose demand has been removed improve acceptance of allocation by prices?

Based on Zajac's results (1995), it's possible to identify different principle of positive fairness. For example, there are some economic rights which mean that nobody can receive less than a minimum amount to cover the basic economic needs (Konow, 2003). Under some circumstances, no access to basic economic rights is judged as unfair.

To refer to Rawls' principle of fairness (1971), Raux and Souche (2004) have built a theoretical framework for analysing the acceptability of pricing changes in the transport sector. The framework makes reference to economic efficiency (efficiently managing demand), spatial equity (guaranteed access), horizontal equity (the user pays principle) and vertical equity (the welfare of the most underprivileged). This framework has been validated by considering an example of an urban toll in Lyon.

Question 4: Can we identify different dimensions of fairness?

In relation to rules of allocation, in particular allocation by pricing, it is important to establish whether an individual's economic situation influences his/her attitude. According to Sah (1987) the poor would gain more from rationing and the rich from the market.

For Eliasson and Mattson (2006), several categories will be affected by the urban road pricing implementation. The car users who live outside the city and who come to the city centre will be constraint by the new system. Always based on the Stockholm case study, Armelius and Hultkrantz (2006) show that the middle income classes who use car and live in the Stockholm suburbs, are the most unfavourable classes because of the road pricing. For Eliasson and Mattson (2006), the urban road pricing impact will be as stronger that both people income and possibility of adaptation will be weak. This possibility of adaptation depends on trip purpose. The working purpose gives the least flexibility. One another category will be penalised by the pricing: men who live in the city centre with high income and who make a lot of trips by car in the central area.

Question 5: Do attitudes vary according to the economic and social situation of individuals?

The above questions have been the subject of an empirical investigation using the questionnaire and survey, which we shall now describe.

Methodology, survey and econometrics model

The survey and questionnaire

The survey was conducted in January 2003 and involved face-to-face interviews by professional pollsters of a sample of 400 persons who were representative of the inhabitants of the Lyon conurbation (population 1.2 million). The sample was randomly selected on the basis of quotas (residential location, age groups, gender and occupation status (working/non working)).

A story was recounted. Although fictional, this story described situations, which were grounded in reality. Because of a situation of congestion in the city of Lyon, it was necessary to implement an urban road pricing to enter and move in the city. Various solutions for solving excess demand were proposed independently of the others and respondents were asked if they found each of the solutions very unfair, essentially unfair, essentially fair, very fair.

The allocation rules which were tested are based on the questions listed in the previous section and are set out in[1]:

[1] The full questionnaire (in French) can be obtained from the authors.

- The “queuing” rule: in the Lyon case study, the road was allowed to fill on a “first come, first served” basis.
- The regulation by quantities is based on two variants: an allocation by quantity fixed by the “administration” (this consisted of allowing the car to drive only three days per week, between Monday and Friday) or by a “lottery” (this consisted of a lottery of even numbers pair or impair).
- The “peak period pricing with constant supply” rule: the proposal to cope with excess demand was to pay an additional charge (during peak hours or to be responsible to congestion).
- The “peak period pricing with additional supply” rule: that is to say new road financed by road pricing revenues.

The compensation rules which were tested are based on the questions listed in the previous section and are set out in:

- The “pricing compensation” rule: the proposal was to compensate those who were travelling based on income criteria (for people with less income), on the residential location inside the pricing area, on the professional activity (for professional who need to move for their work. No pricing for people who practise carpooling.
- The “moral” rule: this consisted of giving priority to persons with reduced mobility or to emergency vehicles.

The econometrics model

The responses in the survey can be considered as ordinal since they can take on the values 1 (very unfair), 2 (unfair), 3 (fair) and 4 (very fair). Thus the statistical model applied was an ordered probit model (or the “proportional odds model”, see McCullagh 1980).

If Y is the response factor with K levels, the model is written:

$$P\left(Y \le k \middle| x\right) = \Phi\left(\theta_j - \beta' x\right)$$

where Φ is the cumulative normal function,

$\theta_0 = -\infty < \theta_1 < \cdots < \theta_K = \infty$ are the breakpoints,

x is the vector of the explanatory factors and β the vector of the unknown parameters.

Since the coding of the responses varies from 1 (very unfair) to 4 (very fair), a positive value for a variable coefficient indicates a tendency to consider the proposed rules as fair.

Personal characteristics include gender, age in five groups (1=under 30 years, 2=between 30 and 39 years, 3=between 40 and 49 years, 4=between 50 and 59 years, 5=60 years and over), driving licence (yes/no), educational level in five groups (1=no diploma, 2=lower certificate, 3=A-levels, 4=graduate level, 5=post-graduate level), occupational in seven groups (2=small businesses and retailers, 3=senior managers, 4=middle managers, 5=office workers, 6=industrial workers, 7=retired, 8=non-working), residential location in two levels (in and outside the pricing area), transport mode (1=public transport, 2=car user ; 3=other), work location in three levels (1=work in the pricing area, 2=work outside the pricing area, 3=no concerned). Income is a sensitive question with a high non-response rate and this is here circumvented by educational level and occupational level which provide a proxy for income.

Results and discussion

We distinguish results on the pricing regulation perception and those on compensation. First an overview of the fairness perception of allocation rules is given. Then we explore the influence of socio-economic characteristics. We use the same method for the fairness perception of compensation rules. This is followed by the discussion of these results.

Results for allocation rules

a) Overview

The Table 1 gives an initial overview of differences in fairness perception of the different allocation rules for urban road pricing[2].

Table 1: Perception of allocation rules in the urban road pricing case study

Reference: « congestion »
Coefficients:

	Value	Std. Error	t value
3days	0.15968858	0.07902652	2.0206962
even numbers	0.02881699	0.07959328	0.3620531
new road	0.13812561	0.07890641	1.7504993
pollution	0.22802937	0.07890596	2.8898878
queuing	0.14910461	0.07947787	1.8760520

Intercepts:

	Value	*Std. Error*	*t value*
0|1	*-2.8003*	*0.1628*	*-17.2012*
1|2	*-0.2368*	*0.0574*	*-4.1238*
2|3	*0.5692*	*0.0582*	*9.7834*
3|4	*1.6625*	*0.0671*	*24.7852*

Residual Deviance: 5685.80
AIC: 5703.80

In the case of urban road pricing, the regulation by congestion pricing on peak hours is the unfairest principle (« congestion »). As showing by the independent test (Annex 1), responses on a regulation by peak pricing or rationing based on even numbers are the same (critics value 3.84 and probability 0.71).

On the opposite, a car payment to be responsible to pollution is the fairest principle. As showing by the independent test, answers to this question are identical to those which consist to pay a tariff to build new road, to keep traffic increase, to ration car using in allowing car traffic three days *per* week (critics value 7.81 and probability 0.66).

b) Two sub models: working *versus* no working

Using a the likelihood ratio, we want to check if we can estimate separately a model for working people and a model for no working people (retired and non-working)[3].

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[2] Reference principle is « congestion », question V26 : « To responsabilize car user for congestion, it is necessary to pay a road pricing during peak hours» . As its principle is rejected the more, we take it as the reference principle.

[3] The constraint model (Model I) is an estimation for all the sample, that is to say to estimate 30 coefficients. The non constraint model correponds to a separte estimation for working people (Model II) and non working one (Model III). The Ho hypothesis is the stability (no distinction between working and no working models).

The hypothesis Ho corresponds to the stability (no distinction between working and no-working models). The likelihood ratio gives a *p-value* near zero, so the null hypothesis of stability of coefficients is rejected. Under these circumstances, we can separate estimations for working and no-working (Annex 2).

Next we tested whether fairness perception depends on respondents' personal characteristics.

(i) The economic and social characteristics for working model

1) General model for working people

The Table 2 presents the general model for working.

Table 2 : General model for regulation (working)

Coefficients:	Value	Std. Error	t value
sexefemale	-0.02731752	0.06486946	-0.4211152
dri.licenseno	-0.06312602	0.11388149	-0.5543132
age2	-0.02948624	0.08362168	-0.3526148
age3	-0.13865003	0.08852167	-1.5662835
age4	-0.19436280	0.10357345	-1.8765698
age5	-0.39073118	0.26470921	-1.4760770
education2	-0.20913559	0.14257388	-1.4668577
education3	-0.12795107	0.14900582	-0.8586985
education4	-0.08626559	0.15473275	-0.5575135
education5	-0.26841060	0.16214478	-1.6553762
occupation3	0.45763278	0.12531068	3.6519853
occupation4	0.15857299	0.12822637	1.2366645
occupation5	0.39097110	0.11630273	3.3616674
occupation6	0.09770331	0.14450492	0.6761244
employment2	0.07639721	0.06513467	1.1729116
employment3	-0.36088365	0.14246896	-2.5330687
mode2	-0.24136696	0.09425795	-2.5607067
mode3	0.11134157	0.10500355	1.0603600
residenceout zone	-0.03621285	0.06777871	-0.5342807
3days	0.13483707	0.10151359	1.3282662
even numbers	0.04780387	0.10244952	0.4666091
new road	0.03721631	0.10164425	0.3661428
pollution	0.16870615	0.10145438	1.6628769
queuing	0.12788237	0.10195067	1.2543553
Intercepts:			
	Value	*Std. Error*	*t value*
0|1	*-3.2492*	*0.3479*	*-9.3397*
1|2	*-0.2517*	*0.2016*	*-1.2487*
2|3	*0.5377*	*0.2018*	*2.6641*
3|4	*1.5543*	*0.2050*	*7.5830*
Residual Deviance:	*3431.658*		
AIC:	*3487.658*		

2) Simplifying the socio-economic characteristics for working model

Next is tested whether some simplification could be made when considering the personal characteristics. After several trials, the following null hypotheses are tested: no influence of gender, driving licence, residential location; education level; occupation can be considered as binary (employees-cadres/ others); age in two groups (less than 30 and the others), job in three groups.

The Model IV with simplified socio-economic characteristics is compared with Model II with full socio-economic characteristics. The likelihood ratio is 6.65 and the *p*-value 0.95 (Annex 2). The null hypothesis cannot be rejected. That is to say, we can use a simplified model. Results are presented in Table 3.

Table 3: The ordered probit model with simplified and significant socio-economic characteristics for regulation (working)

Coefficients:	Value	Std. Error	t value
age2 less 30 years	0.13364445	0.06664901	2.0051977
occupation4SMandOW[4]	0.25074587	0.06331020	3.9605923
mode2car	-0.26060591	0.06201477	-4.2023196
employment2	0.06859878	0.06169911	1.1118279
employment3	-0.34965336	0.12820258	-2.7273504
3days	0.13399507	0.10143349	1.3210141
even numbers	0.05004899	0.10229358	0.4892682
new road	0.03888984	0.10153162	0.3830319
pollution	0.16968354	0.10134278	1.6743525
queuing	0.12749871	0.10186128	1.2516897

Intercepts:

	Value	Std. Error	t value
0|1	-3.0778	0.2966	-10.3776
1|2	-0.1155	0.1015	-1.1378
2|3	0.6697	0.1025	6.5329
3|4	1.6832	0.1108	15.1888

Residual Deviance: 3445.276

AIC: 3473.276

Our resultats show that *t-value* are not significant for all the pricing principles. That is to say, people do not made the distinction between pricing principles and the reference principle "congestion".

They also show that answer may depend on socio-economics variables. To be young, senior manager or office worker, car user only, and not be concerned by the employment question influence perception: the younger, the senior manager or the office worker are more favourable to rules proposed, on the opposite we find those who use only car and who are not be concerned by the employment question.

Gender, diploma, to have a driving licence, residential location in or outside the pricing area have no significant influence on the attitude to rules proposed.

(ii) The economic and social characheristics for non working model

Now, we focus our attention on the action of socio-economics variables on the regulation principle for non working Model.

1) General model for non working people

General model for non working people is presented in Table 4.

Table 4 : General model for regulation (non working)

Coefficients:	Value	Std. Error	t value
sexefemale	0.070151438	0.08986918	0.78059502
dri.licenseno	0.457493667	0.09693619	4.71953447
age2	0.191416664	0.26479829	0.72287726
age3	-0.184716216	0.25089588	-0.73622660
age4	-0.201814138	0.23410905	-0.86205183
age5	-0.095952597	0.26581026	-0.36098155
education2	0.573559662	0.12627101	4.54229091
education3	0.389624030	0.14389553	2.70768679
education4	0.561155861	0.16104255	3.48451915
education5	0.578595850	0.16067925	3.60093698

[4] Senior manager (SM) and office worker (OW).

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occupationNW[5]      0.017931523 0.18176910  0.09865001
employment2         -0.050794425 0.16400149 -0.30971928
employment3          0.003989967 0.22710260  0.01756901
mode2               -0.016930421 0.19180971 -0.08826675
mode3               -0.020379876 0.12845170 -0.15865790
residenceout zone   -0.086561709 0.08163695 -1.06032518
3days                0.212813445 0.12811062  1.66116942
even numbers        -0.018543619 0.12874899 -0.14402925
new road             0.320027497 0.12775758  2.50495902
pollution            0.343426557 0.12814641  2.67995465
queuing              0.200999485 0.12892230  1.55907460
Intercepts:
    Value   Std. Error t value
0|1 -2.2010  0.3175    -6.9317
1|2  0.1319  0.2607     0.5060
2|3  1.0492  0.2618     4.0069
3|4  2.3567  0.2693     8.7507
Residual Deviance: 2095.274
AIC: 2145.274
```

2) Simplifying the socio-economic characteristics for non working model

Next is tested whether some simplification could be made when considering the personal characteristics. After several trials, the following null hypotheses are tested: no influence of sexe, residential location, occupation, age, mode, employment but influence of driving licence (yes/no), of diploma considered as binary (diploma yes/no).

The Model VII with simplified socio-economic characteristics is compared with Model III with full socio-economic characteristics. The likelihood ratio is 7.52 and the *p*-value 0.91 (Annex 2). The null hypothesis cannot be rejected. That is to say, we can use a simplified model. Results are presented in Table 5.

Table 5 : The ordered probit model with simplified and significant socio-economic characteristics for regulation (non working)

```
Coefficients:           Value Std. Error    t value
dri.licenseyes   -0.49373837 0.08549096 -5.7753286
educationyes     -0.56922384 0.11327398 -5.0251951
3days             0.21205186 0.12794364  1.6573850
even numbers     -0.01888871 0.12859674 -0.1468833
new road          0.31729758 0.12763622  2.4859525
pollution         0.34008855 0.12800438  2.6568510
queuing           0.20018967 0.12878235  1.5544806
Intercepts:
    Value    Std. Error t value
0|1  -3.1074   0.2333   -13.3168
1|2  -0.7885   0.1161    -6.7896
2|3   0.1212   0.1148     1.0556
3|4   1.4203   0.1264    11.2343
Residual Deviance: 2106.190
AIC: 2128.190
```

Our resultats show that only answer in favour of new road building and to fight against pollution are significantly different from the others for “congestion” regulation principle. This result is different from the “working Model” where any principle was different.

They also show that to have a driving licence or diploma influence negatively the regulation perception for the non working people.

[5] Non working (NW). We test retailed people on one side and people without work on the other .

Results for compensation principles

a) Overview

The **Table 6** gives an initial overview of differences in fairness perception of the different compensation rules for urban road pricing[6].

Table 6: Compensation rules perception for the urban case study

Reference : « resident rate »

	Value	Std. Error	t value
carpool	0.1728941	0.07839527	2.205415
emergency	1.6664755	0.09662636	17.246593
handicap	0.7077897	0.08174087	8.658945
poor	0.1459681	0.07852237	1.858937
professional rate	0.1461446	0.07849193	1.861906

Intercepts:

	Value	*Std. Error*	*t value*
0|1	*-2.4884*	*0.1362*	*-18.2696*
1|2	*-1.0835*	*0.0623*	*-17.3971*
2|3	*-0.4560*	*0.0580*	*-7.8667*
3|4	*0.6293*	*0.0583*	*10.7858*

Residual Deviance: 5021.925
AIC: 5039.925

In the urban road pricing case study, compensation principle, which means to exempt of the toll pricing some emergency vehicles, is the fairest principle (« emergency »).

On the opposite, to propose a compensation to people who live inside the pricing area is the unfairest. As showing by the independent test (Annex 1), answers to this question are identical to those which consist to pay a small tariff for those who have the lower income or to profesionnal who need to move (critics value 5.99 and probability 0.09).

b) No difference working/no working

Using a the likelihood ratio, we want to check if we can estimate separatly a model for working people and a model for no working people (retired and non-working) as we have previously done to regulation principle.

The hypothesis Ho is the stability (no distinction between working and no-working models). The likelihood ratio gives a *p-value* superior to 0.05 (Annex 2). We can't reject the null hypothesis of stability of coefficients. Under these cirumstances, we can't separate estimations for working and no-working (Annex 2).

Next we test whether fairness perception depends on the respondent personal characteristics.

c) The economic and social characheristics

The **Table 7** presents the general model for compensation.

Table 7: Global model for compensation principles

```
Coefficients:                  Value Std. Error      t value
sexefemale            -1.103071e-01 0.05357583 -2.058895877
```

[6] Reference principle is « resident rate», question V36 "People who live in the pricing area would have a cheaper tarif, 1 € per day compare to 3, for one car *per* household» . As its principle is rejected the more, we take it as the reference principle.

```
dri.licenseyes        -8.737602e-02 0.07577704 -1.153067203
age2                  -1.784878e-02 0.07978708 -0.223705147
age3                  -8.674259e-05 0.08248849 -0.001051572
age4                   2.174934e-01 0.09194152  2.365562792
age5                   2.796877e-01 0.15628034  1.789653676
education2             1.087692e-01 0.09510529  1.143671846
education3             1.680917e-01 0.10333059  1.626737292
education4             1.931503e-01 0.10896827  1.772537365
education5             1.159858e-01 0.11401785  1.017260395
occupation3           -9.257637e-02 0.12091089 -0.765657898
occupation4           -1.781408e-01 0.12712746 -1.401277119
occupation5            9.946933e-02 0.11331399  0.877820389
occupation6           -2.407104e-01 0.14216655 -1.693157564
occupation7           -1.634996e-01 0.18599204 -0.879067699
occupation8           -1.406871e-01 0.13278899 -1.059478311
employment2            1.126737e-01 0.06182954  1.822327894
employment3            5.570616e-02 0.10360864  0.537659395
mode2                 -1.203831e-01 0.08157311 -1.475769226
mode3                  4.901270e-02 0.08267180  0.592858703
residenceout zone     -1.399409e-01 0.05256046 -2.662474777
carpool                1.731926e-01 0.07855167  2.204823803
emergency              1.692000e+00 0.09737375 17.376345025
handicap               7.198923e-01 0.08207255  8.771413602
poor                   1.485650e-01 0.07872279  1.887191406
professional rate      1.484189e-01 0.07868582  1.886221156
Intercepts:
    Value    Std. Error t value
0|1  -2.5321   0.2084   -12.1516
1|2  -1.1274   0.1697    -6.6433
2|3  -0.4940   0.1684    -2.9325
3|4   0.6107   0.1685     3.6244
Residual Deviance: 4965.716
AIC: 5025.716
```

3) Simplifying the socio-economic characteristics

Next is tested whether some simplification could be made when considering the personal characteristics. After several trials, the following null hypotheses are tested: no influence of sexe, no influence of driving licence, of diploma, of occupation, of employment but influence of age (over 50/others), of mode (car user only/others), of residential location (in/out pricing area).

The Model IV with simplified socio-economic characteristics is compared with Model I with full socio-economic characteristics. The likelihood ratio is 26.9 and the *p*-value 0.08 (Annex 2). The null hypothesis cannot be rejected. That is to say, we can use a simplified model. Results are presented in Table 8.

Table 8: The ordered probit model with simplified and significant socio-economic characteristics for compensation.

```
Coefficients:
                        Value Std. Error   t value
age3less50          -0.1712601 0.05341828 -3.206020
mode2car            -0.1119659 0.05168227 -2.166427
residenceout zone   -0.1225880 0.04855548 -2.524699
carpool              0.1717523 0.07847832  2.188532
emergency            1.6759562 0.09690846 17.294220
handicap             0.7136849 0.08193393  8.710493
poor                 0.1467170 0.07863748  1.865739
professional rate    0.1457338 0.07858990  1.854358
```

```
Intercepts:
    Value    Std. Error t value
0|1  -2.7042   0.1413   -19.1376
1|2  -1.3076   0.0764   -17.1148
2|3  -0.6776   0.0727    -9.3198
3|4   0.4174   0.0719     5.8046
Residual Deviance: 4994.175
AIC: 5018.175
```

Our resultats show that only answer in favour of a compensation which will exempt emergency vehicles, people with a low mobility are significantly different from compensation principle in favor of resident in the pricing area.

Residential location outside the urban area, using only car, age under 50 influence the rules perception. In this case, compensation principle are perceived as more unfair. On the opposite, gender, occupation, to have a driving licence and to have a diploma, employment location have no influence.

Discussion

We test attitude toward the pricing tool. Congestion pricing with constant supply or rationing compare to car even numbers are perceived not only as the unfairest rules but also as more unfairer than the queuing principle.

This result is close to Frey and Pommerehne (1993) one's in which the traditional procedure of "first arrived, first served" is preferred to pricing.

This result is also consistent with (Raux and *al.*, 2009) who show that in a scarce situtation of seats in a train or parking spaces. Although the fairness rules perception depends on context, the fairness rules ranking seems to be the same by the fairest to the unfairest one: moral rules and compensation, then queuing and peak pricing with additional supply, then peak pricing with constant supply, rationing and lottery.

Our result show the rejection of pricing and rationing tools.

Result 1 : Regulation by peak pricing or rationing are rejected.

However, pricing to make car user responsible for pollution or to build new road, and also do nothing and keep car traffic develop are percieved as more unfair than regulation by peak pricing.

These results are consistent with Frey and Pommerehne ones which show that pricing risk aversion decreases when people anticipate an increase in supply. Raux and al. (2009) show that people's opposition can be reduced if they can influence the way the revenues are used.

Second result underlines that an additional supply or an environmental improvement consecutively to a price increase allow to reduce respondant opposition.

Result 2 : Negative attitude toward pricing with constant supply can be moderated by the supply increase perspective or to make person responsible.

Our results show a hierarchy in the compensation principles. That is to say, compensation principles are not equivalent.

Ethic or moral compensation, which means to provide with a free road pricing to emergency vehicles or to handicaped people are the fairest compensation rules.

For KKT (1986), the unfair feelings appear when the exchange fails to take account of the "reference transaction". The "reference transaction" concept is helpful to understand that

fairness perception is linked to ethic or moral principles. Our results show that a compensation principle in the sense of moral rule is judged fairer than the others compensation principles.

Thus, the reference transaction refers to the moral rule and it is the basis even with a hypothetical solution like with road pricing.

Ethic or moral compensation is different from the other form of compensation for example to income, location or professional purpose.

Furthermore, perception difference in a compensation to less advantaged person, to outer residential location, or to professional activity appear only if we detail the individual socio-economics analysis.

In particular, compensation principles are unfair if the respondent lives outside the pricing area, use only car and is aged less than 50.

Result 3: The perceived moral or ethic compensation is different to the other form of compensation.

Regulation by road pricing is more unfair if the respondent is a car user, non-working with a diploma or working non-concerned by employment.

If the first result is not surprising, it's not the case of the second one. Rejection of the road pricing is to be high for respondents who seem to be less constraint. This result is quite different to those we usually find in the literature. How can we explain it? We can formulate the hypothesis that we are face with an income effect. Even if they have a diploma, non-working received less income than working with equivalent diploma. The situation is the same for working who do not work, by choice or obligation.

Furthermore, the youngest working senior manager or office worker are the least favourable to reject regulation by peak pricing. We can formulate the idea that between suffer to congestion or paid, this category prefers to pay.

Finally, compensation rules are judged less fair if the respondent lives outside the pricing area, use only car, and is aged less than 50.

Result 4: Fairness perceptions of allocation and compensation rules are influenced by the socioeconomics situation of the respondent.

Conclusion

An overview of our results point out a striking result: moral or ethic rule is the fairest compensation principle. On the opposite, peak pricing or rationing are the unfairest allocation rules. However, this hierarchy and the level of the fairness perception can depend on the socioeconomics characteristics and on compensation given.

Our results show that regulation by means of price or quantity are judged as unfair but the urban road pricing is perceived as less unfair if it allows to make people responsible for pollution or to build new road. This last point seems to be paradoxical, because if the new road building improves the car traffic in short term, in a long term it facilitates new congestion and environmental damages. It is true that our survey takes place in 2003, maybe the role of car in pollution is now different after the Copenhague Conference and the Grenelle law in France!

Finally, our result underline that compensation can be moral or ethic and can be dissociated to the other form of compensation and takes the role of a reference transaction. Road pricing rejection seems also to be higher for people who seem to be less constraint. To explain this result, we have made the hypothesis of an income effect. A study with more details on the income effect could be interesting.

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Annex 1: Independent test

```
Questions :Even numbers (v52), Congestion (v26) (regulation principles)
wald test: (chi2 à 1 level of freedom)
statistics : 0.13
critics value : 3.84
critics proba : 0.7173

Questions :Queuing (v50), New road (v28), 3days (v30), Pollution (v25)
(regulation principles)
wald test: (chi2 à 3 level of freedom)
statistics: 1.59
critics value: 7.81
critics proba: 0.6612

Questions :Resident rate  (v36), Poor (v37), Professional rate (v38)
(compensation principles)
wald test : (chi2 à 2 level of freedom)
statistics: 4.63
critics value: 5.99
critics proba: 0.0989
```

Annex 2: The likelihood ratio

The likelihood ratio to regulation working/no working

	Regulation	Regulation	Regulation

	Model I working + no working	Model II working	Model III no working
Variables	30 5 regulation rules, 1 driving licence, 1 gender, 4 age, 4 diploma, 6 occupational, 2 employment, 2 mode, 1 residential location, 1 constante, 1 individual effect, 2 boundaries	28	25
LnL	- 2799.072	- 1715.829	- 1047.637
Likelihood Ratio Test	Model II + Model III – Model I		
LR	71.212		
df	23		
p-value	7.892696e-07		

The likelihood ratio to socioeconomics characteristics (regulation working)

	Regulation working Model IV
Variables	14 5 regulation rules, 1 age,1 occupational, 1 mode, 2 employment, 1 constante, 1 individual effect, 2 boundaries
LnL	- 1719.156
Likelihood Ratio Test	Model IV – Model II
LR	6.654
Df	14
p-value	0.9472283

The likelihood ratio to socioeconomics characteristics (regulation no working)

	Regulation non working Model VII
Variables	11 5 regulation rules, 1 driving licence, 1 diploma, 1 constante, 1 individual effect, 2 boundaries
LnL	-1051.399
Likelihood Ratio Test	Model VII – Model III
LR	7.524
df	14
p-value	0.9126234

The likelihood ratio to compensation working/no working

	Compensation Model I working + no working	Compensation Model II working	Compensation Model III non working
Variables	30 5 compensation rules, 1 driving licence, 1 gender, 4 age, 4 diploma, 6 occupational, 2 employment, 2 mode, 1 residential location, 1	28	25

	constante, 1 individual effect, 2 boundaries		
LnL	-2482.858	-1539.119	-931.16
Likelihood Ratio Test	Model II + Model III – Model I		
LR	25.158		
df	23		
p-value	0.3421906		

The likelihood ratio to socioeconomics characteristics (compensation)

	Compensation working + non working Model IV
Variables	12 5 compensation rules, 1 age, 1 mode, 1 location, 1 constante, 1 individual effect, 2 boundaries
LnL	-2496.903
Likelihood Ratio Test	Model IV - Model I
LR	26.902
df	18
p-value	0.08085203