SCATTER

SPRAWLING **C**ITIES **A**ND **T**RANSPOR**T**:
FROM **E**VALUATION TO **R**ECOMMENDATIONS

Lic. Sc. Kari Lautso/LT Consultants:

The Helsinki case

SCATTER WORKSHOP

Brussels, November 9th, 2004

Contents

1. Methodology: City sprawl assessment/sustainability assessment
2. Helsinki – background
3. Examples of tested policies and their effects on city sprawl and urban sustainability
4. Overall conclusions

1. Methodology: City sprawl assessment/sustainability assessment

Two methods for describing urban sprawl:

- Urban sprawl variables
- Sustainability indicators and indeces

Urban sprawl variables

Overall mobility

- Average travel time (all modes) — minutes/trip

Public transport

- Modal share of public modes — %
- Passenger-km by public modes — km/household/a

Road traffic

- Private vehicle-km — km/household/a
- Greenhouse gases from transport — eq.ton/household/a
- Average road traffic speed — km/h

Land use

- Inhabitants in urbanised zones — #
- Employees in urbanised zones — #

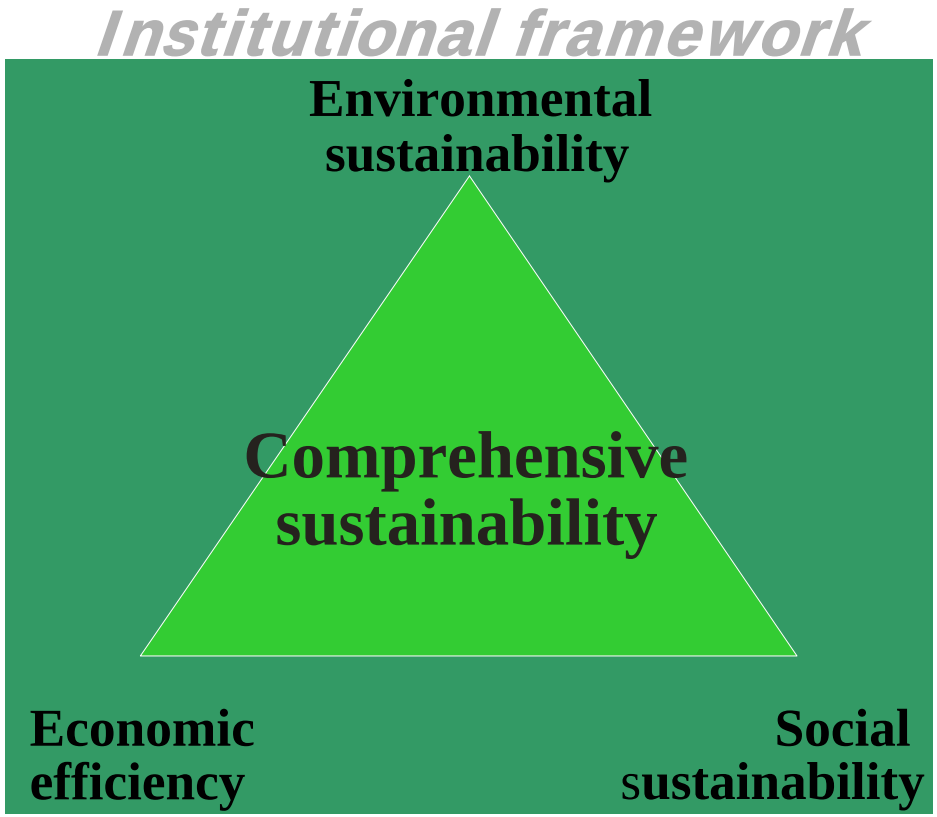
Accessibilities

- Average home-work travel distance — kilometres
- Accessibility to city centre — minutes/trip
- Accessibility to services — minutes/trip
- Productivity gain from land use — %

Why sustainability evaluation?

- The phenomenon of city sprawl is illustrated and can be understood through the city sprawl variables.
- The aim of sustainability evaluation is to answer the following questions:
  - Is city sprawl sustainable or not?
  - Is one alternative to fight city sprawl better than another one?

What is sustainability in urban planning context?



For a city to be sustainable it needs to use resources in an efficient and equitable way within the carrying capacities of the environmental and social systems it is dependent on.

Environmental indicators

Global climate change

- Greenhouse gases from transport

Air pollution

- Acidifying gases from transport
- Volatile organic compounds from transport

Consumption of natural sources

- Consumption of mineral oil products, transport
- Land coverage
- Need for additional new construction

Environmental quality

- Fragmentation of open space
- Quality of open space

Environmental Index

Social indicators…

Health

Exposure to particulate matter
from transport in the living environment

Exposure to nitrogen dioxide
from transport in the living environment

Exposure to traffic noise

Traffic deaths

Traffic injuries

Equity

Justice of distribution of economic benefits
Justice of exposure to particulates
Justice of exposure to nitrogen dioxides
Justice of exposure to noise
Segregation

…Social indicators

Opportunities

- Housing standard
- Vitality of city centre
- Vitality of surrounding region
- Productivity gain from land use

Accessibility

- Total time spent in traffic
- Level of service of public transport and slow modes
- Accessibility to city centre
- Accessibility to services
- Accessibility to open space

Social Index

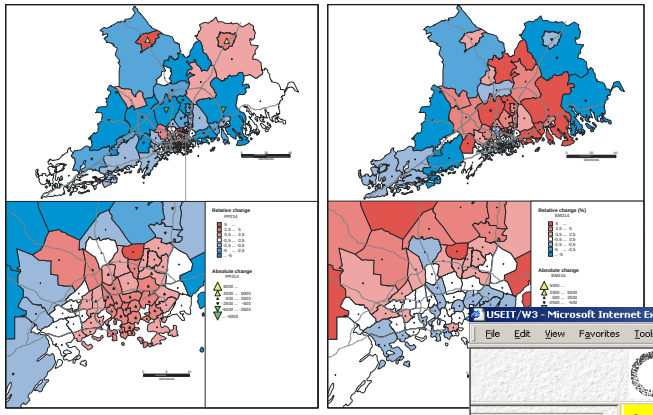
Economic indicators

Transport investment costs
Transport user benefits
Transport operator benefits
Government benefits from transport
Transport investment costs
Transport external accidents costs
Transport external emissions costs
Transport external greenhouse gases
Transport external noise costs

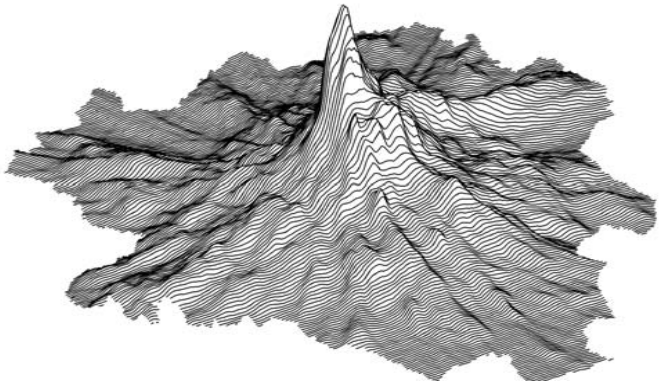
Economic index: total savings €/inhabitant (NPV)

TOOLS for calculating the indicator values (from PROPOLIS)

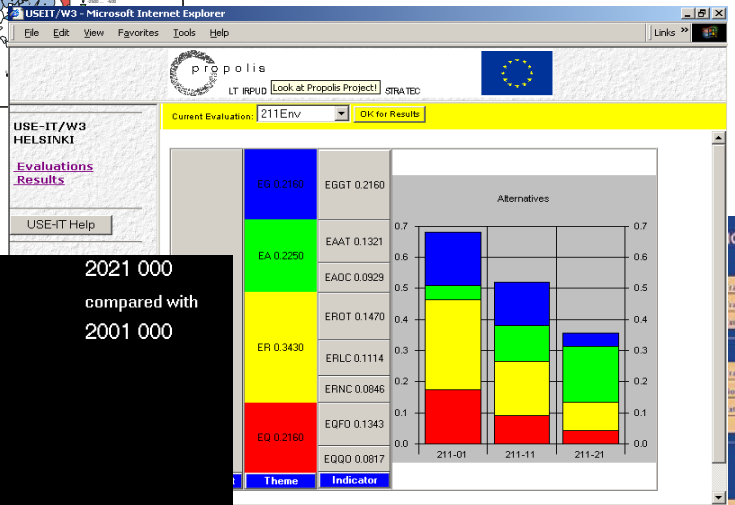
Land use and transport models



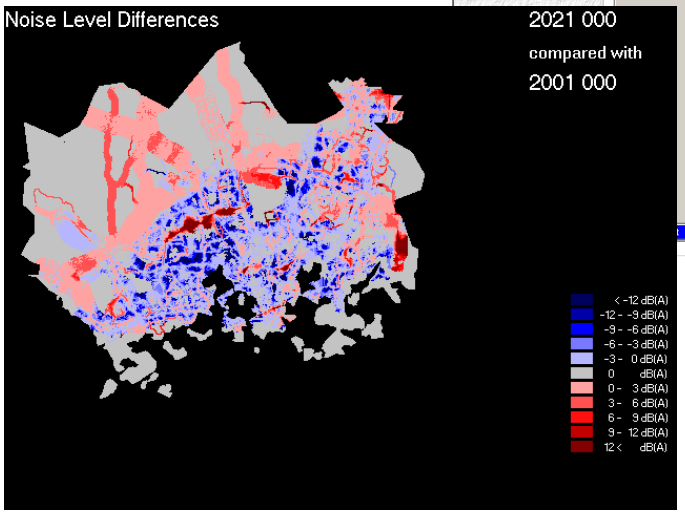
Illustration



Evaluation

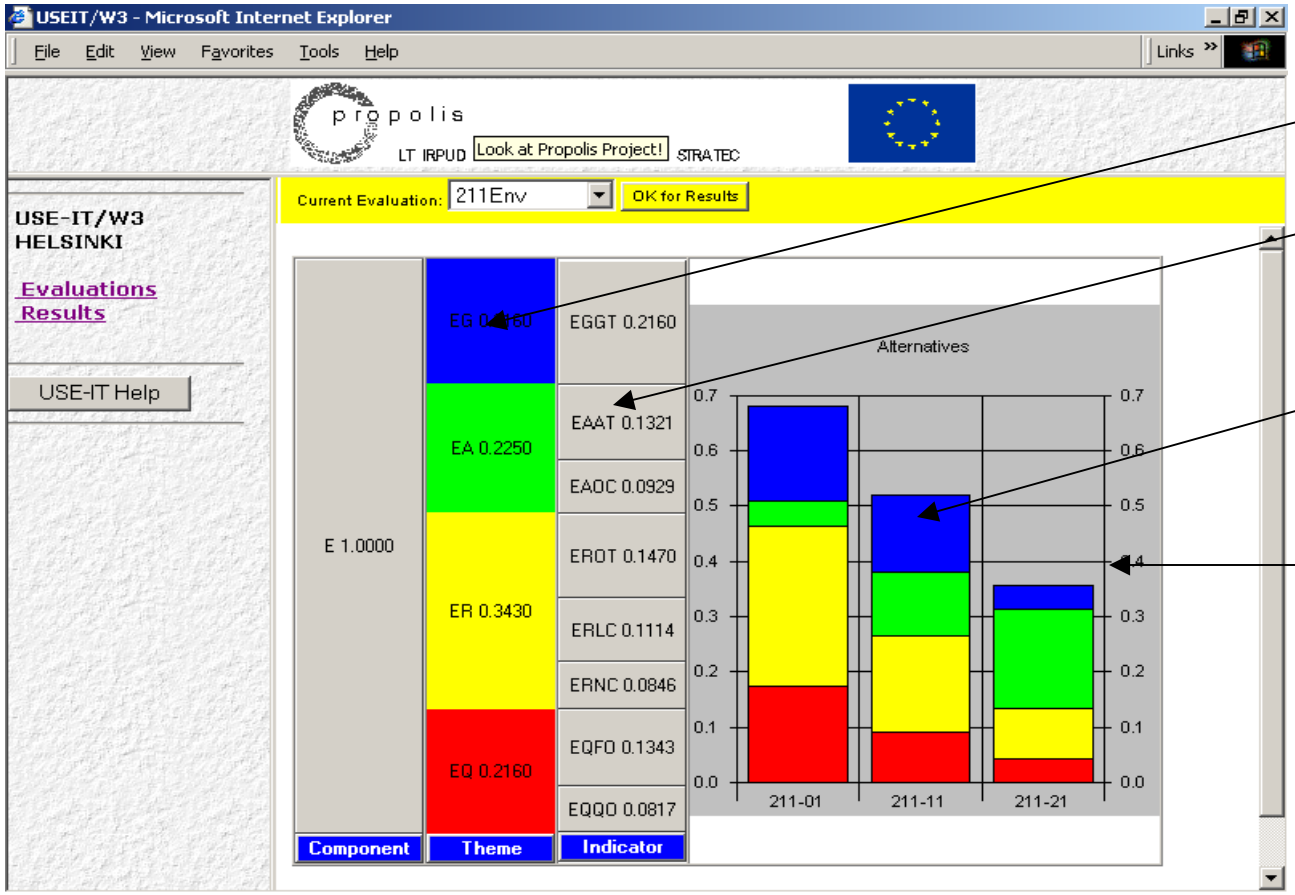


GIS



Ecomic calculations

The evaluation process



Weights of the themes

Weights of the indicators

Alternative scenarios

The environmental index

2. Helsinki – background

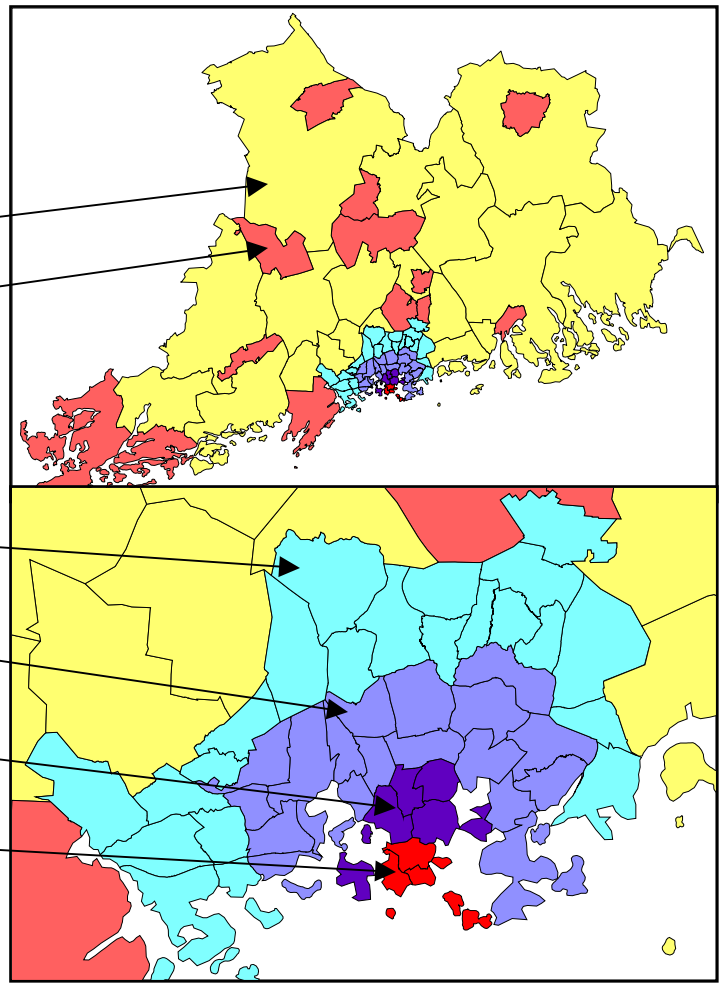
Land use superzones

Surrounding region

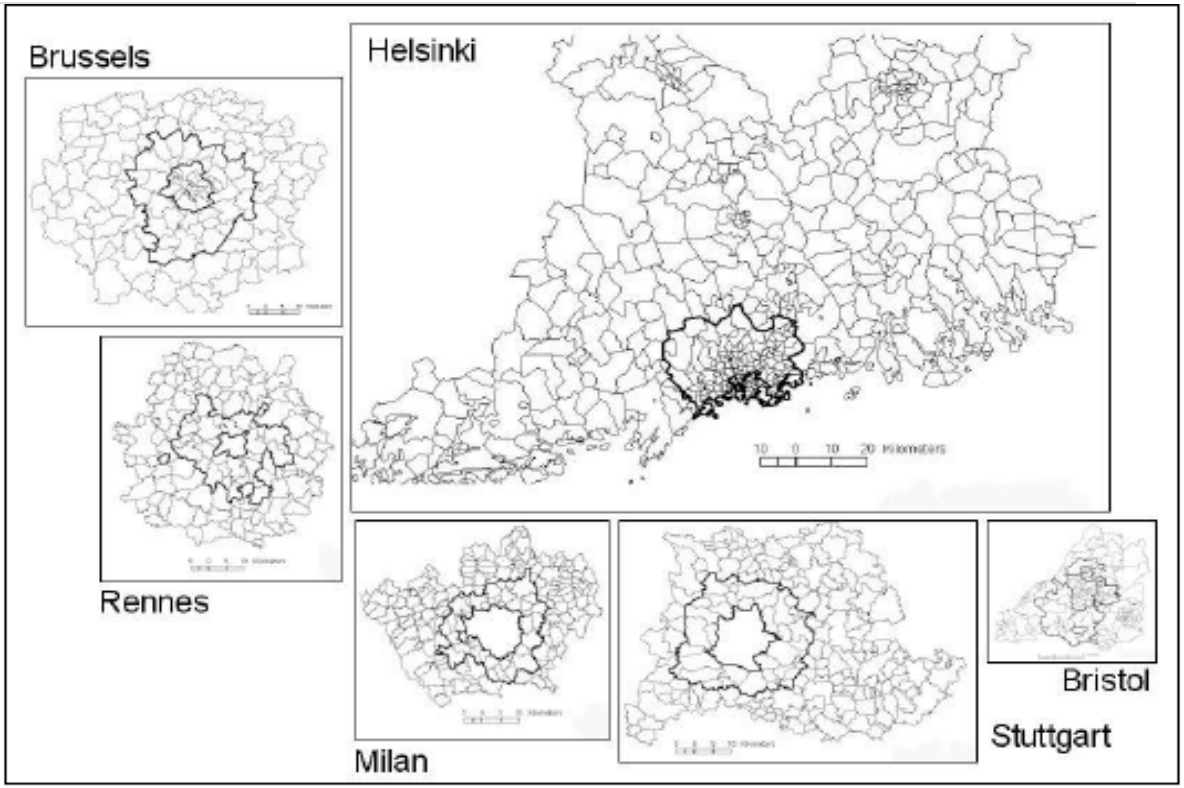
- Rural
- Urban

Metropolitan area

- outer parts (suburbs)
- inner parts
- central parts
- city centre



Intercity comparisons



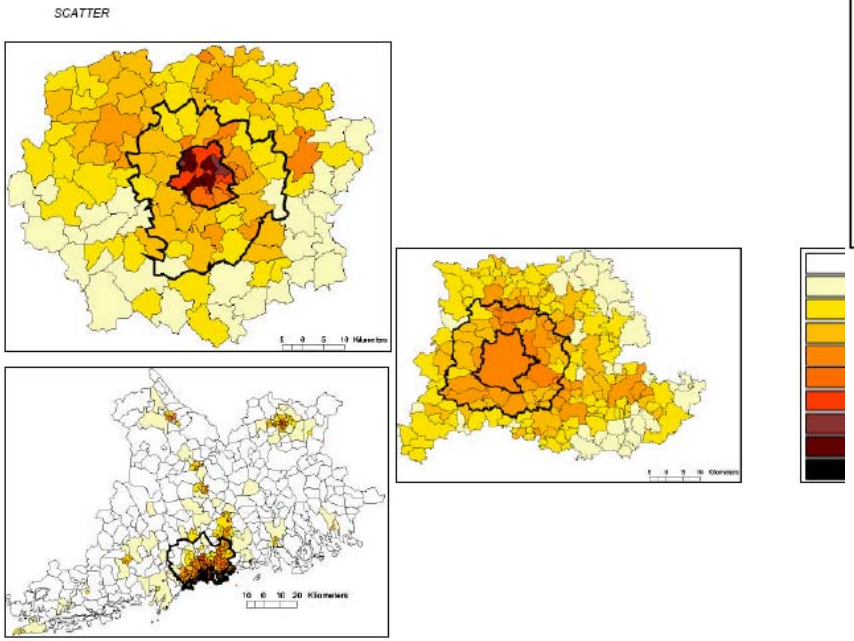
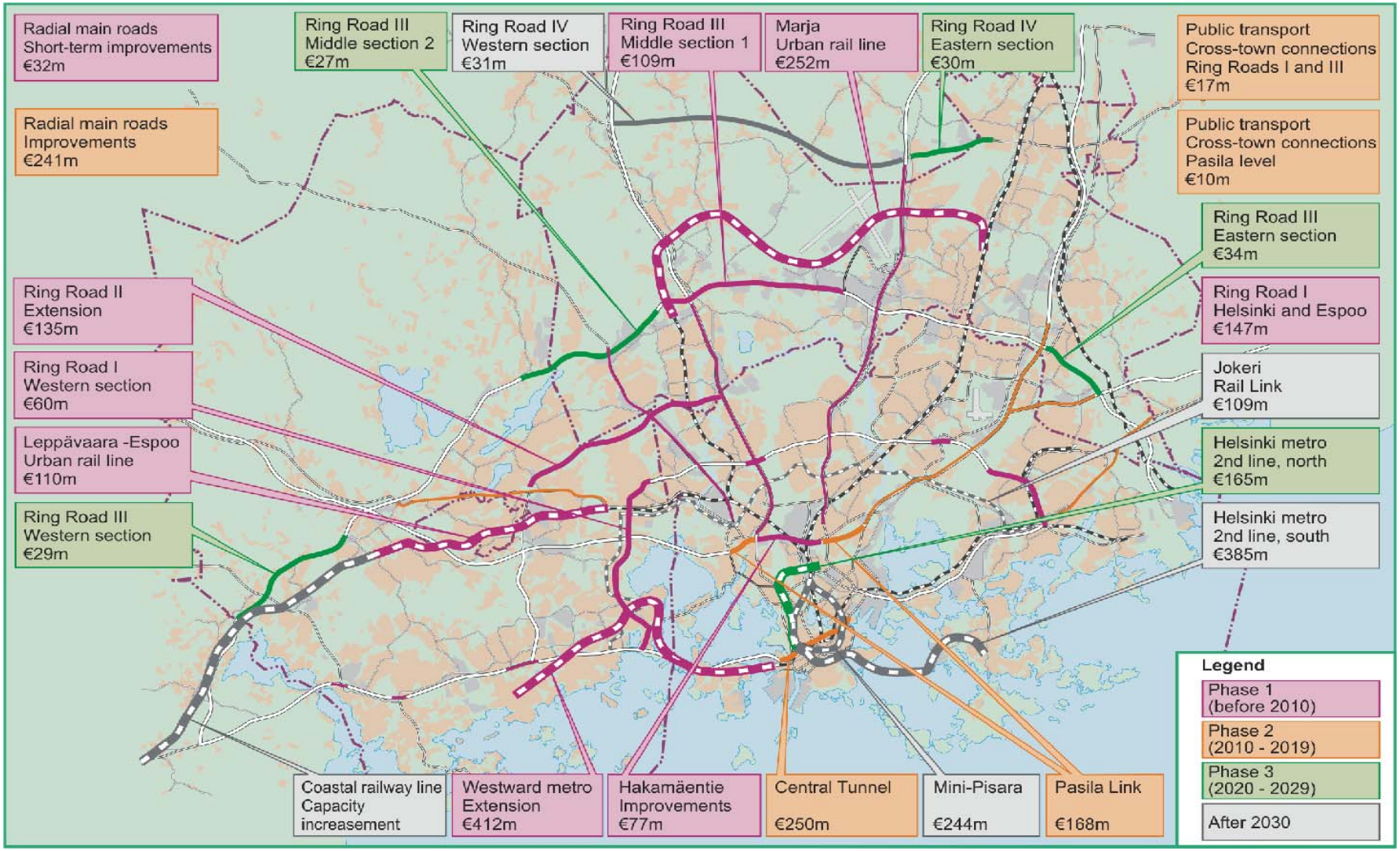


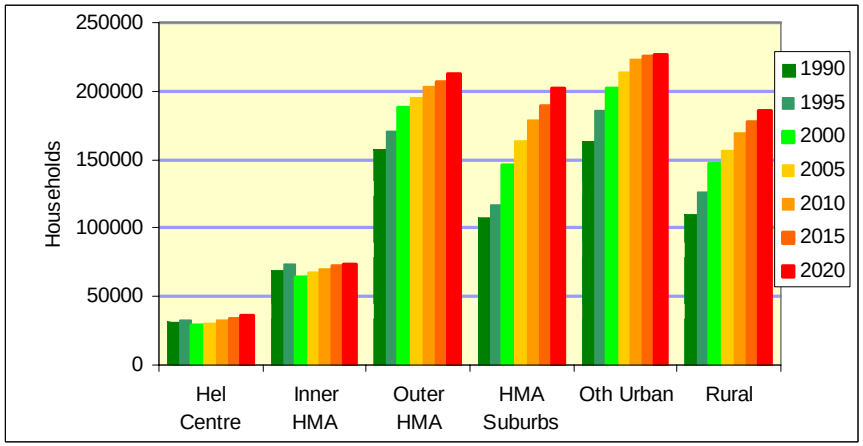
Figure 7.2 Population density in the study areas of Brussels (2001), Helsinki (1999) and Stuttgart (2000) (perso

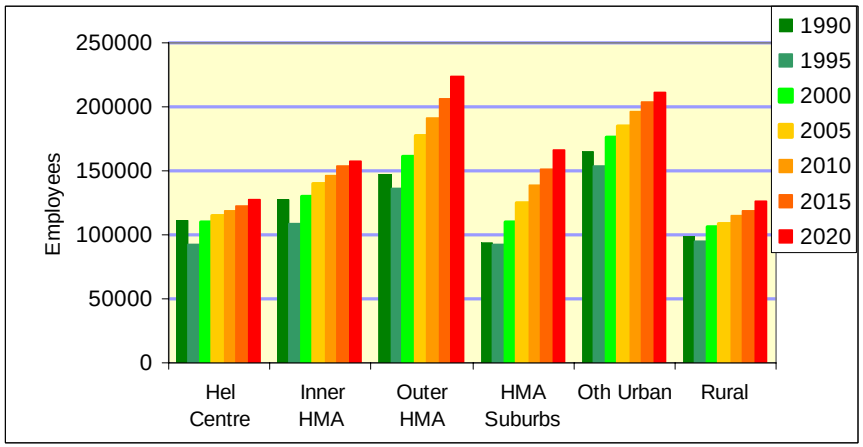
Projects included in the reference solution



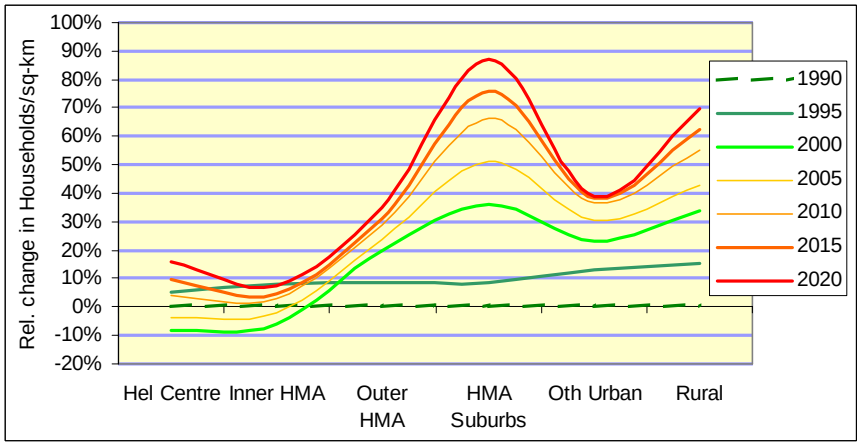
Population and densities in the base forecast

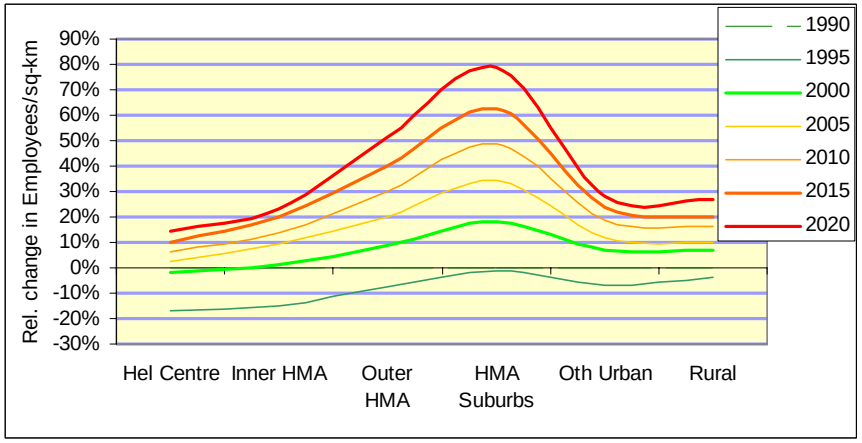
Polpulation and employment:





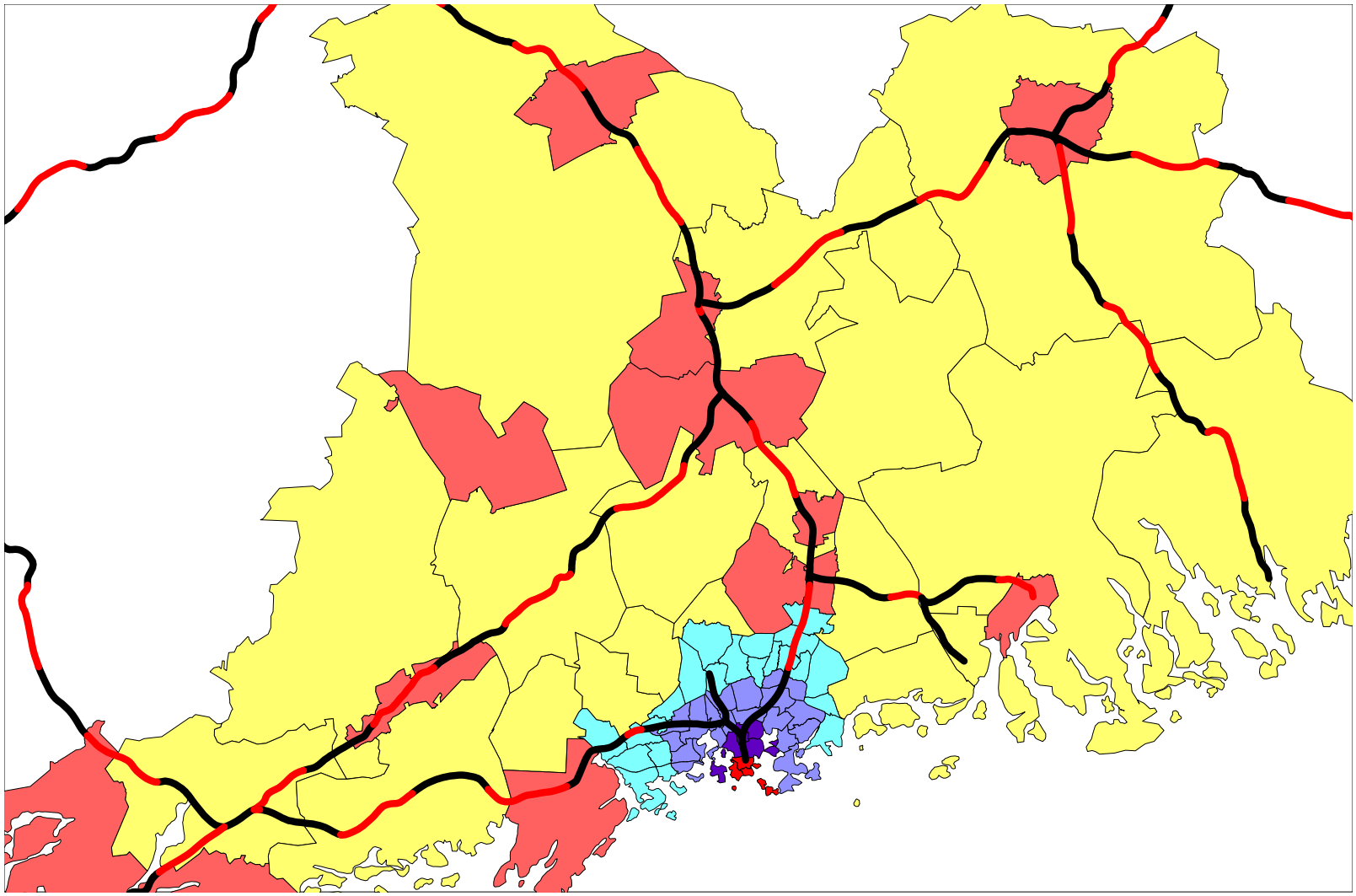
Relative densities vs 1990:





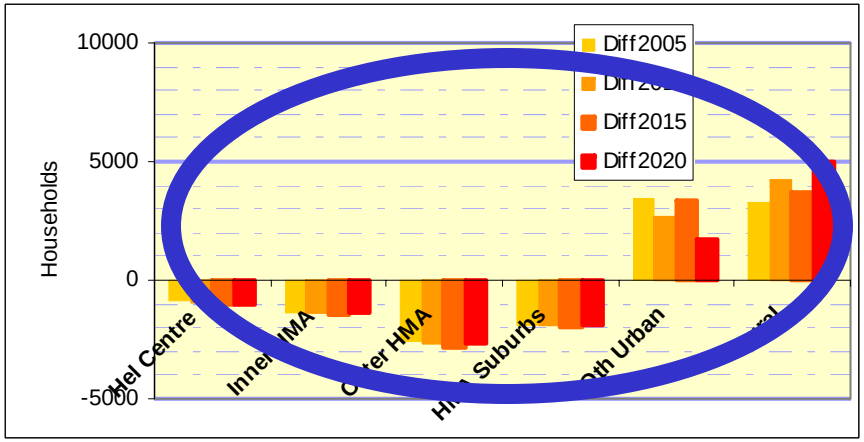
3. Examples of tested policies and their effects on city sprawl and urban sustainability

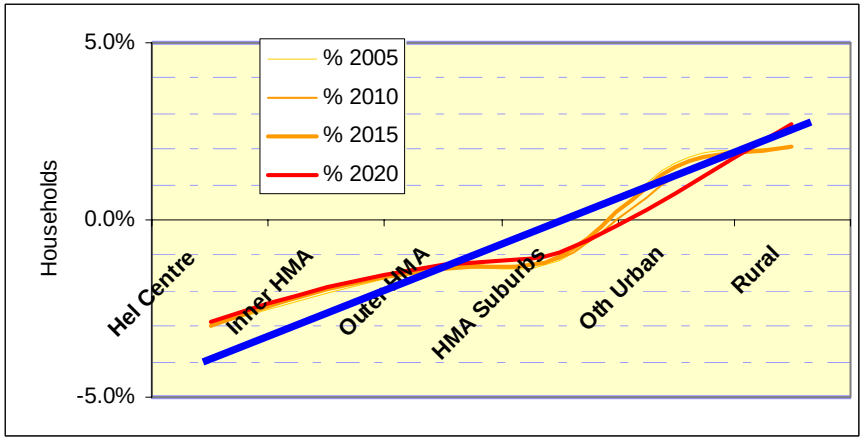
Increase speed of current rail services 25%?

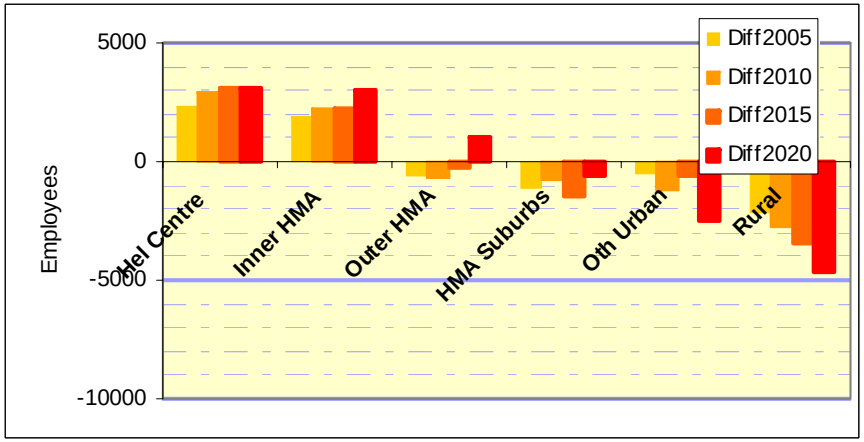


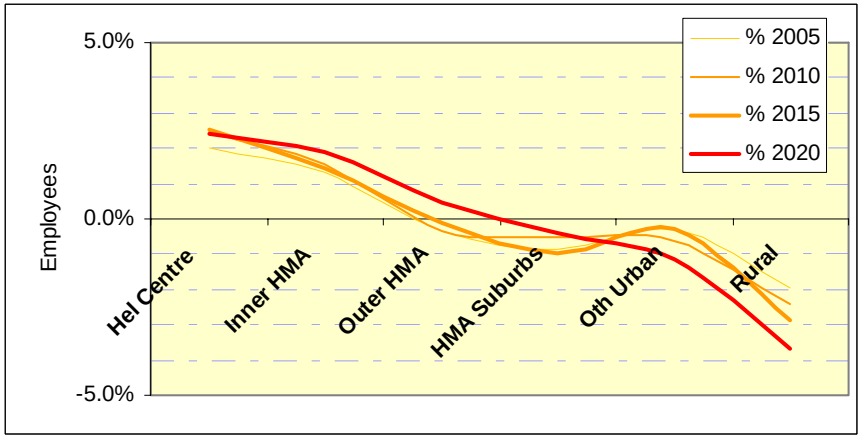
In general (big/radial) rail enhancements contribute to sprawl…

113 H – Decrease current rail travel times 30%





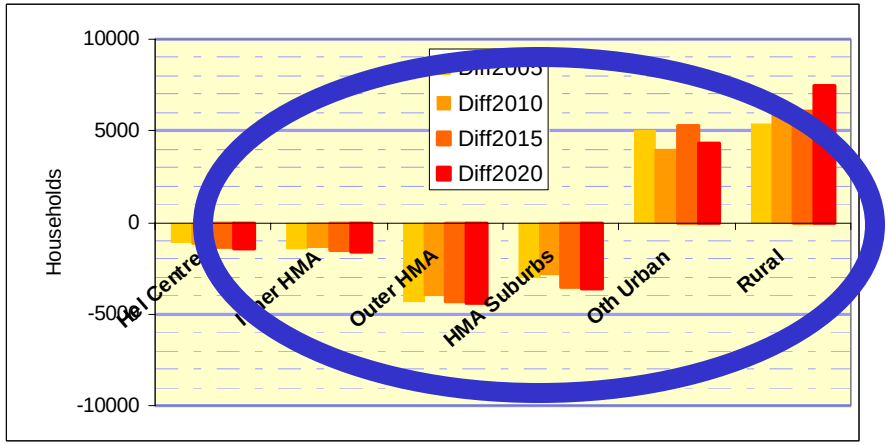


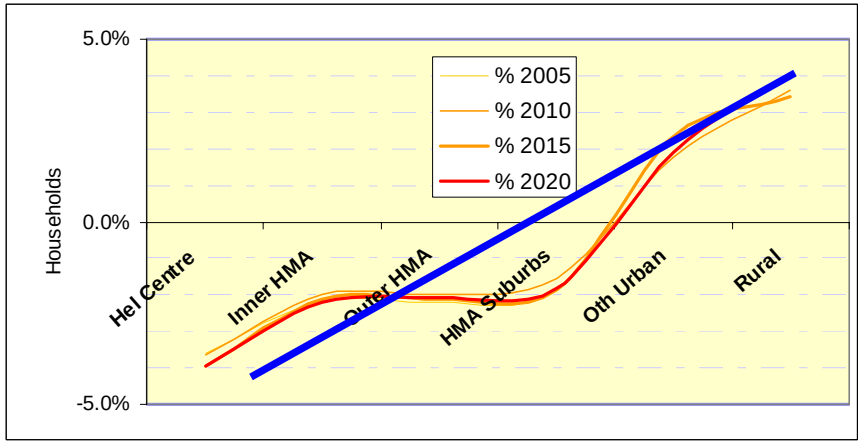


…like the reduction of public transport fares

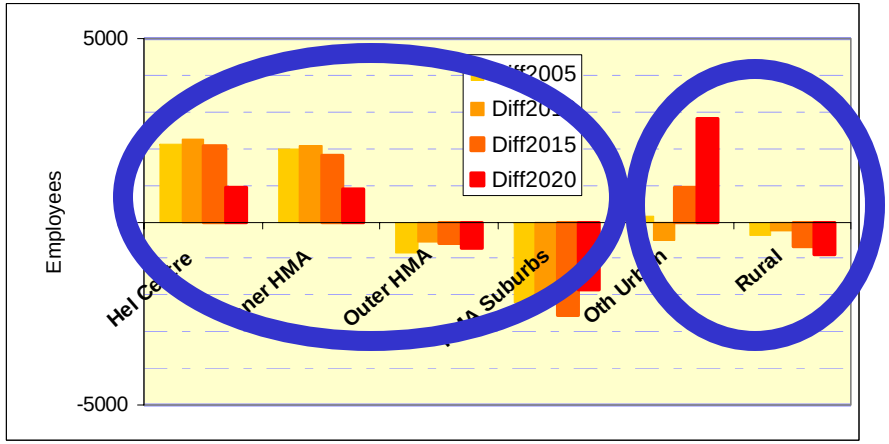
512 H – Decrease public transport fares by 20 %

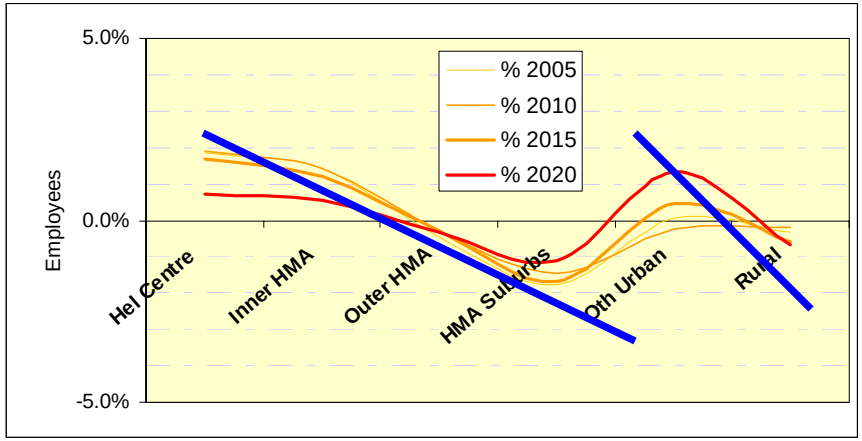
Relocation from HMA



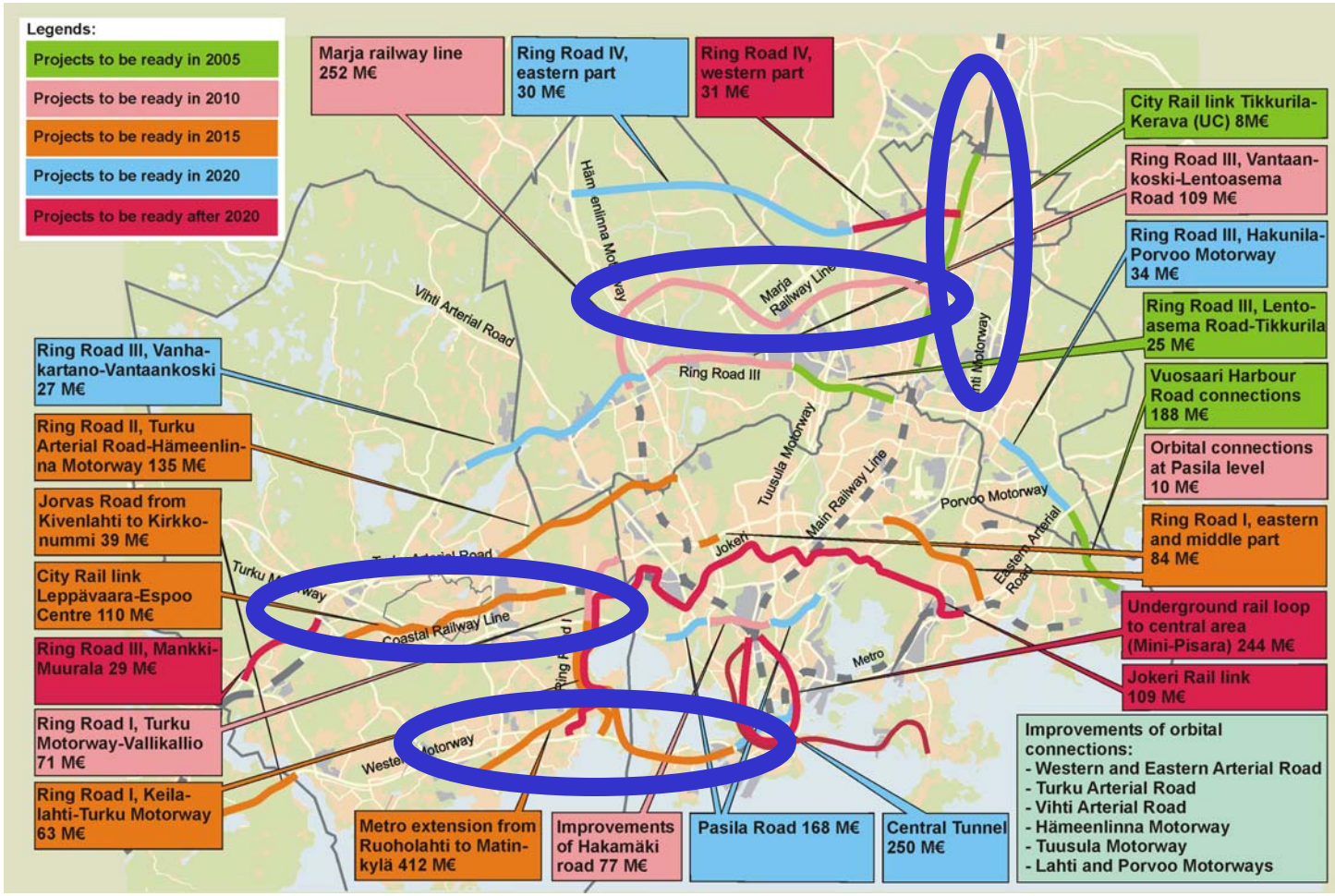


From suburban areas towards centre and from rural areas to urban



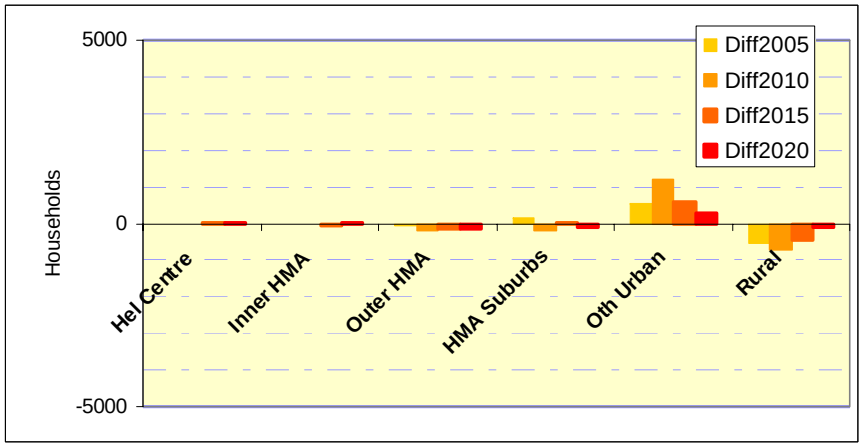


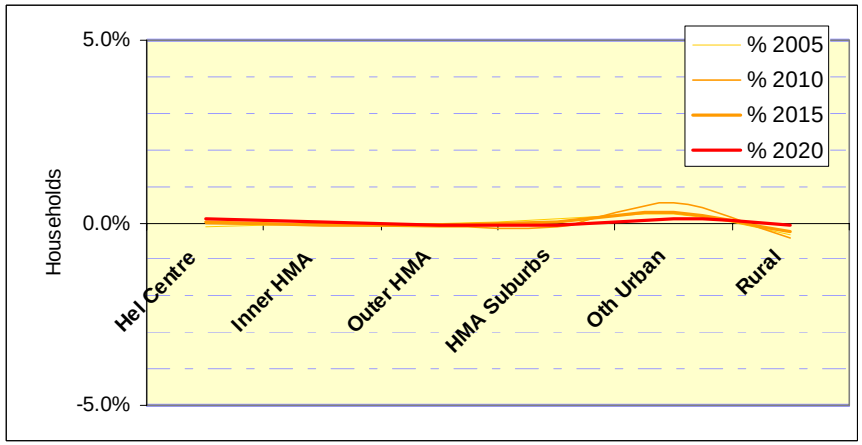
Planned Metropolitan Area Rail Investments…

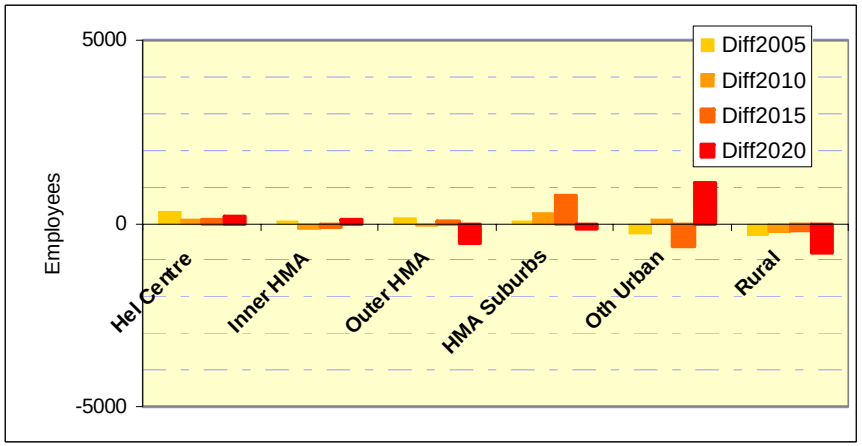


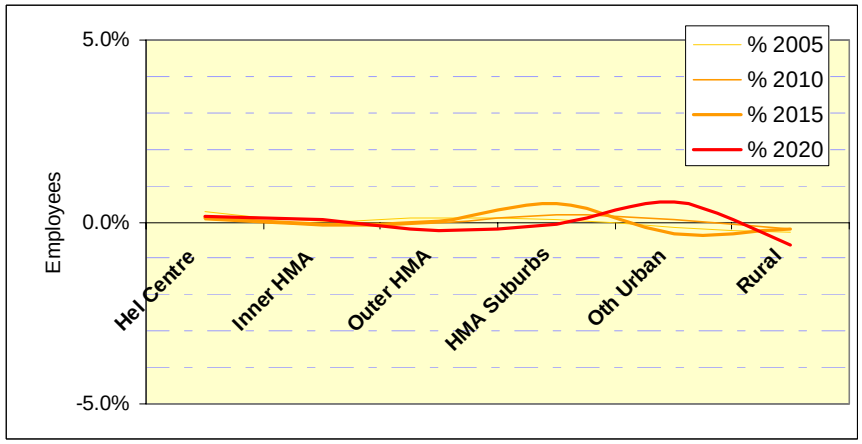
…do not, however, seem to contribute to sprawl

112 H – HMA plan-public transport rail investments, compare with do-nothing :

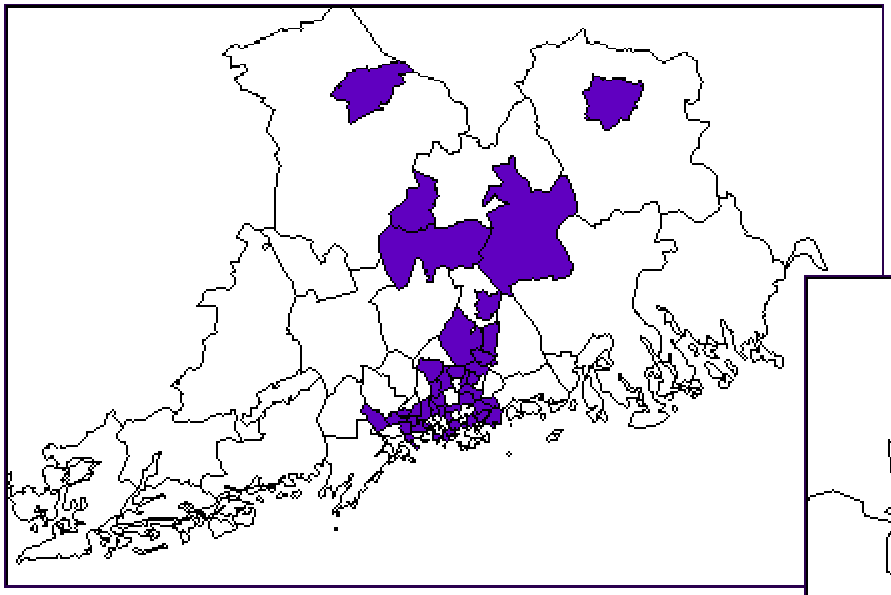




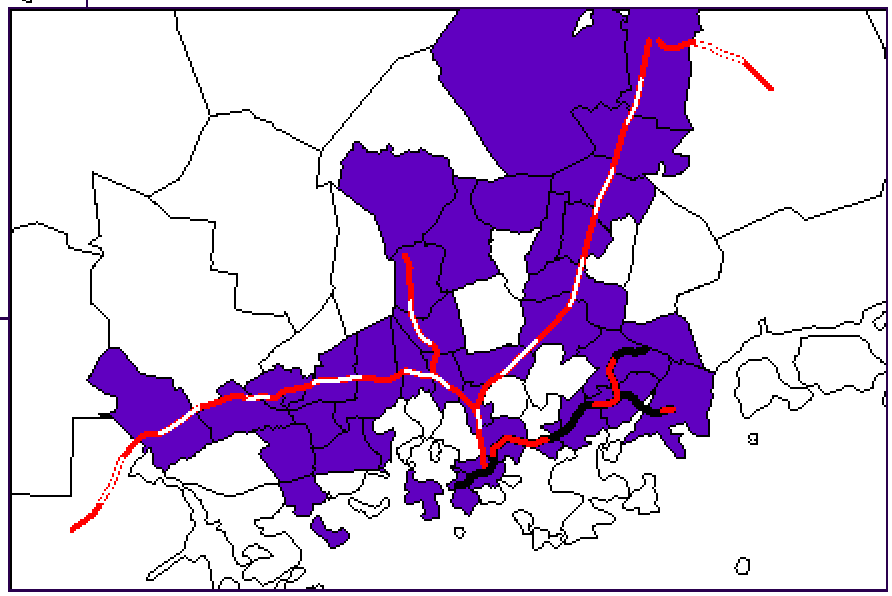




Land use measures

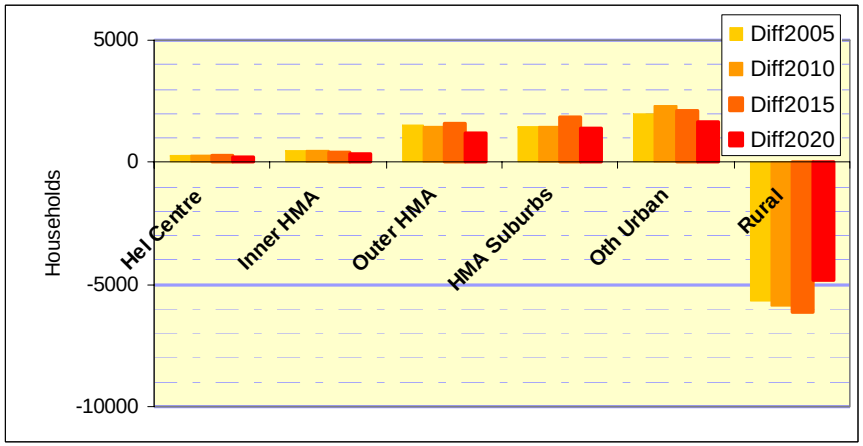


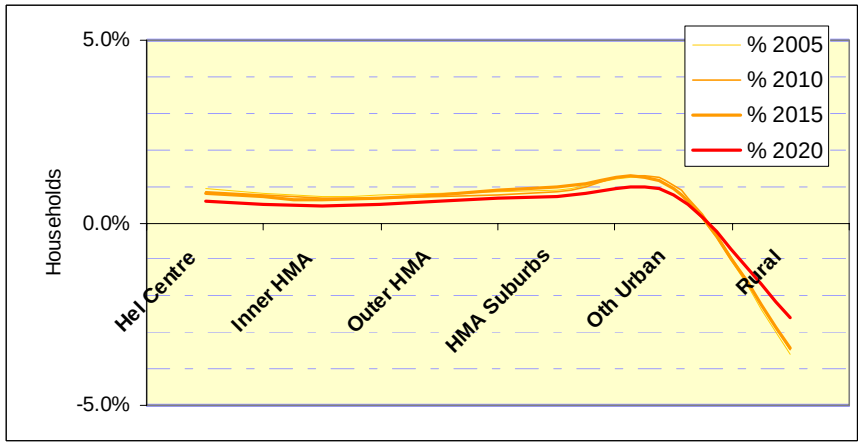
A-type land-use zones

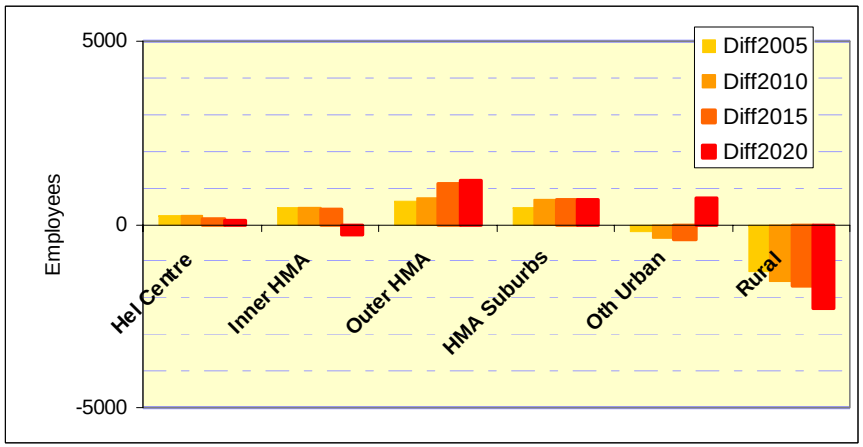


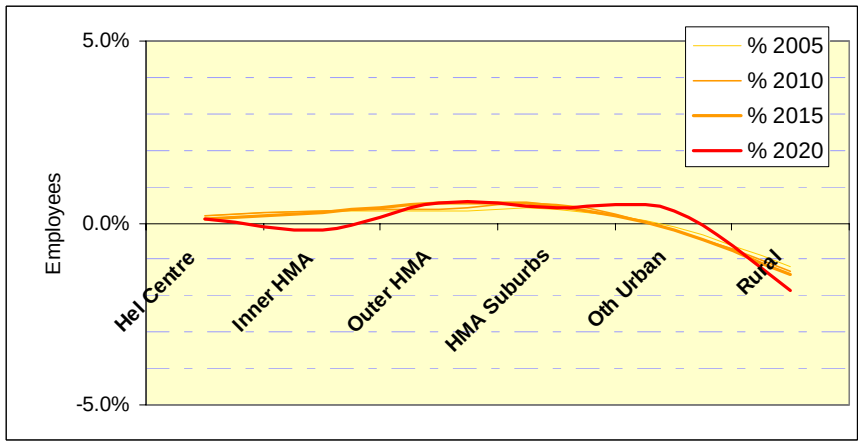
Pricing land-use seems (also) efficient

311 H – Annual tax (development impact fee) in non urban zones
+ fiscal incentive (tax reduction) in urban zones



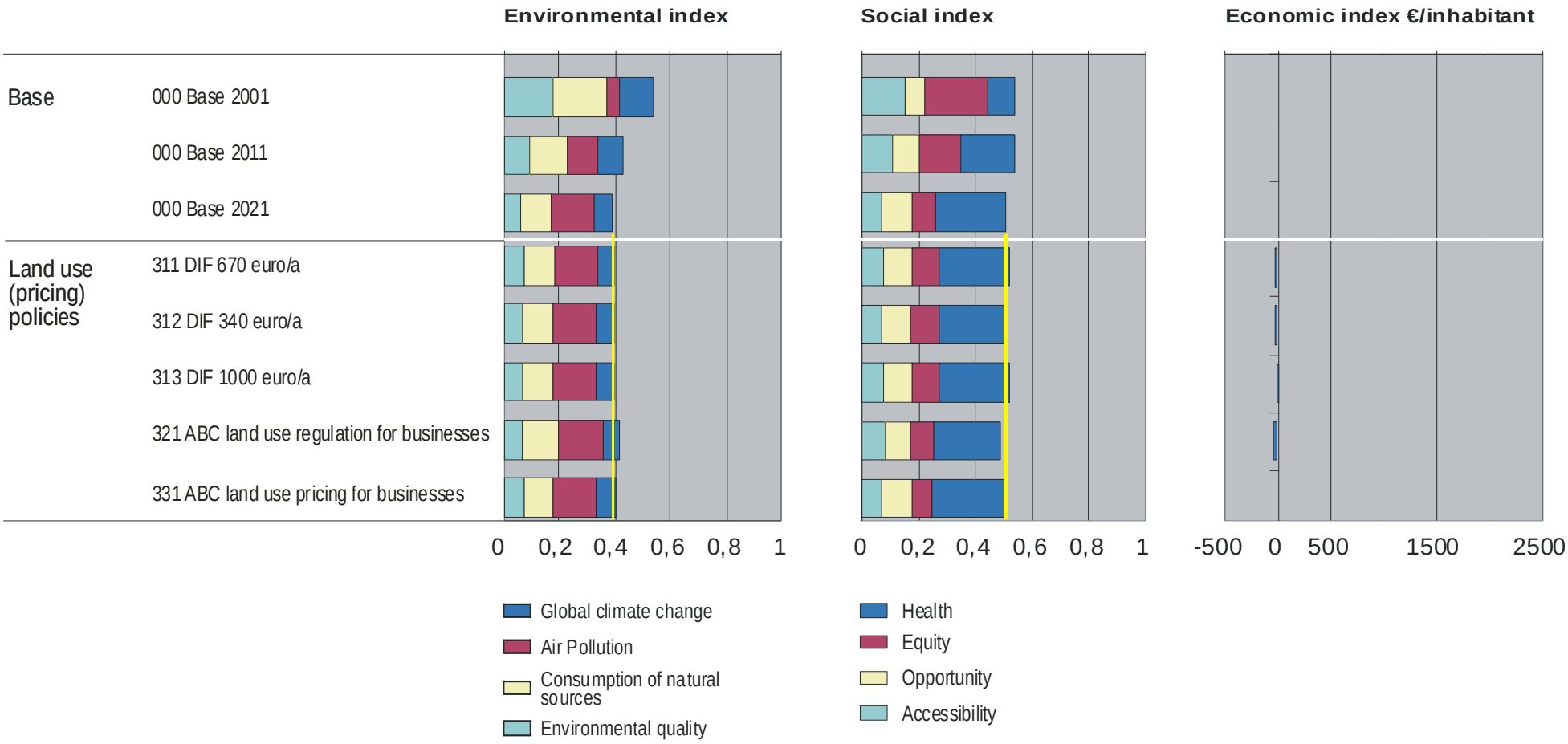






Policies tested and their sustainability evaluation

Land use (pricing) policies

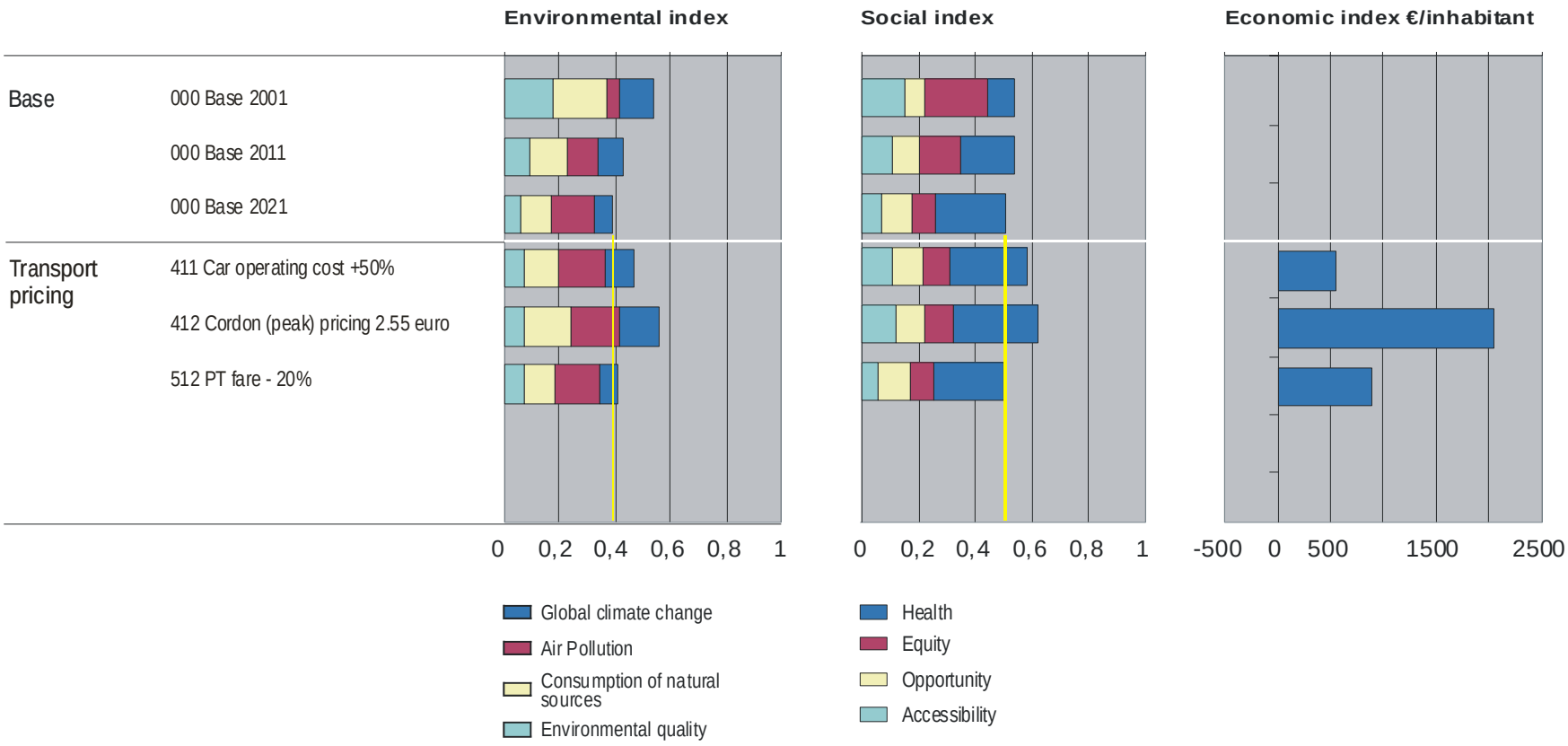


Conclusions – land use (pricing) policies

- The changes of the environmental, social and economic sustainability indeces are small
- The effects of land pricing policies on
  - overall mobility
  - city sprawl
  - CO2 emissions and
  - accessibilities

  are positive

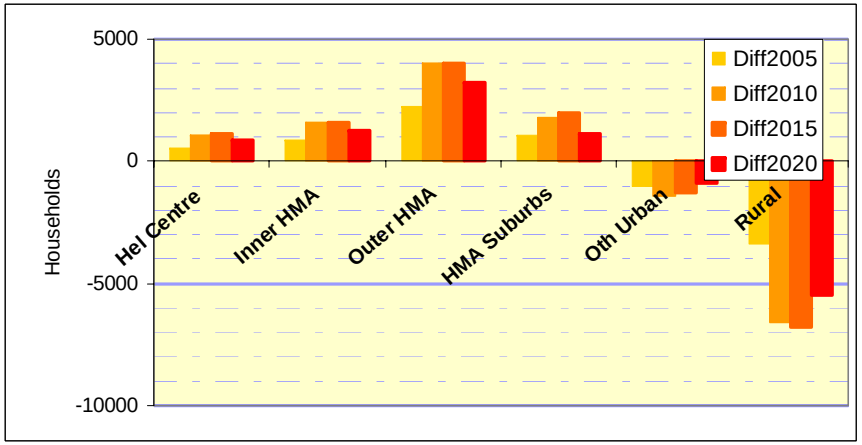
Transport pricing

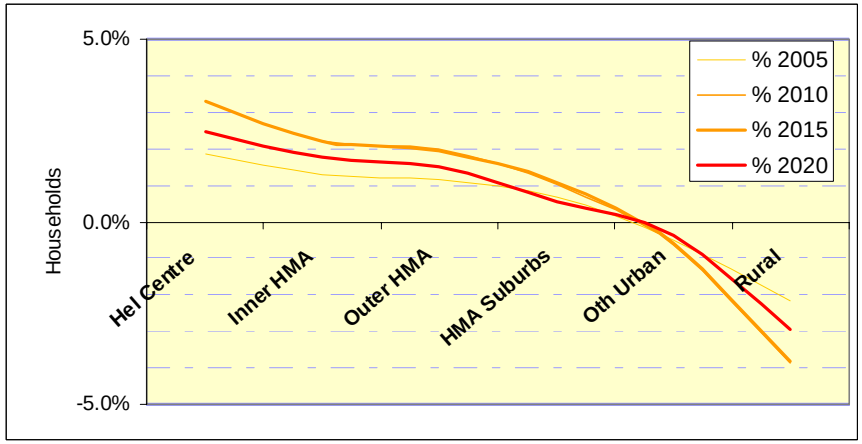


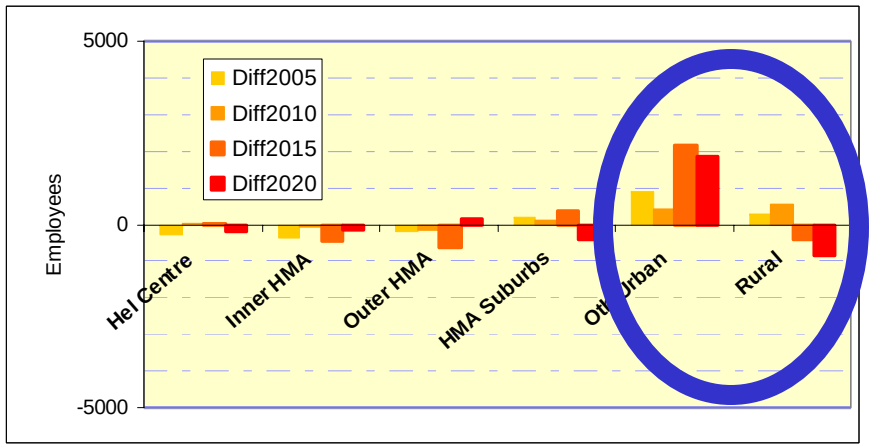
Road pricing is efficient in reducing (population) sprawl

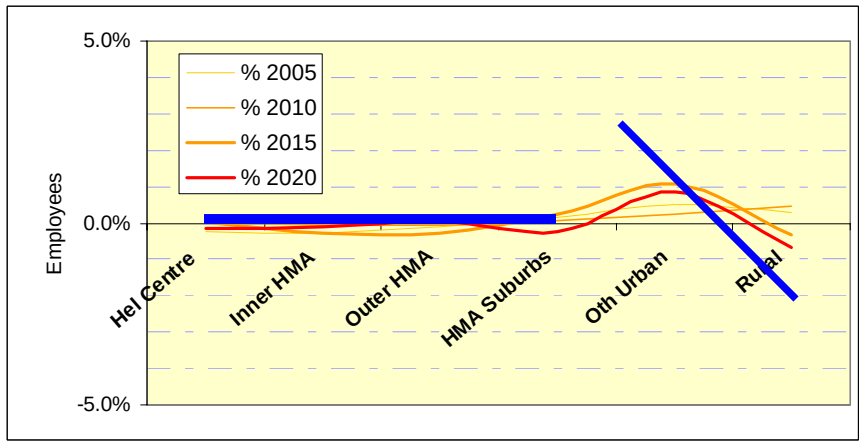
Relocation to HMA

411 H – Car operating costs +50%





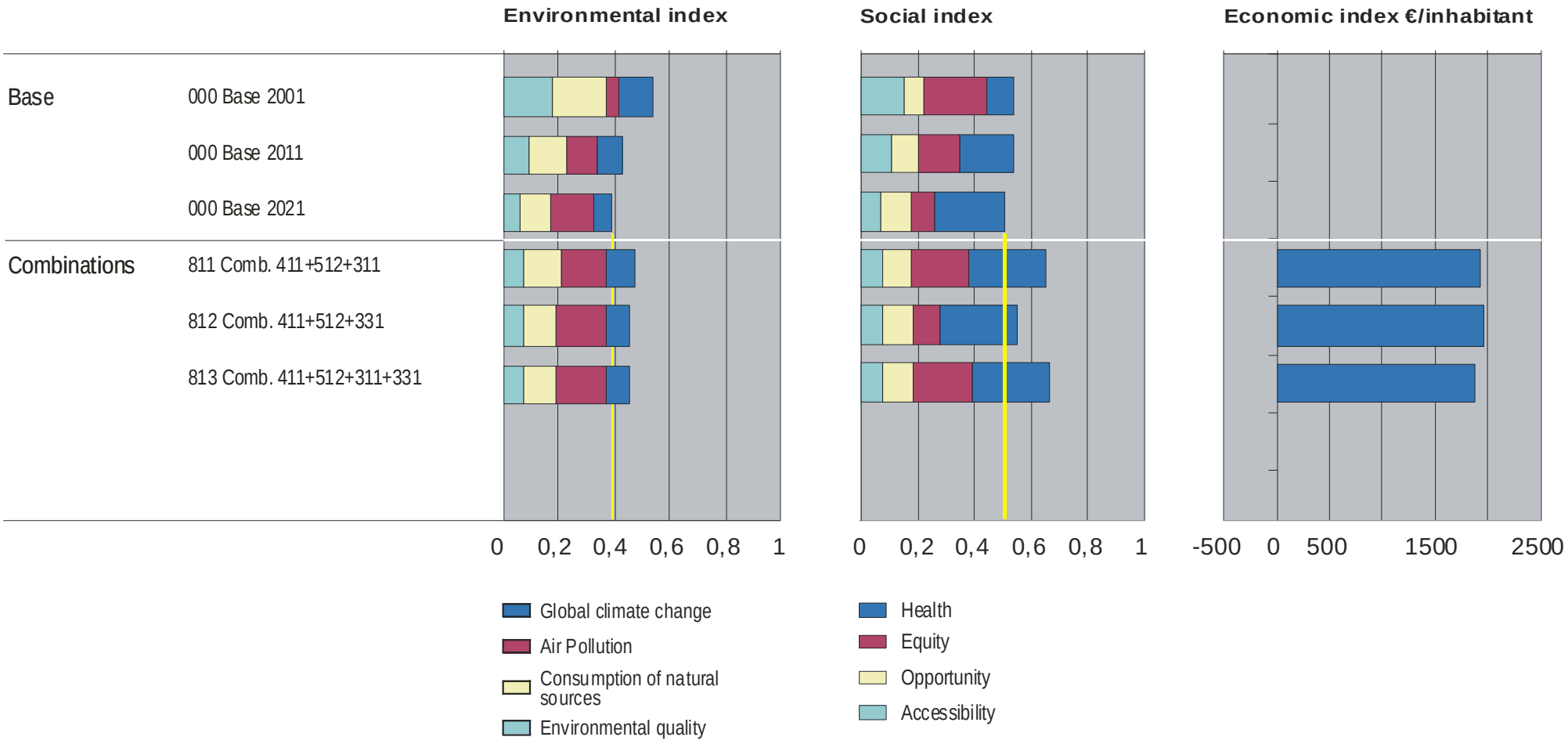




Conclusions - transport pricing

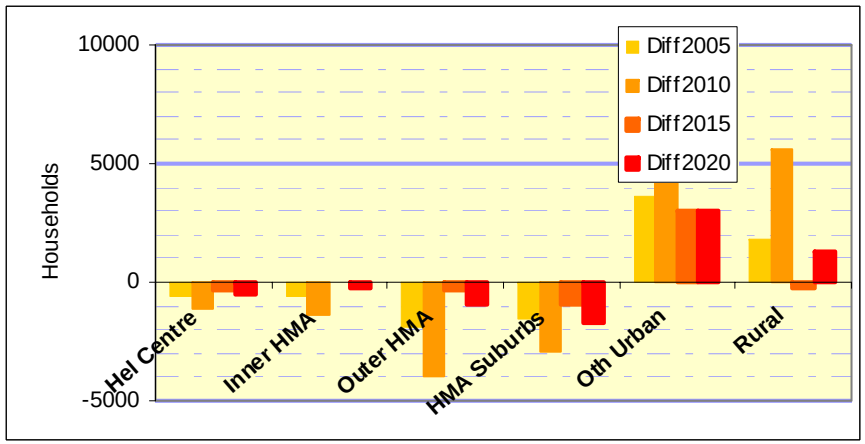
- The transport pricing policies perform well environmentally, socially and economically
  - However, lowering PT fares, increasing speed and service have a negative impact on city sprawl indicators
  - Car pricing policies work efficiently against the city sprawl effect
- Combination of car pricing and PT policies have positive effects while also the city sprawl remains at reasonable level

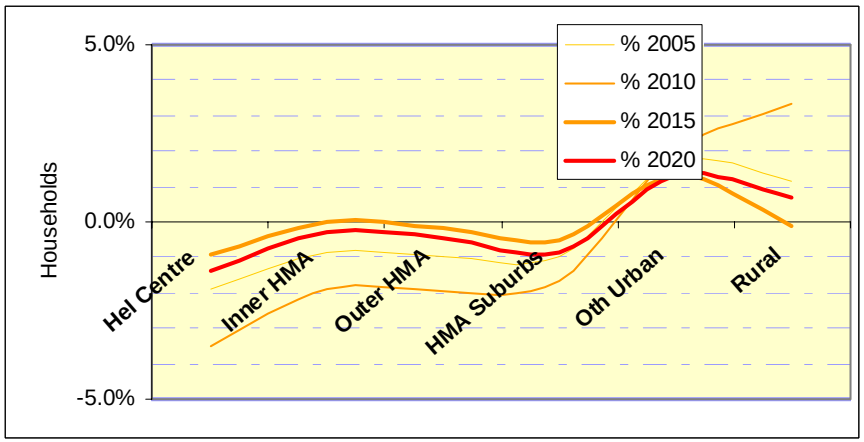
Combinations (car pricing, PT, land use)

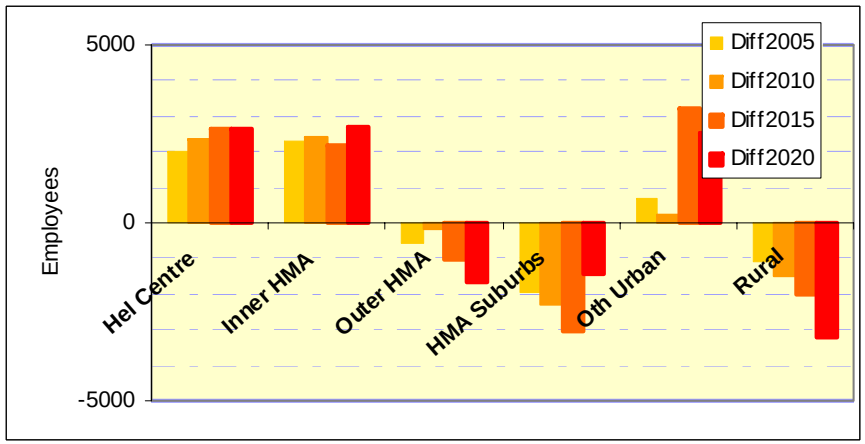


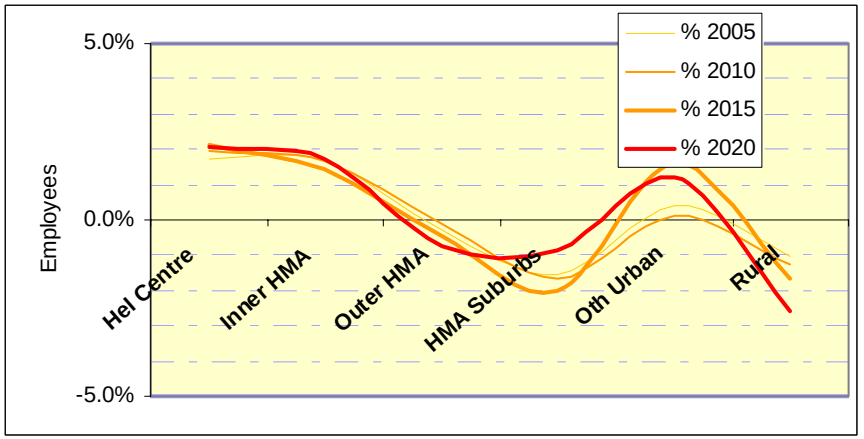
Policy combination 2

812 H = 411 (VOC+50%) + 512 (fares –20%) + 331 (LU pricing)









Conclusions - combinations

- The combination policies are able to simultaneously improve all dimensions of sustainability (compared with the base scenario)
- In some cases they also maintain or improve the current level of sustainability
- The combinations work efficiently against city sprawl but the overall effect remains small compared with the base trends: population and welfare growth.

Conclusions - combinations

- Results of the combination policies in Helsinki:
  - car-km reduction - 14 –18%
  - PT-km increase +16 -17%
  - CO2 reduction - 11 – 12%
  - accident reduction - 12 – 14%
  - less exposure to noise and pollutants
  - improved accessibilities
  - less sprawl
  - economic benefits (NPV) +1900€/inh

4. Overall conclusions

Overall conclusions

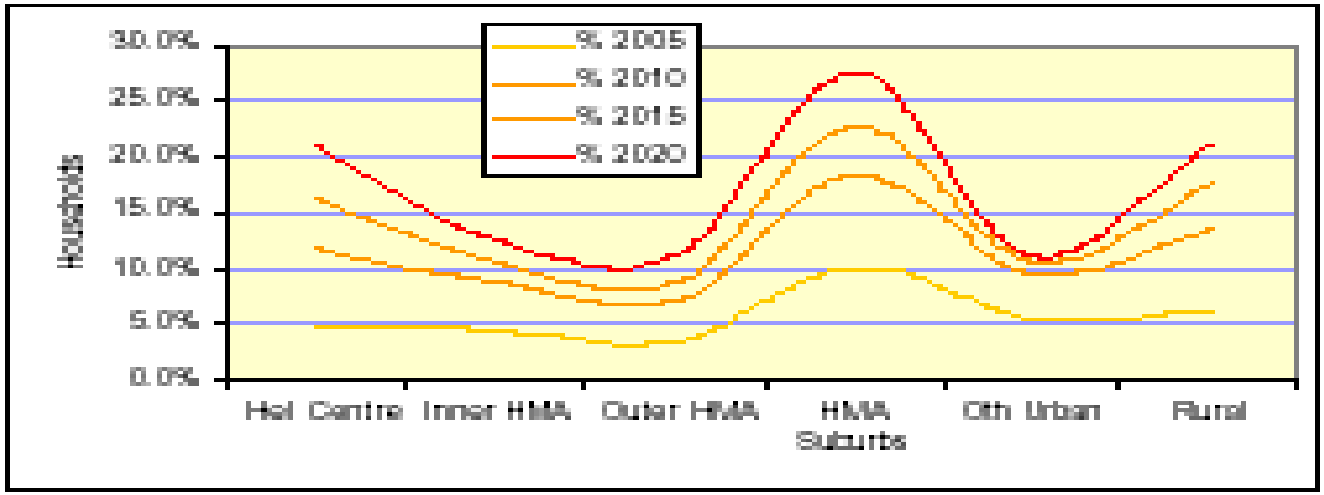
- The sustainability evaluation showed that mosts of the tested policies reducing sprawl also improved the three dimensions of sustainability, i.e.
- Reduced sprawl means increased sustainability (exception: PT improvements may sustainable but may add to city sprawl)

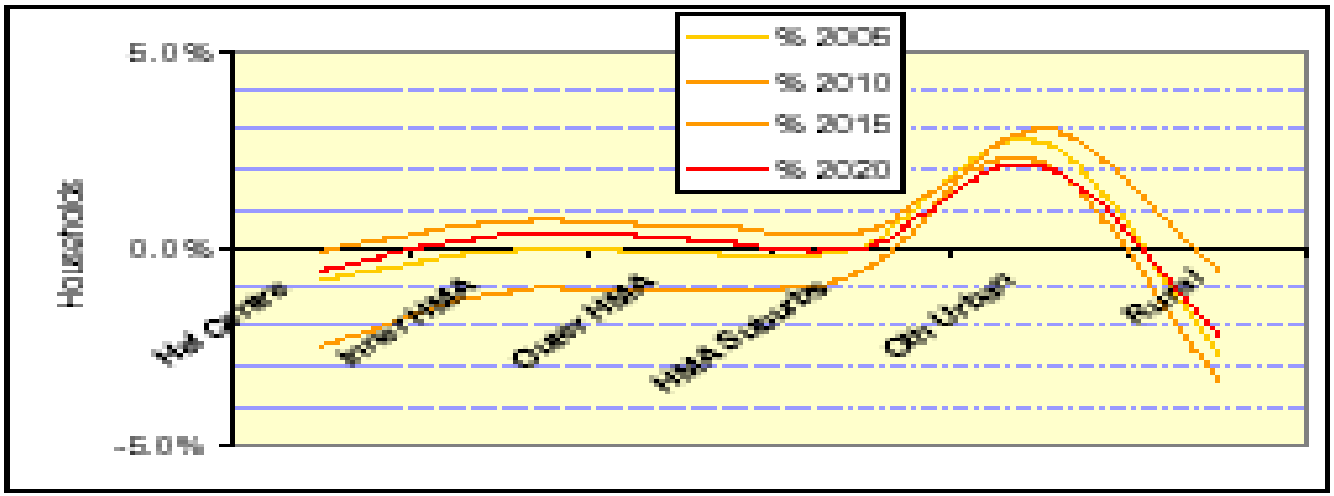
Conclusions

- The best policies were the combinations of car pricing, PT fare reductions and land use policies
- They had positive impacts on most of the city sprawl variables and simultaneously improved all the three dimensions of sustainability

Thank you for your attention!

Base trends vs. policy combination 813





SCATTER		Base		Investment policies				
Indicators of Work package 5: basic indicators for simulation results		PRESENT	Base 2021	Do not invest	Only car investments	Only PT investments	All reference investments	Develop orbital connections of PT
Helsinki case city		2001	000	001	002	003	004	121
Indicator	Unit							
Overall mobility								
Average travel time (all modes)	minutes	29.8	29.2	-0.5%	0.0%	-0.3%	0.0%	-0.2%
Public transport								
Modal share of modes	%	44.1	42.3	-1.4	-1.4	0.2	0.0	0.1
Passenger-km by public modes	km/inhabitant/a	5232	5734	-5.1%	-4.2%	-0.6%	0.0%	0.3%
Road traffic								
Private vehicle-km	km/inhabitant/a	2451	2930	-6.7%	-1.4%	-4.9%	0.0%	-0.7%
Greenhouse gases from transport	eq.ton/inhabitant/a	1.41	1.78	-1.6%	-0.9%	-0.5%	0.0%	-0.8%
Land use								
Households in core metropolitan area	#	265432	304320	0.1%	0.0%	0.1%	0.0%	-0.1%
Employees in core metropolitan area	#	392807	499005	-0.2%	-0.2%	-0.2%	0.0%	-0.1%
Accessibilities								
Average home-work travel distance	kilometres	16.2	15.0	-0.7%	1.0%	-0.9%	0.0%	-0.3%
Accessibility to city centre	minutes/trip	29.3	29.8	-0.9%	-0.6%	0.0%	0.0%	-0.3%
Accessibility to services	minutes/trip	27.7	28.2	-1.6%	-1.2%	-0.4%	0.0%	0.3%
Productivity gain from land use	%	0.0	0.0	-0.5	0.4	-1.1	0.0	0.2
	HMA	diff. in % units						

SCATTER		Base		New town alternatives				
Indicators of Work package 5: basic indicators for simulation results		PRESENT	Base 2021	Vuosaari	Marja-Vantaa	Keski-Pasila	Espoon keskus	Matinkylä
Helsinki case city		2001	000	211	212	213	214	215
Indicator	Unit							
Overall mobility								
Average travel time (all modes)	minutes	29.8	29.2	0.2%	0.9%	2.8%	-0.4%	3.2%
Public transport								
Modal share of modes	%	44.1	42.3	-0.5	-0.2	0.7	-0.2	0.0
Passenger-km by public modes	km/inhabitant/a	5232	5734	-1.4%	-0.9%	2.4%	-1.0%	0.1%
Road traffic								
Private vehicle-km	km/inhabitant/a	2451	2930	1.8%	1.2%	4.7%	-1.4%	6.0%
Greenhouse gases from transport	eq.ton/inhabitant/a	1.41	1.78	2.6%	1.5%	4.1%	-0.4%	5.6%
Land use								
Households in core metropolitan area	#	265432	304320	0.0%	-0.9%	-0.4%	-0.2%	-0.6%
Employees in core metropolitan area	#	392807	499005	-3.6%	-3.9%	0.5%	-1.6%	-2.4%
Accessibilities								
Average home-work travel distance	kilometres	16.2	15.0	1.0%	0.8%	3.4%	0.1%	4.7%
Accessibility to city centre	minutes/trip	29.3	29.8	-0.4%	-0.6%	1.0%	-0.9%	0.6%
Accessibility to services	minutes/trip	27.7	28.2	0.1%	0.7%	0.5%	0.0%	0.6%
Productivity gain from land use	%	0.0	0.0	-0.4	-0.2	-0.7	0.4	-0.7
	HMA	diff. in % units						

SCATTER		Base		Land use (pricing) policies				
Indicators of Work package 5: basic indicators for simulation results		PRESENT	Base 2021	DIF 670 euro/a	DIF 340 eur/a	DIF 1000 euro/a	ABC land use regulation for businesses	ABC land use pricing for businesses
Helsinki case city		2001	000	311	312	313	321	331
Indicator	Unit							
Overall mobility								
Average travel time (all modes)	minutes	29.8	29.2	-0.4%	-0.4%	-0.7%	-0.3%	-0.1%
Public transport								
Modal share of modes	%	44.1	42.3	-0.1	0.1	-0.1	-0.2	0.0
Passenger-km by public modes	km/inhabitant/a	5232	5734	-0.6%	0.0%	-0.4%	-0.5%	-0.3%
Road traffic								
Private vehicle-km	km/inhabitant/a	2451	2930	-1.1%	-0.2%	-0.9%	0.6%	-0.4%
Greenhouse gases from transport	eq.ton/inhabitant/a	1.41	1.78	-1.0%	-0.2%	-0.9%	0.7%	-0.4%
Land use								
Households in core metropolitan area	#	265432	304320	0.6%	0.3%	0.9%	0.5%	0.1%
Employees in core metropolitan area	#	392807	499005	0.2%	0.1%	0.4%	1.8%	0.3%
Accessibilities								
Average home-work travel distance	kilometres	16.2	15.0	-0.1%	-0.1%	-1.1%	0.5%	-0.2%
Accessibility to city centre	minutes/trip	29.3	29.8	-0.7%	0.1%	-0.6%	0.0%	0.0%
Accessibility to services	minutes/trip	27.7	28.2	-0.1%	0.0%	-0.2%	-0.5%	-0.1%
Productivity gain from land use	%	0.0	0.0	0.2	-0.1	0.1	0.2	0.0
	HMA	diff. in % units						

SCATTER		Base		Transport pricing		
Indicators of Work package 5: basic indicators for simulation results		PRESENT	Base 2021	Car operating cost +50%	Cordon (peak) pricing 2.55 euro	PT fare - 20%
Helsinki case city		2001	000	411	412	512
Indicator	Unit					
Overall mobility						
Average travel time (all modes)	minutes	29.8	29.1	-5.1%	-3.5%	5.1%
Public transport						
Modal share of modes	%	44.1	42.3	0.8	3.4	4.5
Passenger-km by public modes	km/inhabitant/a	5232	5734	-0.8%	6.2%	14.8%
Road traffic						
Private vehicle-km	km/inhabitant/a	2451	2930	-17.4%	-35.9%	0.9%
Greenhouse gases from transport	eq.ton/inhabitant/a	1.41	1.78	-11.8%	-25.1%	0.0%
Land use						
Households in core metropolitan area	#	265432	304320	1.7%	3.0%	-2.3%
Employees in core metropolitan area	#	392807	499005	0.0%	-1.9%	0.2%
Accessibilities						
Average home-work travel distance	kilometres	16.2	15.0	-13.8%	-3.9%	16.4%
Accessibility to city centre	minutes/trip	29.3	29.8	-2.7%	-6.7%	-1.7%
Accessibility to services	minutes/trip	27.7	28.2	-2.3%	-3.2%	1.7%
Productivity gain from land use	%	0.0	0.0	1.0	-0.6	0.4
	HMA	diff. in % units				

SCATTER		Base		Combinations		
Indicators of Work package 5: basic indicators for simulation results		PRESENT	Base 2021	Comb. 411+512+311	Comb. 411+512+331	Comb. 411+512+311+331
Helsinki case city		2001	000	811	812	813
Indicator	Unit					
Overall mobility						
Average travel time (all modes)	minutes	29.8	29.2	0.8%	1.1%	-0.2%
Public transport						
Modal share of modes	%	44.1	42.3	6.1	12.3	12.2
Passenger-km by public modes	km/inhabitant/a	5232	5734	16.8%	16.9%	16.2%
Road traffic						
Private vehicle-km	km/inhabitant/a	2451	2930	-16.1%	-15.9%	-17.6%
Greenhouse gases from transport	eq.ton/inhabitant/a	1.41	1.78	-10.7%	-10.6%	-12.0%
Land use						
Households in core metropolitan area	#	265432	304320	0.1%	-0.5%	0.2%
Employees in core metropolitan area	#	392807	499005	0.9%	0.8%	1.2%
Accessibilities						
Average home-work travel distance	kilometres	16.2	15.0	0.5%	0.9%	-0.3%
Accessibility to city centre	minutes/trip	29.3	29.8	-2.1%	-2.3%	-2.6%
Accessibility to services	minutes/trip	27.7	28.2	0.0%	0.1%	-0.1%
Productivity gain from land use	%	0.0	0.0	0.3	0.4	0.7
	HMA	diff. in % units				

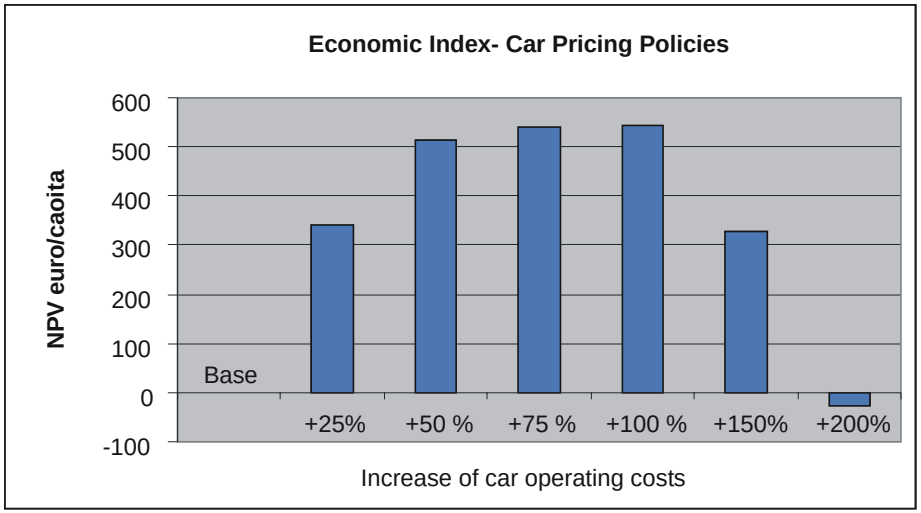
Less cars

Less sprawl

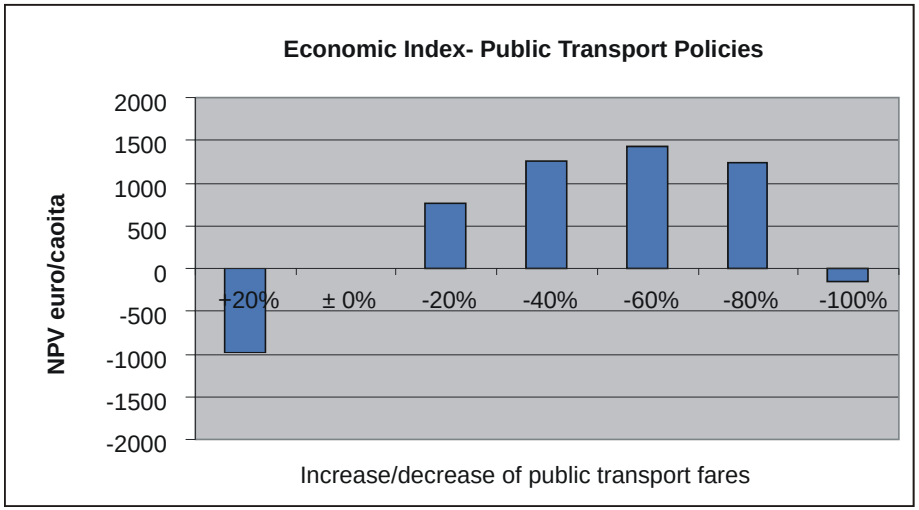
better accessibilities

Pricing policies:
There is an optimum for car pricing and PT fares

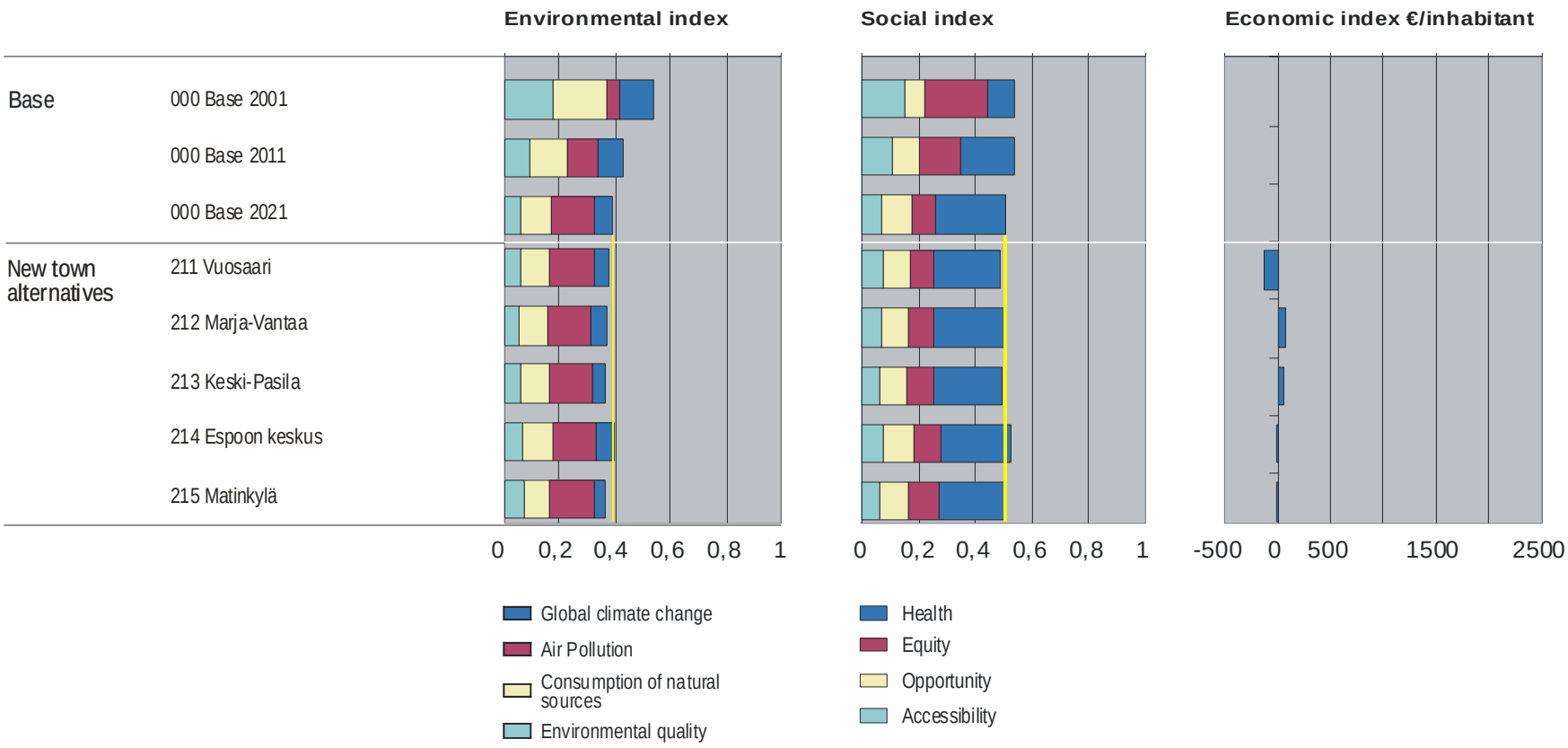
The Economic index in different car pricing policies



The Economic index in different public transport pricing policies



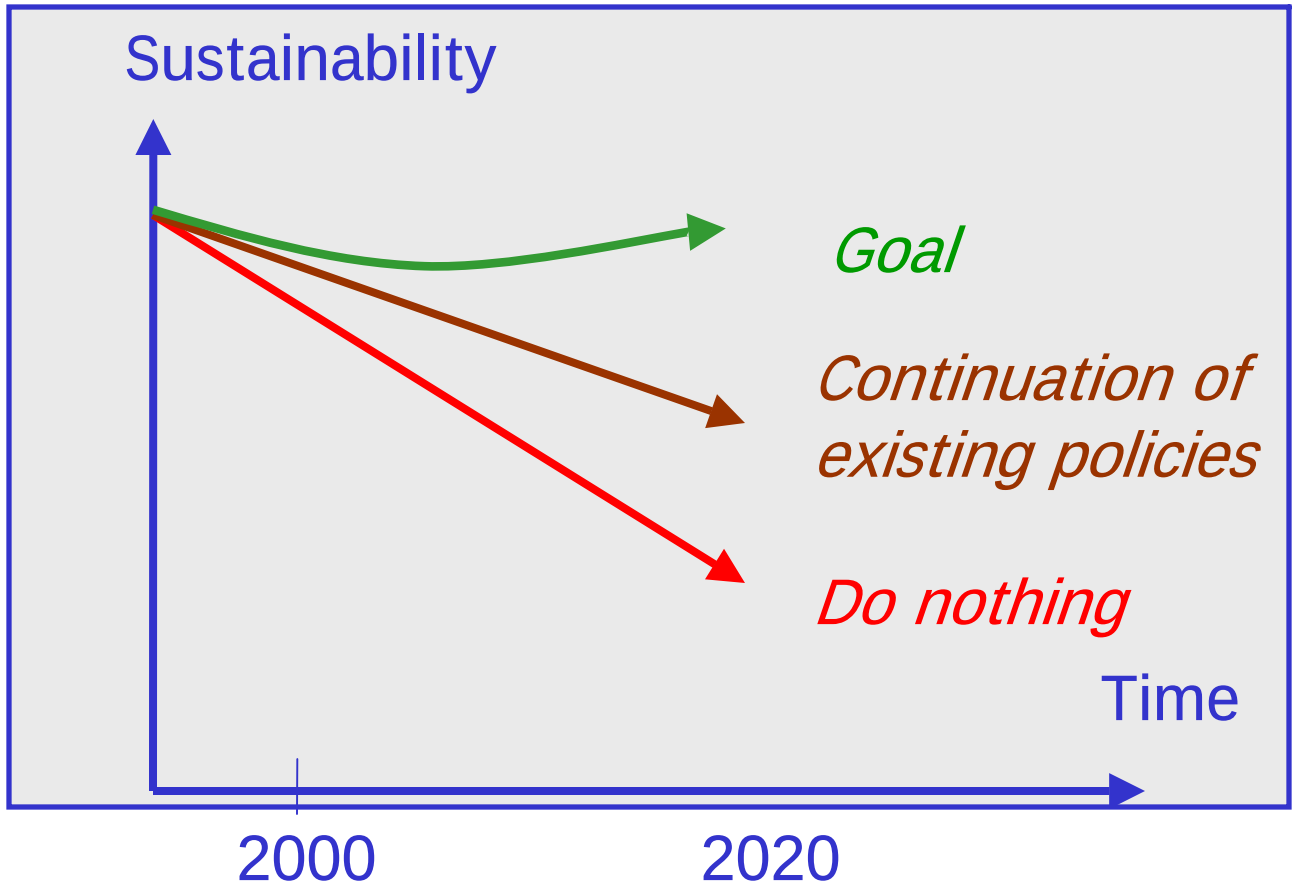
New town alternatives



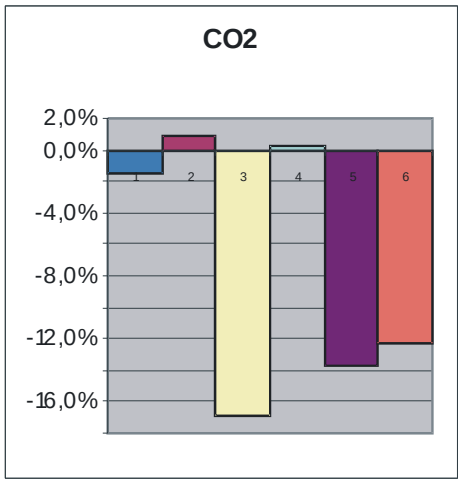
Conclusions – New town alternatives

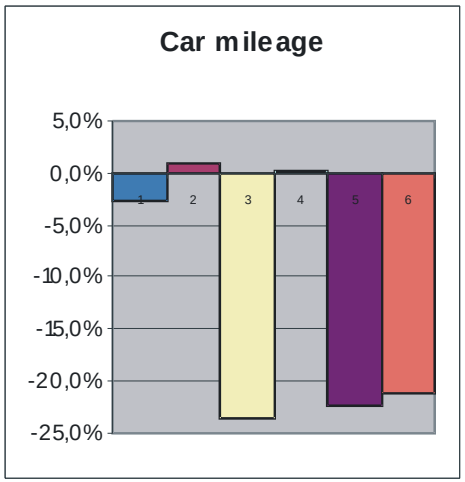
- The overall differences are environmentally, socially and economically small between the alternative locations
- Pasila, the most central alternative, with best PT and road connections has also the highest increase in overall mobility

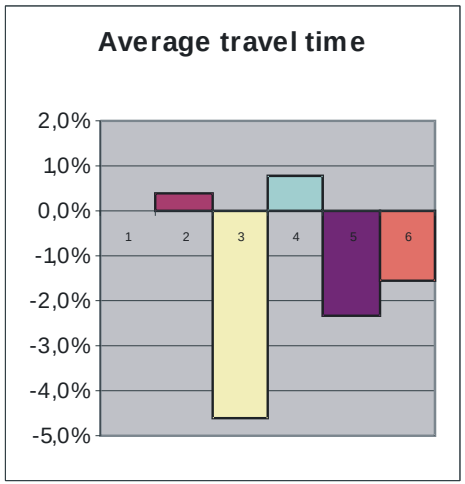
Objectives: What are the current trends - what do we try to achieve?

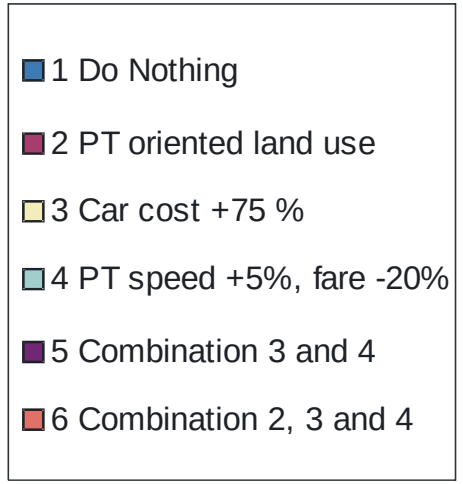


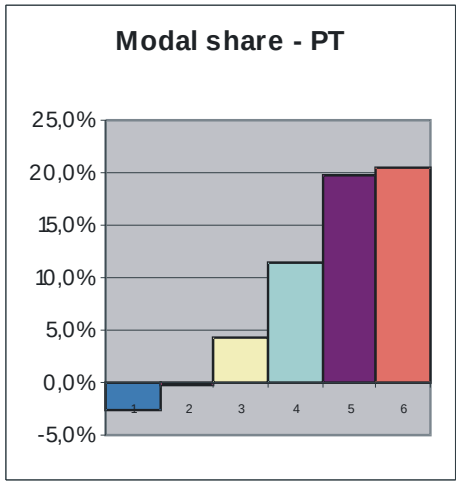
Urban sprawl assessment

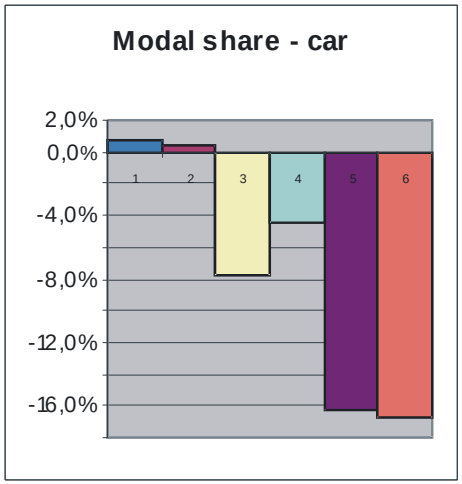


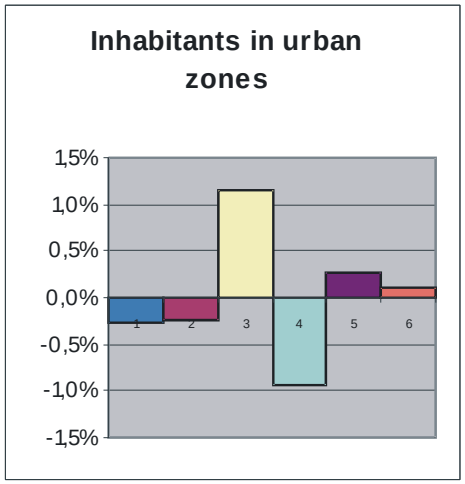


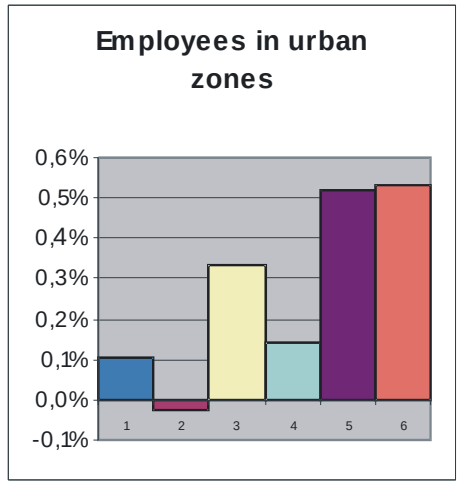






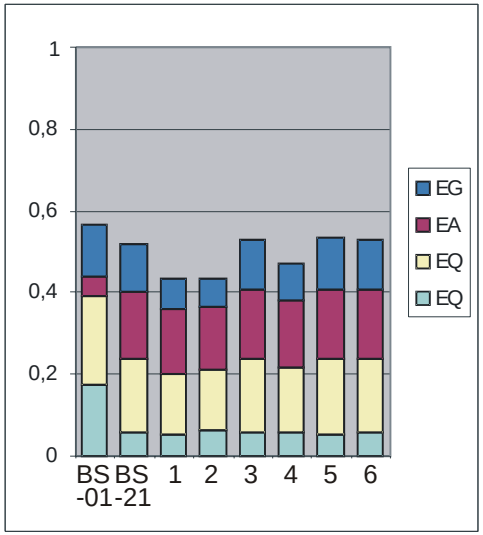




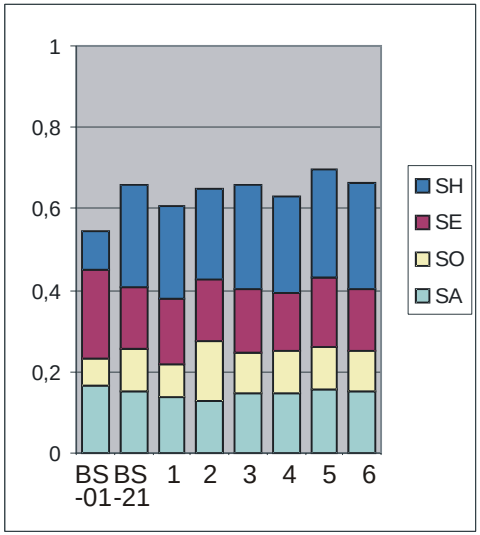


Sustainability evaluation

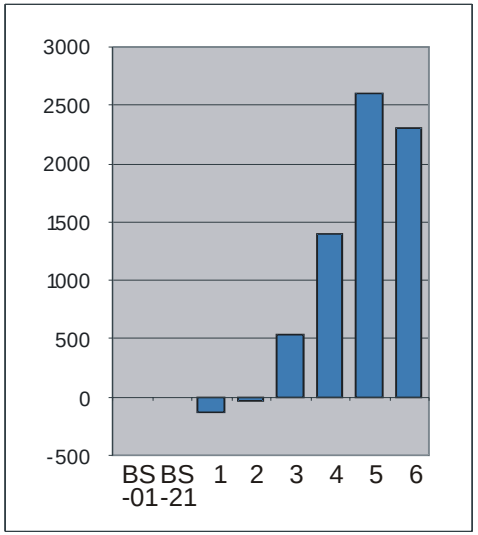
Environmental index



Social index



Economic index



1 Do Nothing

2 PT oriented land use

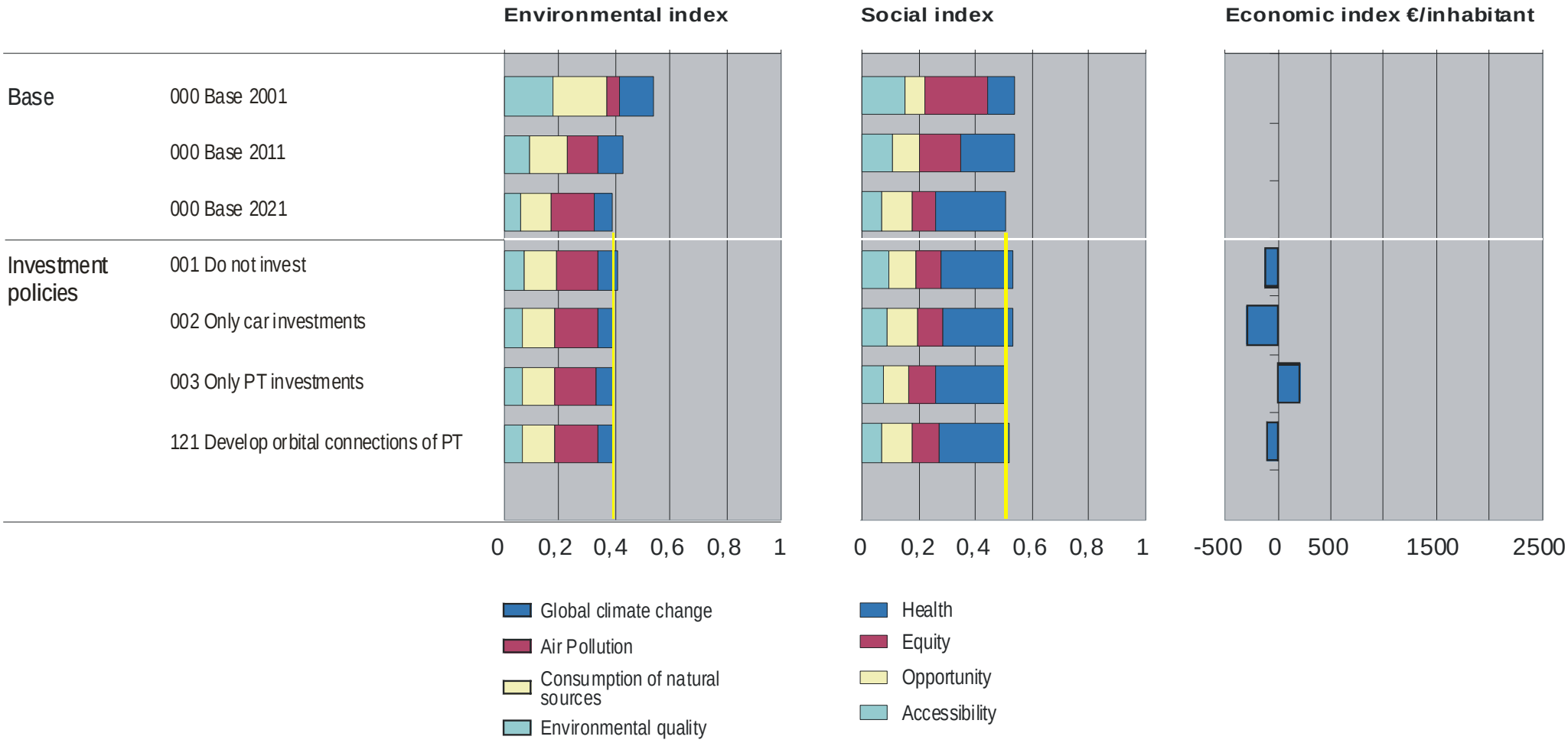
3 Car cost +75 %

4 PT speed +5%, fare -20%

5 Combination 3 and 4

6 Combination 2, 3 and 4

Investment policies

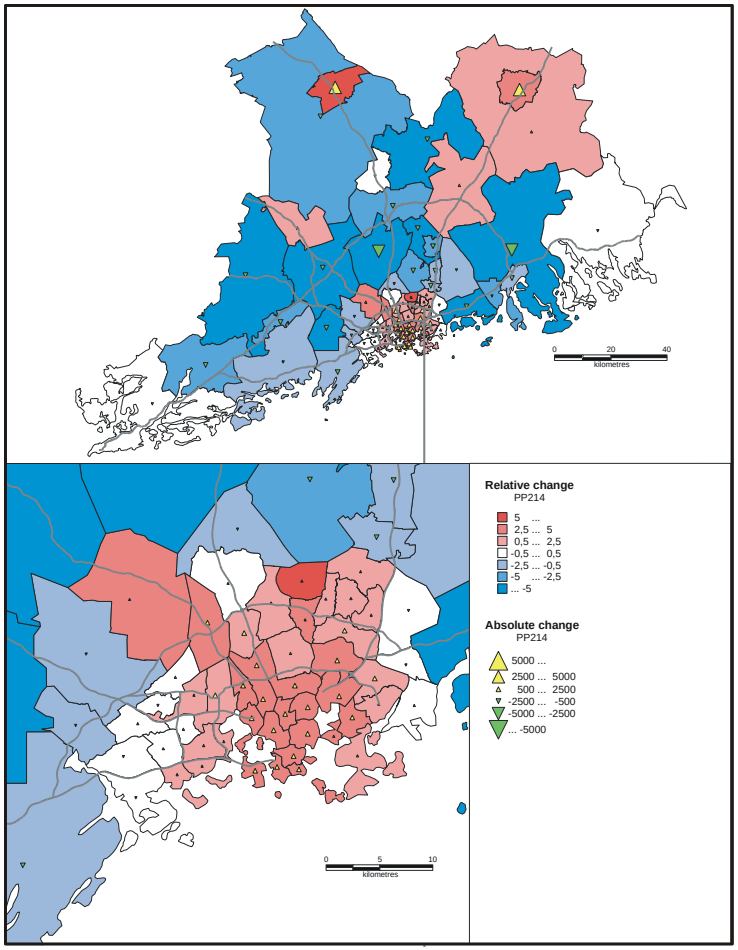


Conclusions – Investment policies

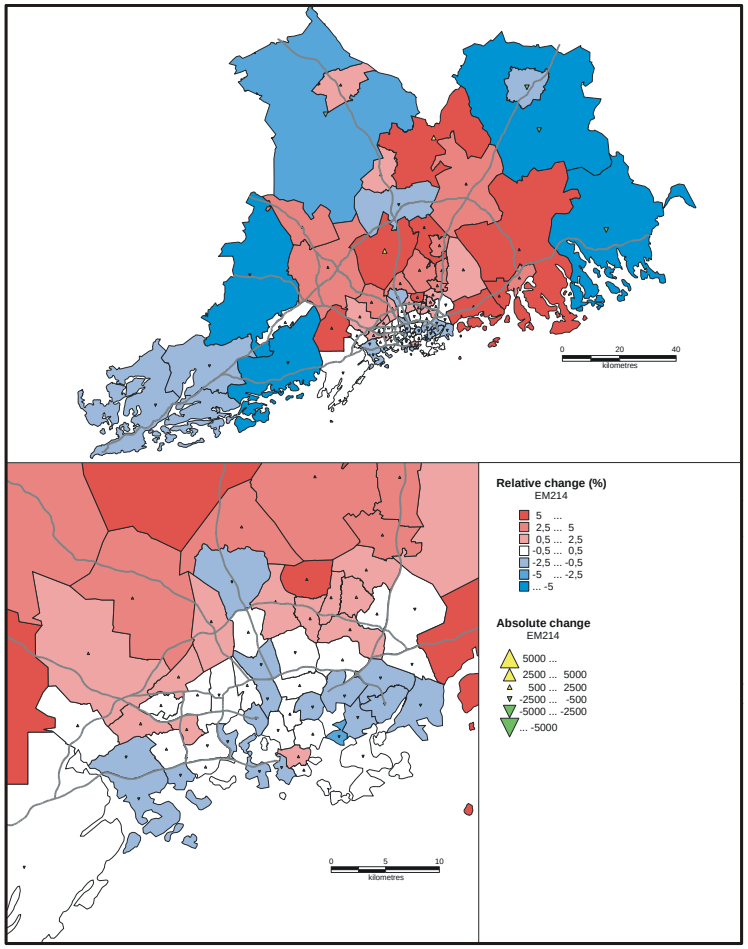
- The effect on environmental and social sustainability is small
- Transport investments (both PT and road) tend to, in many cases:
  - increase kilometres travelled
  - increase the average travel time
  - increase CO2 emissions
  - decrease accessibilities

Car costs +75% - Land use changes

Population



Employment



Indicators are defined to measure each dimension of sustainability (PROPOLIS). The indicator themes are:

ENVIRONMENTAL

Global climate change
Air pollution
Consumption of natural sources
Environmental quality

SOCIAL

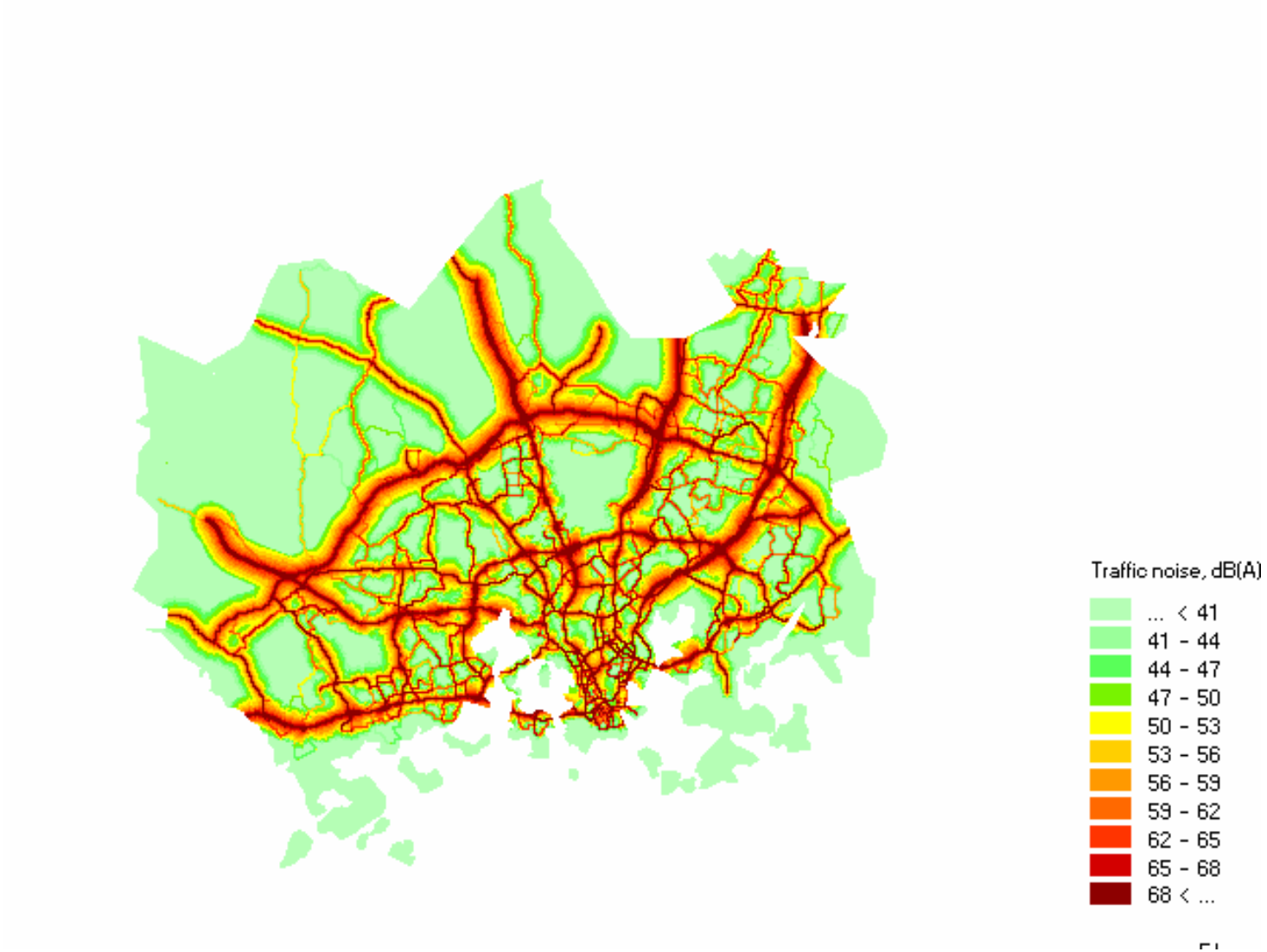
Health
Equity
Opportunities

Accessibility and traffic

ECONOMIC

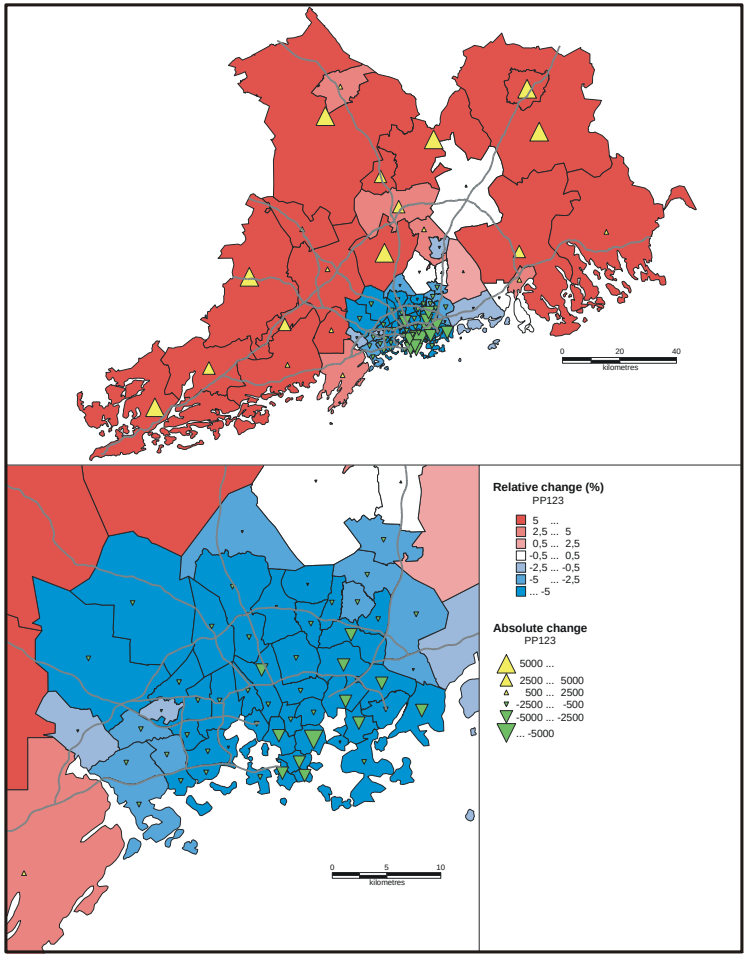
Total net benefit from transport

Example: Noise levels and exposure to noise

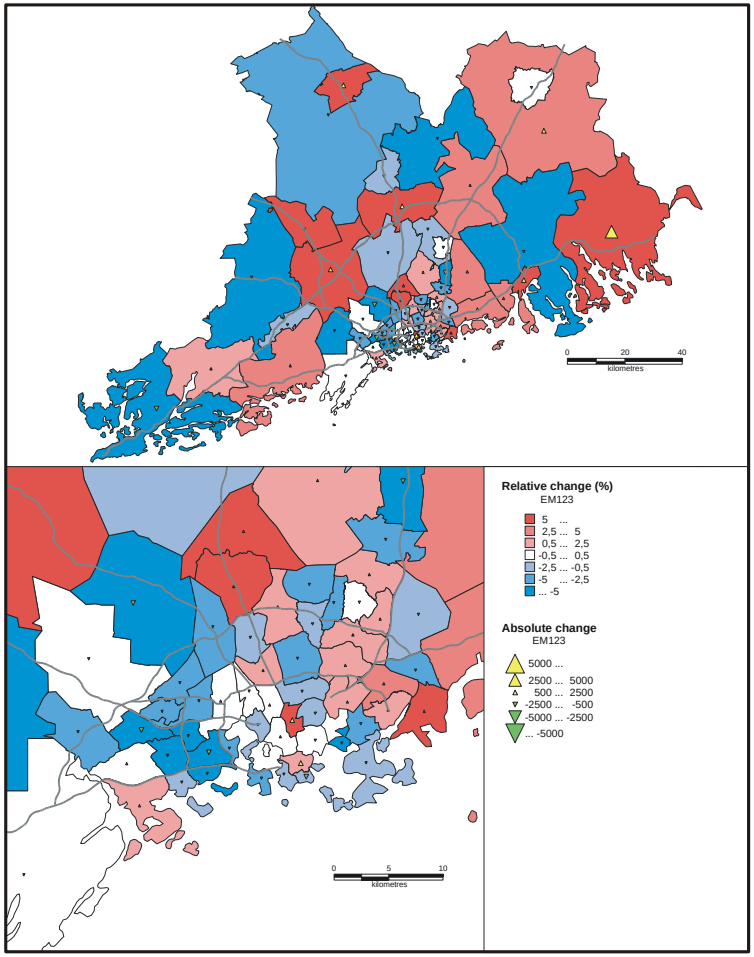


PT-fares –60% - Land use changes

Population

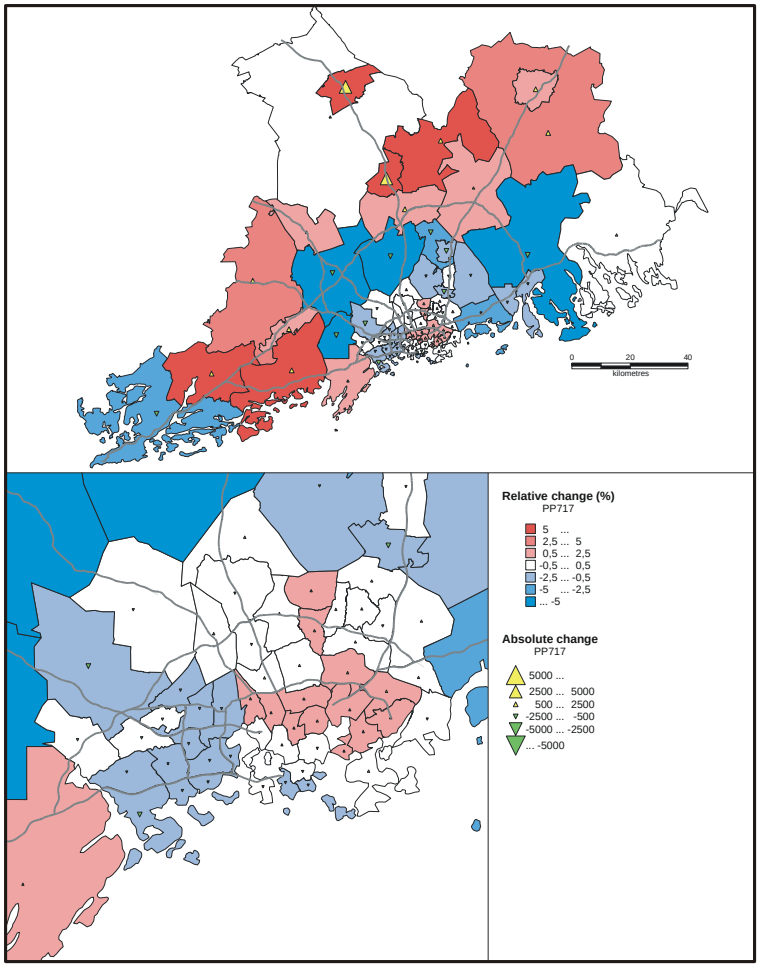


Employment



Car costs +75%, PT speed/service +5%, PT fare –20%

Population



Employment