

Theory and degrees of decoupling in the transport sector

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Structure of the talk

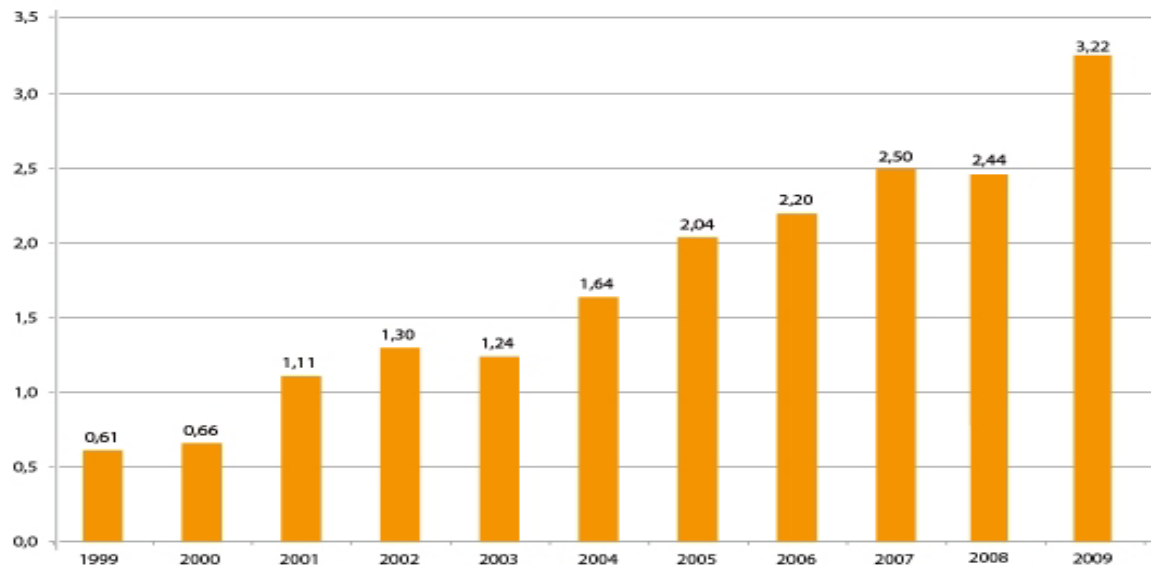
- Organizational background
- Climate and transport
- Decoupling framework
 - Decoupling Diamond
 - Decoupling what from what?
- Empirical studies on decoupling





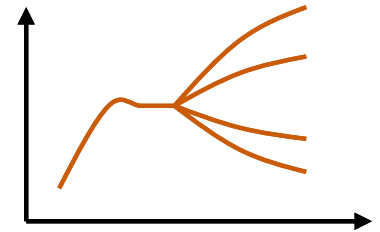
On Finland Futures Research Centre

- Founded 1992, now part of University of Turku
- Offices in Turku, Helsinki and Tampere + 10 teleworkers
- Staff 50-60
- External funding over 80%
- Annual turnover 1999-2009 (M€):
- www.ffrc.utu.fi



Central activities at FFRC

- Education
 - Finland Futures Academy
 - Master's program in Futures Studies
 - Summer School
 - Annual international conference
- A variety of futures studies applications
 - Developmental studies
 - Regional studies
 - Business foresight
 - Cultural studies
 - Educational research
 - Sectoral environmental applications: Energy, Transport, Industry, Agro-Food, Forest, Waste
 - Most environmental applications climate policy oriented
- www.ffrc.utu.fi



Research group FIDEA

- Frameworks for InterDisciplinary Environmental Analysis
- Hybrid group between
 - Finland Futures Research Centre, Univ. Turku
 - Environmental Policy Centre, Finnish Environment Institute SYKE
 - Environmental Sciences, Univ. Helsinki
- www.fidea.fi



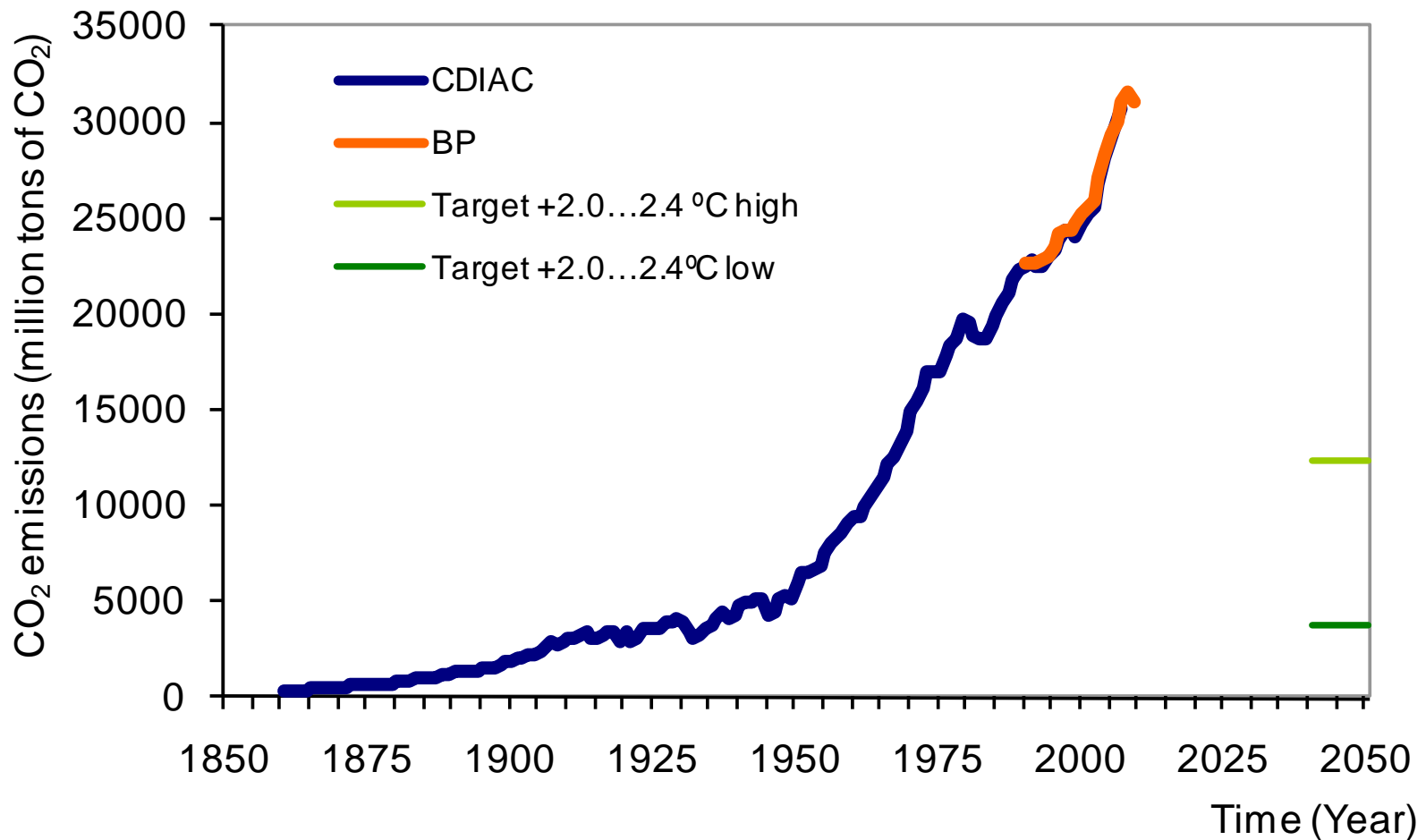
Current transport research by FIDEA group



- SIGHT
 - Transport and total CO₂ emissions in the world
 - Statistical analysis of past trends
 - Data from 137 countries
- CAST
 - Climate policy discussion of transport in Finland
 - Delphi study and media analysis
 - Qualitative and quantitative
- ILARI (lead by VTT)
 - Scenarios using transport climate policy packages
 - Transport visions of young people and professionals

CO₂ 1860-2009 and climate stabilization target

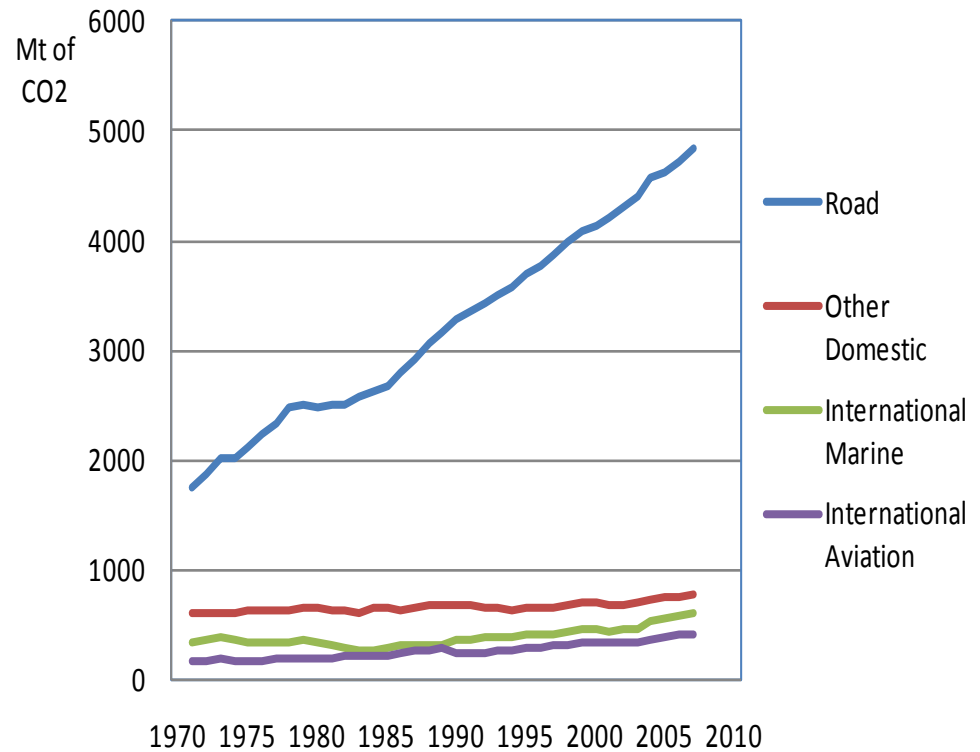
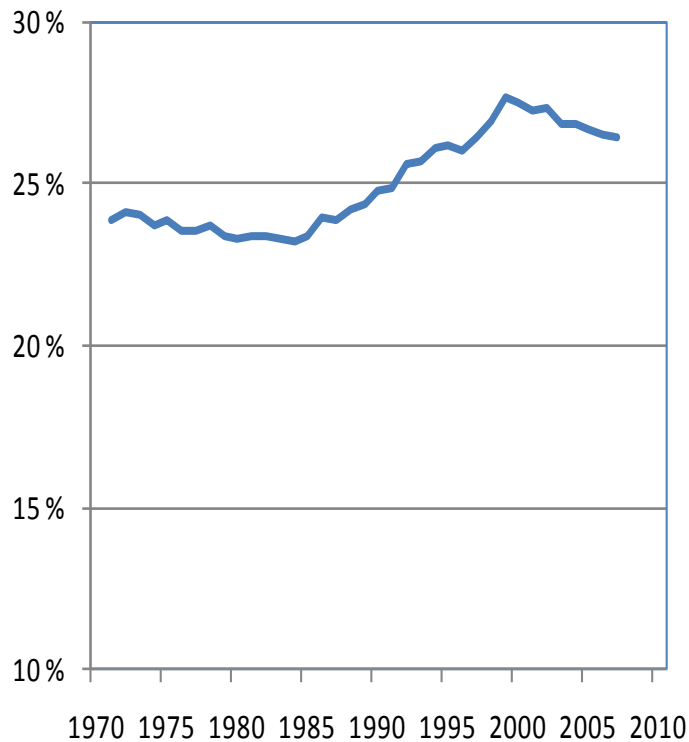
Limit global warming to +2.0...2.4 °C (Source: CDIAC & BP & IPCC)



Global CO₂ emissions 1971-2009

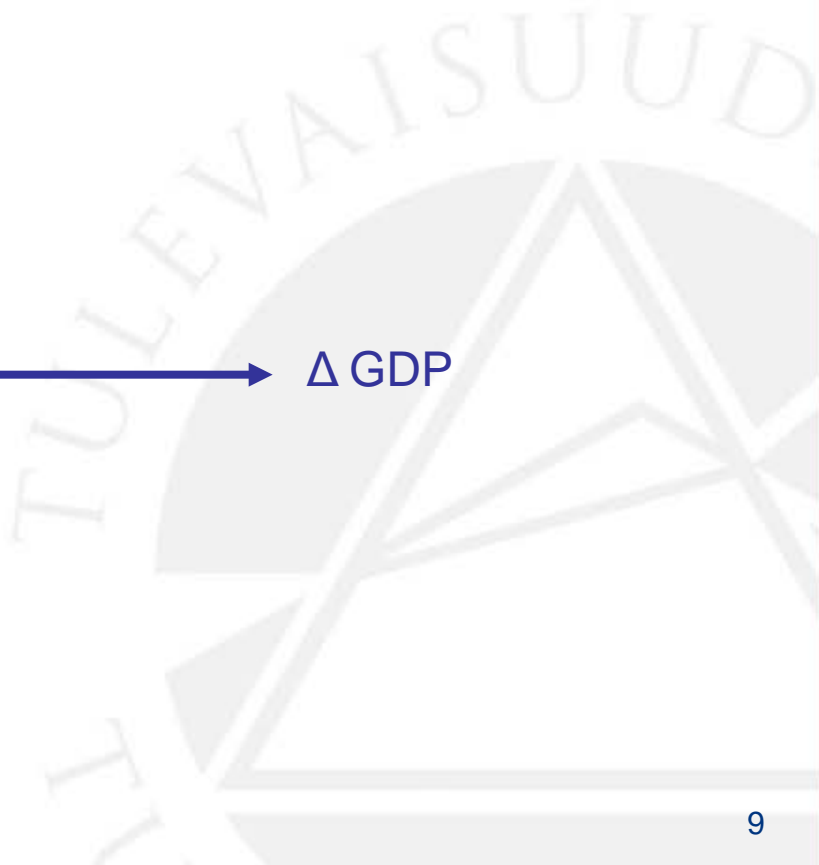
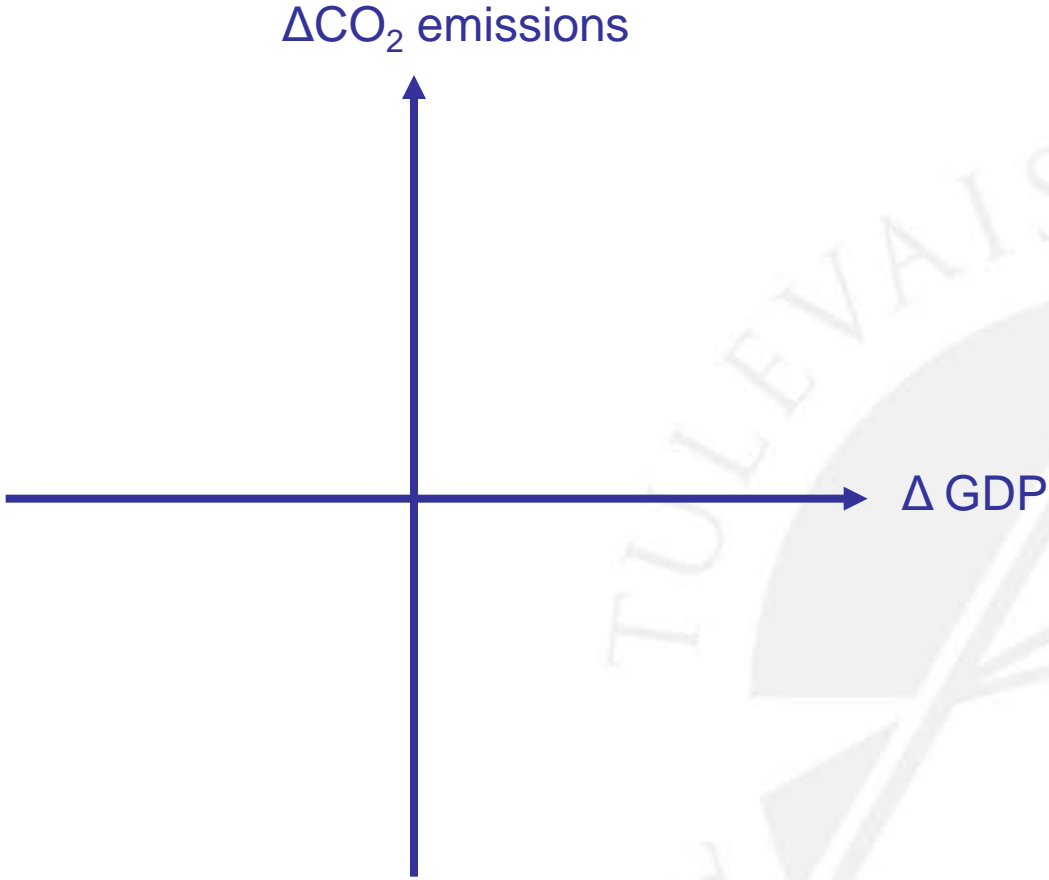
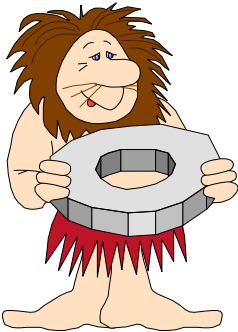
Transport's share

Breakdown

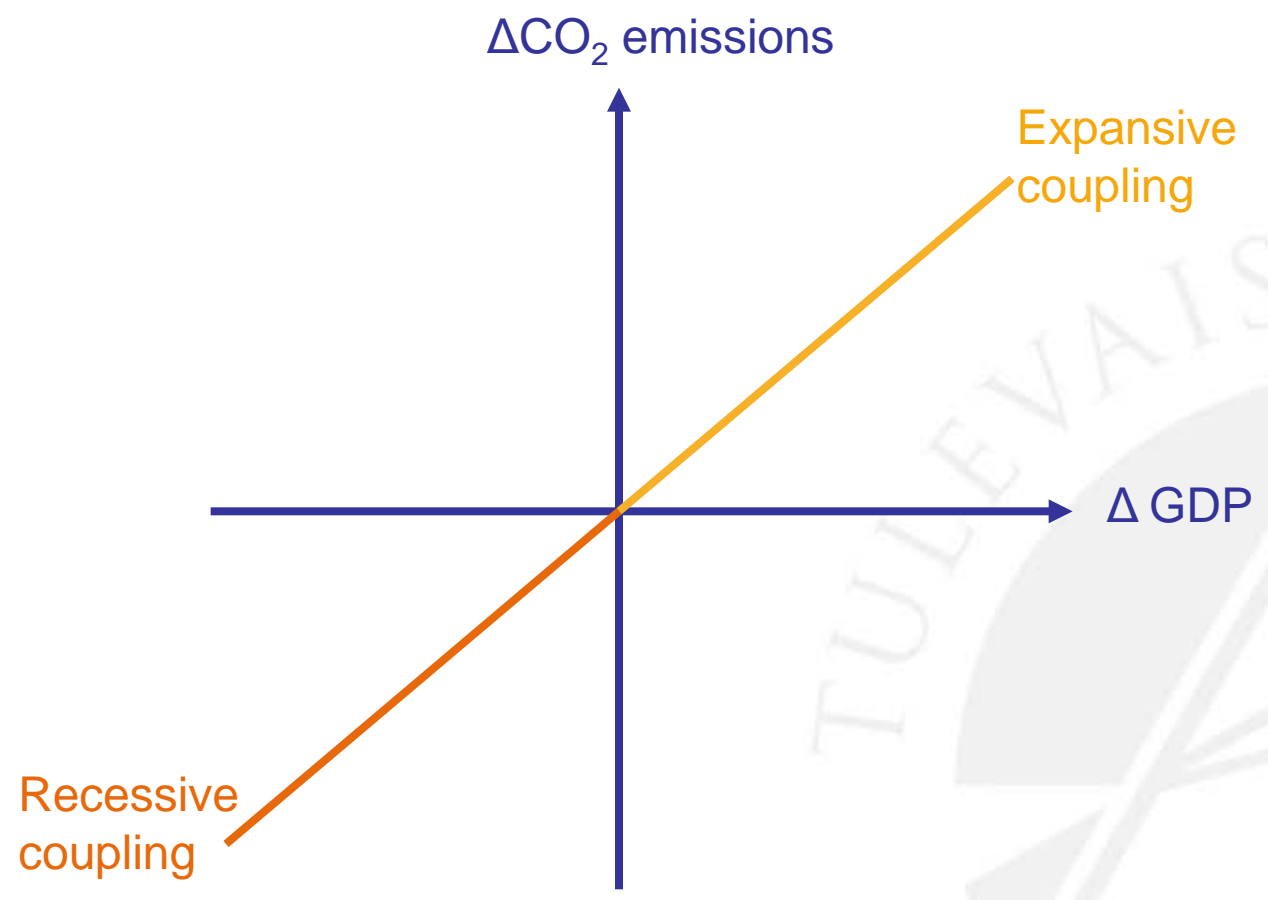


- Data: IEA 2009

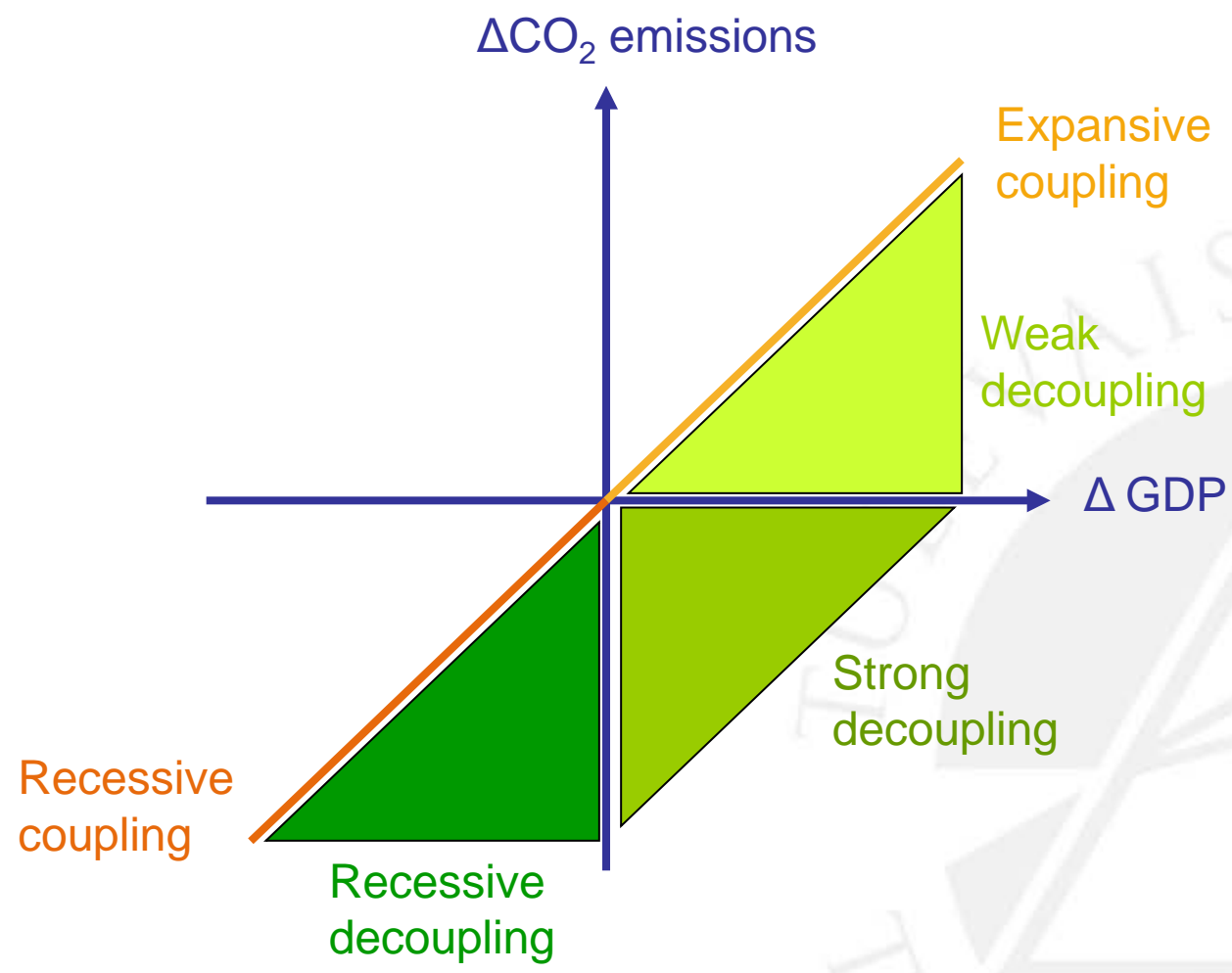
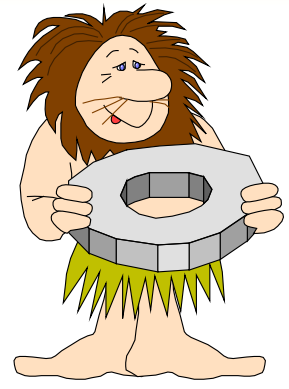
Theoretical framework – the decoupling discourse



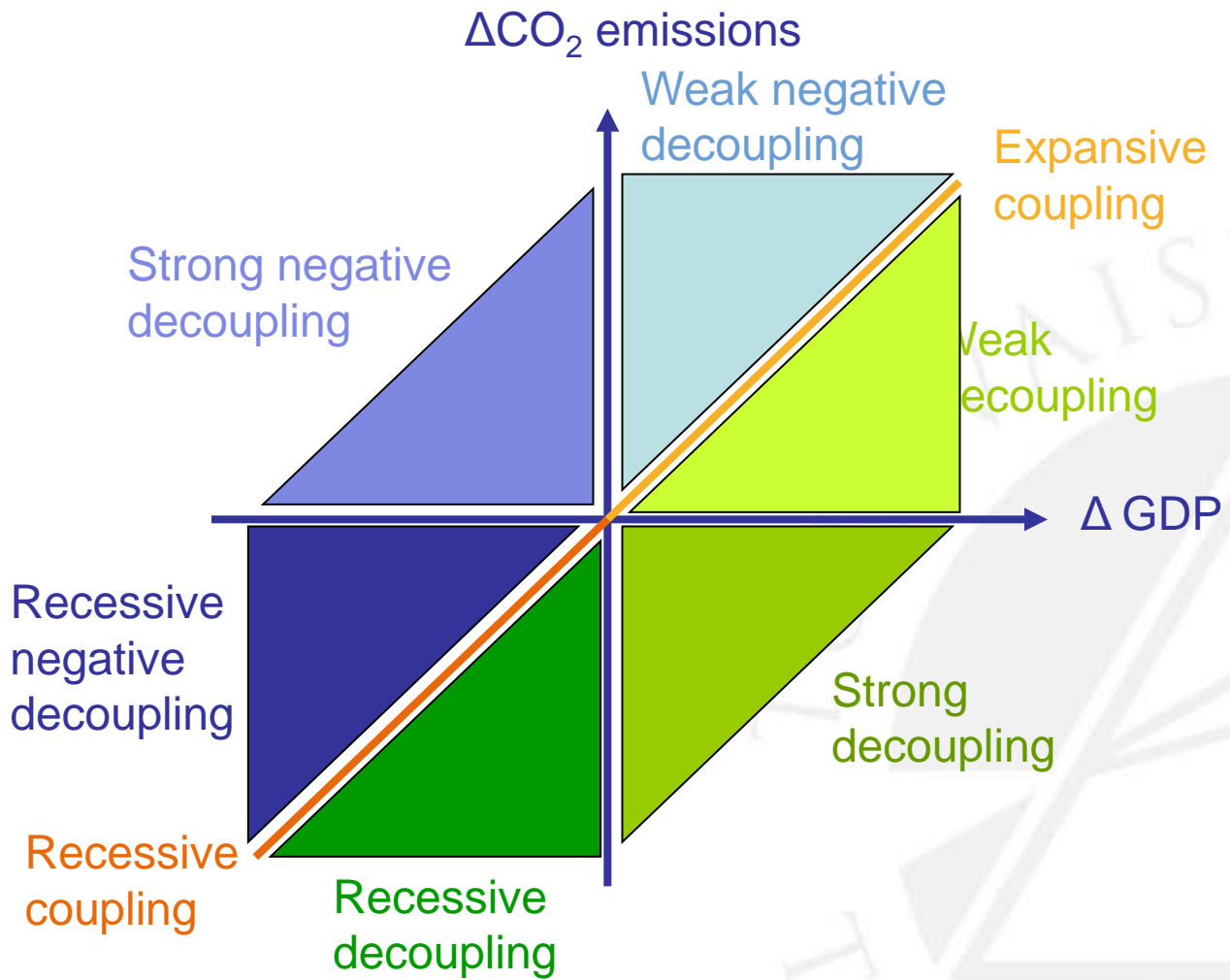
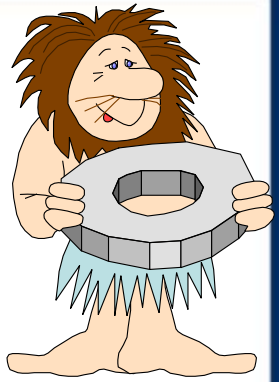
Theoretical framework - coupling



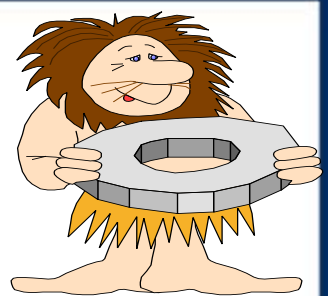
Theoretical framework - decoupling



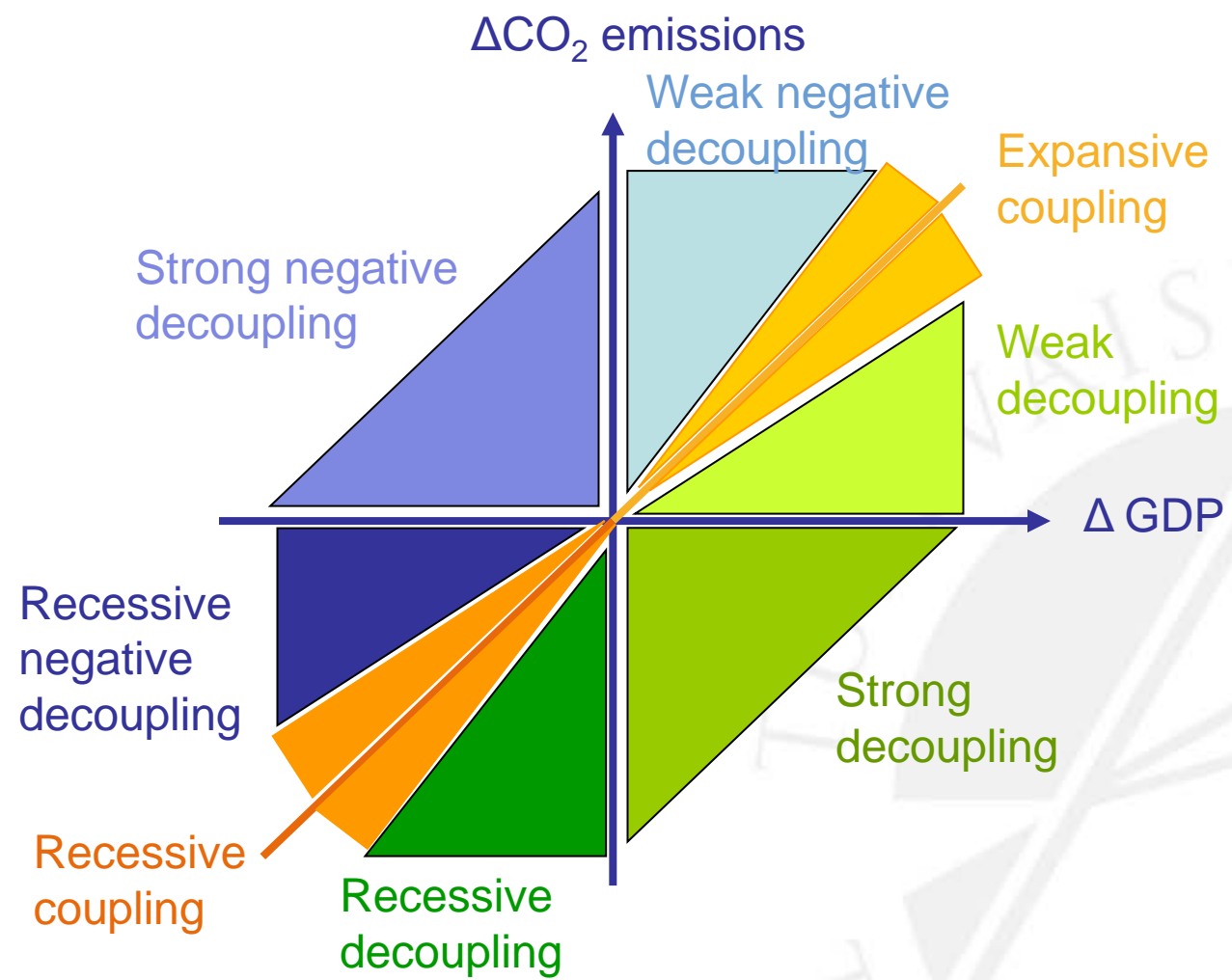
Theoretical framework – negative decoupling



Spreading the categories of coupling



Elasticity
0.8-1.2



Tapio (2005) Towards the theory of decoupling, Transport Policy 12(2):137-151.
N.Finel & P.Tapio (forthc.) Decoupling transport CO₂ from GDP in the World.

Decoupling what from what?

Main elements



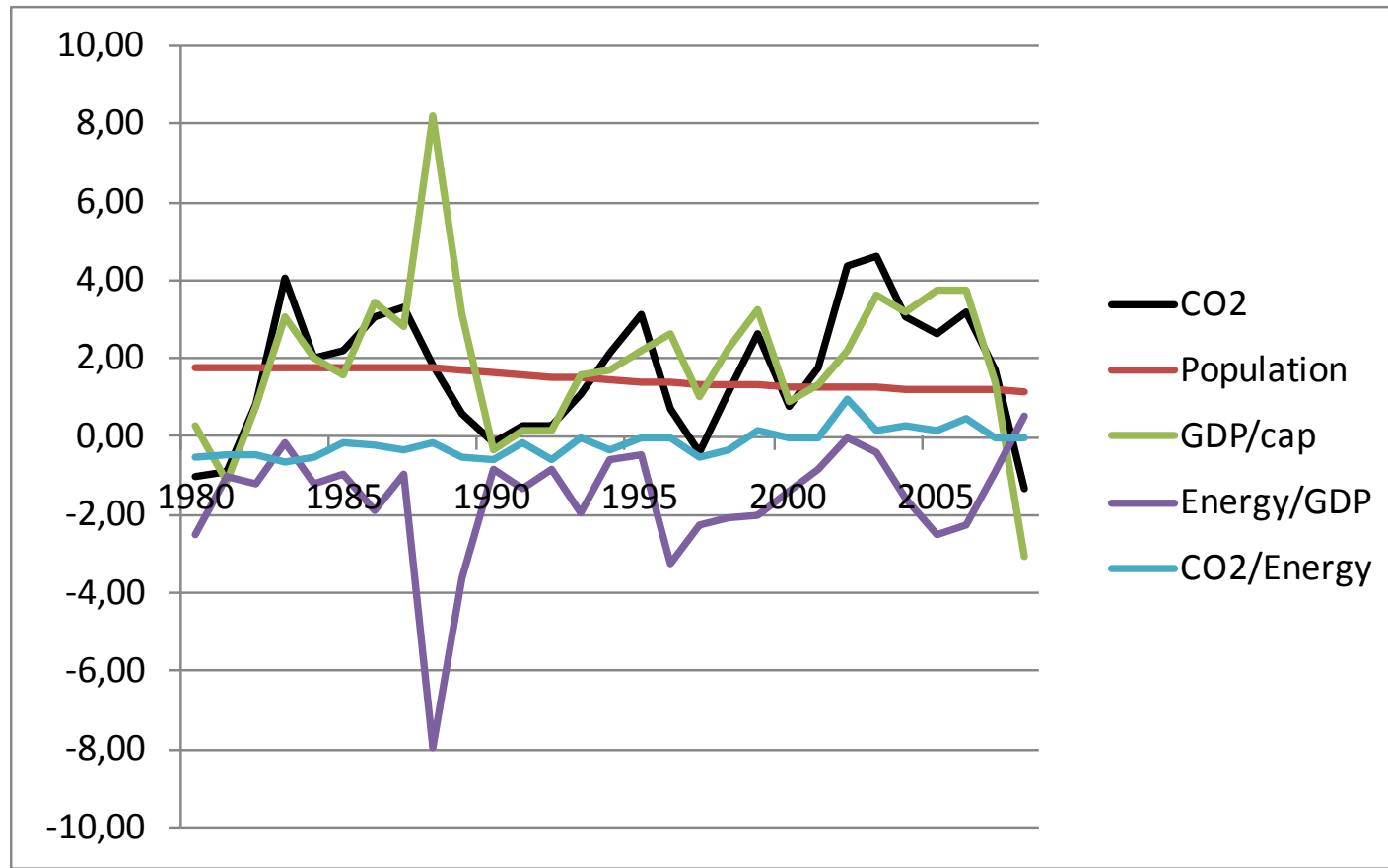
	Welfare	Economic production	Population	Material production	Environmental harm
Welfare		X	X	X	X
Economic production			X	X	X
Population				X	X
Material production					X
Environmental harm					

Measuring what with what?



Element	Welfare	Economic production	Population	Material production	Environmental harm
Measure	Questionnaires	GDP, Turnover, Disposable income	Number of people	Passenger km Ton km, Vehicle km	Eg. GHG, CO ₂ emissions, Ecological rucksack, TMR

Relative annual changes (%) World 1980-2009



- Data: BP, UN; World Bank

Research questions

- What kind of decarbonisation patterns have there been in World's countries 1971-2005?
- Are the countries having similar decarbonisation profiles similar to each other in terms of
 - GDP per cap
 - Transport CO₂ emissions per cap
- Two analyses
 - Each country examined in the decoupling framework
 - Similar profiles searched by grouping countries with cluster analysis



Decoupling study

- GDP elasticity of transport CO₂ emissions
- Five year intervals
- 1975-1990: 111 countries as well as Other Asia, Other Africa, Other Latin America, Former USSR & Former Yugoslavia
- 1990-2005: 137 countries as well as Other Asia, Other Africa, Other Latin America

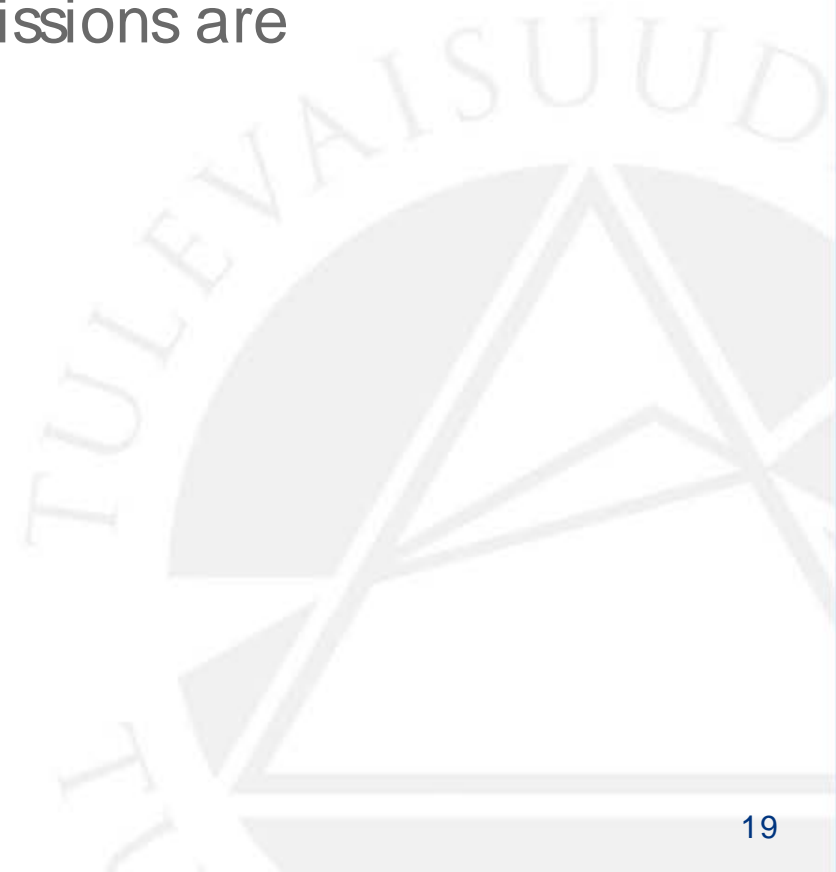


Decarbonisation indicators

- Decarbonisation = decreasing carbon intensity
 - Transport CO₂ / GDP

Data

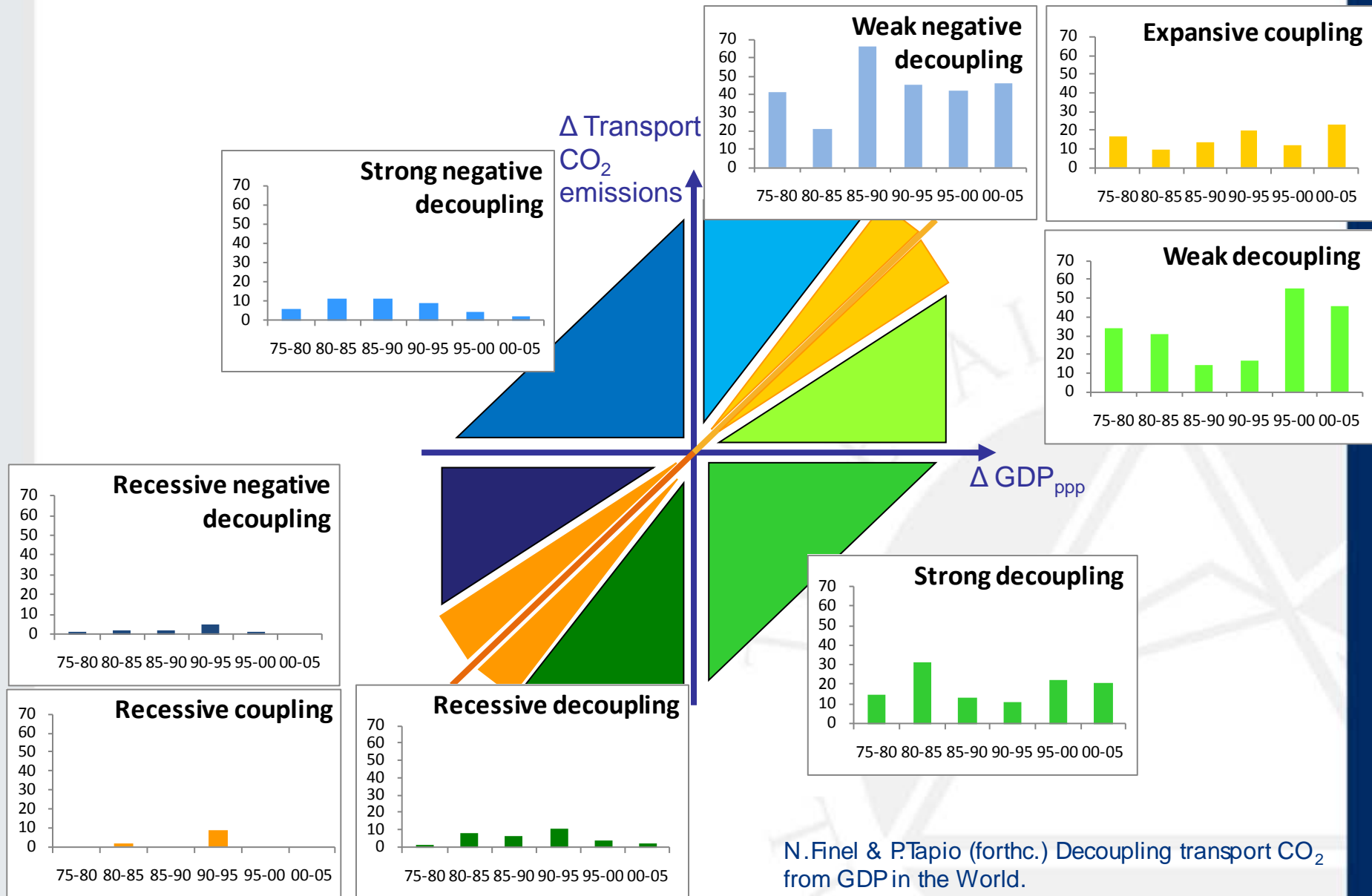
- IEA CD-Rom: CO₂ emissions from fuel combustion, data 1971-2005
- International transport emissions are included



	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000	2000-2005
Recessive coupling		AR GT		AL GE KZ LV LT MD RU TM ZM ForYugosl		
Expansive coupling	AU CL TP CO CY FR? DE ID IE IL MA SG SY TG TT TN GB	BD TP DK DO EG IL IT KR PY PT	AU AT BD CZ DE GH IT JM JP NL PK SE US YE	AR BO CA CL CN CO CY EC GH IS IN ID IE IL JM KW NL NG PE LK	EG FR GI HU IS IE JO MN NI SA LK TT	DZ AO BR CN HR GH GI HK IR? JM JO KW MY NZ NG PY SA SI SE TJ TH UY ZM
Weak Decoupling	AT BH BE BR CN CU CZ DK DO GT HN HK HU IS IN IT JP JO KE MY MT NL NO PE PT SA LK SD SE TH TR US UY ForYugosl	AO AU BE BG CM CN CG CU FI FR DE HK IN ID KE LB MX NZ NO OM PK PA SG ES LK SE TN TR GB US ZW	CA CN CO IN IE IL KE KP MN LK TZ UY VE ZW	AU BE DE JO KE MY AN NO OM PL SA SN SG SY GB US VE	DZ AO AR AU BHBD BO BA BW BN KH CM CA CN TP CR CI CU EE ET FI DE GR IQ IL IT JP KR KW MK MX MA MZ MM NL NZ NO PA PE PL QA SK ZA SD SE SY TG TN TR GB US UY VE YE OthAfrica ForYugosl	AU BY BW KH CM CA CL TP CO CD EC EE FI GR HN IS IN ID IE KR LB LY LT MN MA MZ MM NO PK PE PH RO RU SN ZA LK TT TN TR TM UA AE GB US OthAfrica OthAsia
Strong decoupling	BJ BG GH GI OM PA PH PL RO SN SK ZA TZ VN ZW	AL AT BR CA CL CD CR CI CZ HU IE JM JP KP MT MA MM NL NI PE PL RO SN SK ZA TZ YE ZM OthAfr OthLatAm ForYugosl	AL AO BH BJ CI GA MA AN NG SA SN OthLatAm OthAsia	DZ BH BJ BA CG MZ RS SD TG YE OthAsia	AZ BY CO DK ER GE IN KZ KE KG LV LB LT MT RU RS SI TJ TH AE ZM ZW	AR AM CU DK DO EG ER FR GA DE IL JP KZ MK MT NP NI CH SY TZ UZ
Recessive Decoupling	JM	BH BO GH KW MZ AN PH TG	CG CD CU KW MM PL	AM BY BG CU EE FI HU KP KG MN RO	KP MD PY UA	KP ZW
Weak Negative Decoupling	AL DZ AO AR BD BO BN CM CA CG CR CI EC EG ET FI GR HT IQ KP KR KW LY LU MX MZ MM NP NG PK PY QA ES CH AE VE YE ZM OthAfrica OthLatAm OthAsia	DZ BJ CO CY EC GA GI GR HN IS IR JO LU MY NP SD CH SY TH VN OthAsia	DZ BE BO BW BR BN BG CL TP CR CY DK DO EC EG SV ET FI FR GI GR GT HT HN HK HU IS ID IR KR LU MY MT MX MZ NP NZ NO OM PY PH PT SG SK ZA ES SD CH SY TH TG TN TR AE GB VN ZM OthAfrica	AT BD BW BR BN TP CR CI DK DO EG SV ET FR GA GI GR GT HN HK IR IT JP KR LB LY LU MT MX MA MM NP NZ NI PK PA PY PH PT QA ZA ES SE CH TZ TH TT TN TR AE UY UZ VN ZW OthAfrica OthLatAm	AL AM AT BE BJ BR CL CG HR CY CZ DO EC SV GA GH GT HT HN HK ID IR LY LU MY NA NP NG OM PK PH PT SN SG ES CH TZ TM UZ VN OthLatAm OthAsia	AL AT AZ BH BD BE BJ BO BA BN BG CG CR CI CY CZ SV ET GE GT HU IT KE KG LV LU MX MD NA NL AN OM PA PL PT QA RS SG SK ES SD TG VE VN YE OthLatAm ForYugosl
Strong negat. decoupling	CD SV GA IR LB NZ	BN SV ET IQ LY NG QA SA TT AE VE	AR CM IQ JO LY PA PE QA RO TT ForYugosl	AO AZ CM CZ HT MK SI TJ UZ	CD JM AN RO	HT IQ
Recessive neg. Decoupling	NI	HT UY	LB NI	CD HR IQ SK UA	BG	

Degrees of decoupling 1975-2005

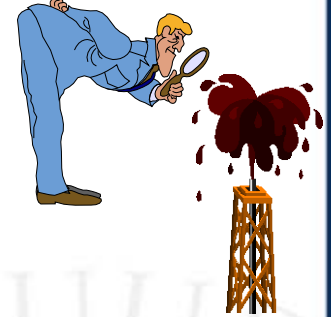
(Number of countries)



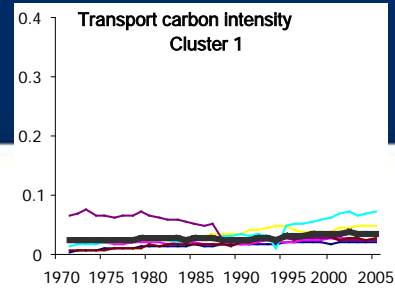
N. Finel & P. Tapio (forthc.) Decoupling transport CO₂ from GDP in the World.

Decarb. profile study: Cluster analysis

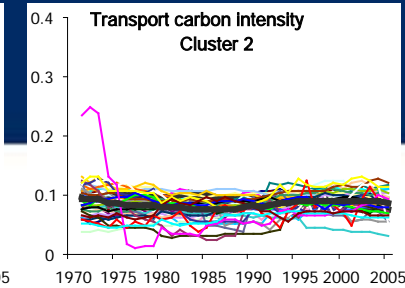
- The variable
 - $\text{TRIN} = \text{Transport CO}_2 / \text{GDP}_{\text{ppp}}$
- 35 variables form a time series
 - $\text{TRIN}_{1971}, \text{TRIN}_{1972}, \text{TRIN}_{1973}, \dots, \text{TRIN}_{2005}$
- No variable standardization
- Furthest neighbour method
- Larger clusters broken into smaller ones



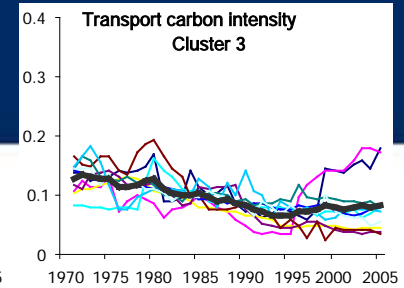
Transport CO₂/ GDP clusters



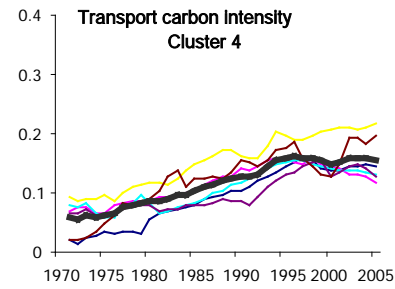
Cluster 1: BD, CD, ET, HT, MA, NP



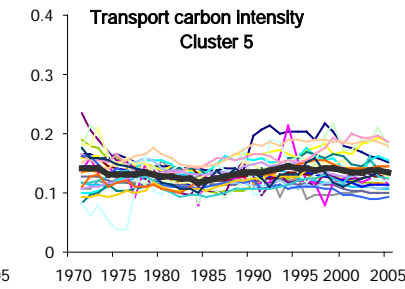
Cluster 2: DZ, AR, AT, BR, CM, TP, CO, CR, CZ, DO, SV, FR, DE, GH, GT, HN, HU, IN, ID, IL, IT, JP, MZ, MM, NI, PK, PE, PH, PT, RO, SK, CH, TZ, TG, TN, TR, UY, VN, OthAfr, OthAsia



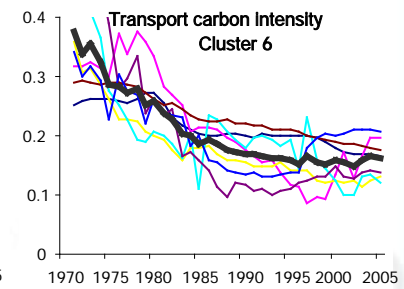
Cluster 3: AL, BJ, CN, CI, CU, KP, PL, LK, SD, ZW



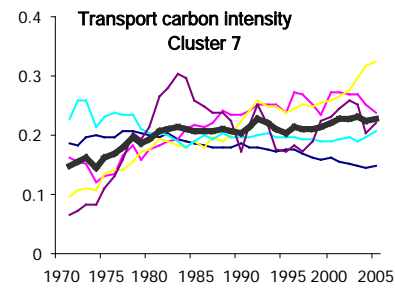
Cluster 4: BN, GR, IR, KR, PY, QA



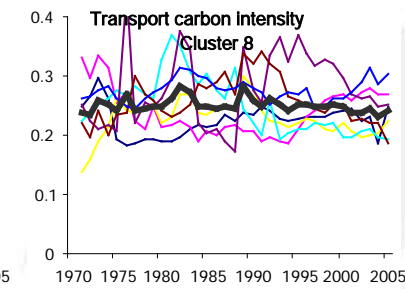
Cluster 5: ForUSSR, AO, BE, BO, BG, CL, DK, EG, FI, GA, HK, IS, IE, MY, MX, NZ, NO, PA, ZA, ES, SE, TH, GB, ZM, ForYU



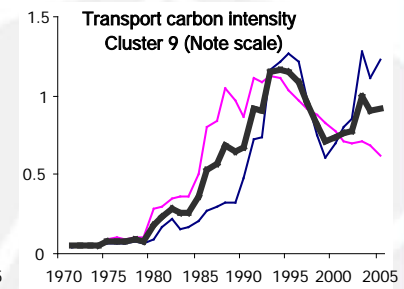
Cluster 6: CA, CG, KE, MT, SN, US, Other Latin America



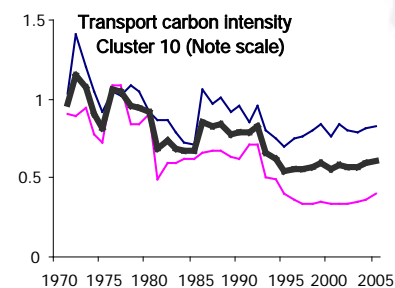
Cluster 7: AU, EC, LU, NL, NG



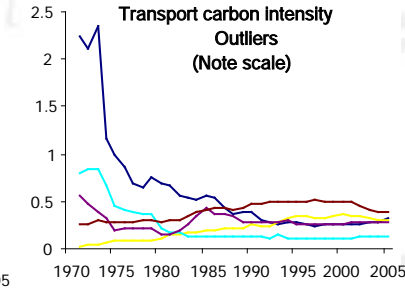
Cluster 8: CY, JM, JO, KW, LB, SY, VE



Cluster 9: IQ, AE



Cluster 10: SG, YE

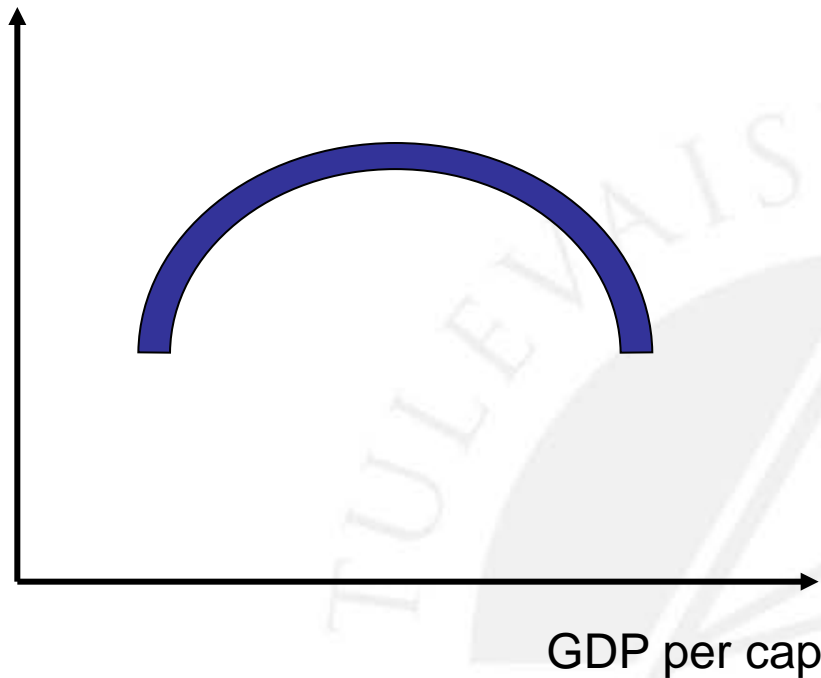


Outliers: BH, LY, OM, SA, TT. GI excluded (min 3.2, max 6.1).

P.Tapio, N.Finel, D.Banister, J.Luukkainen, J.Vehmas & R.Willamo (forthc.) Global decarbonisation patterns – total and transport CO₂ intensity.

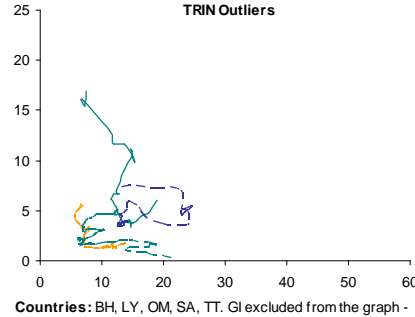
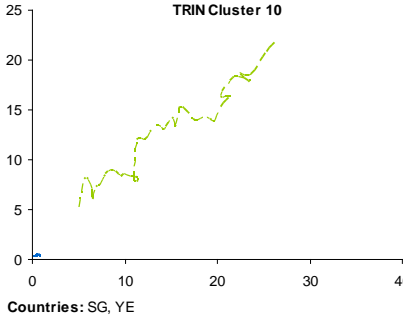
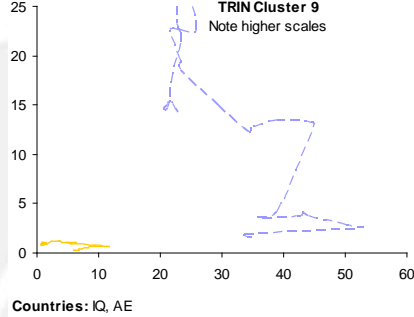
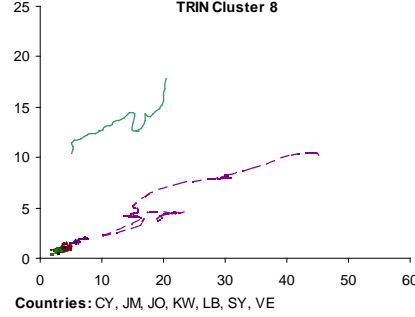
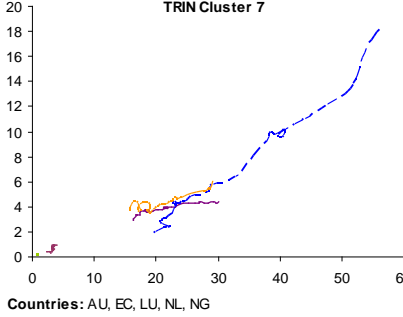
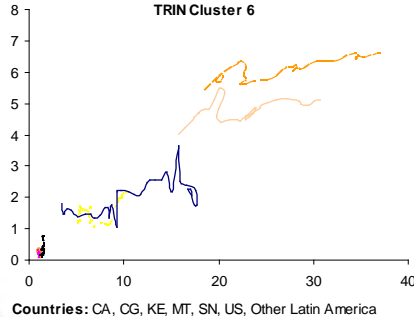
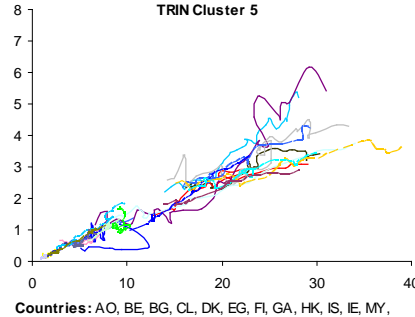
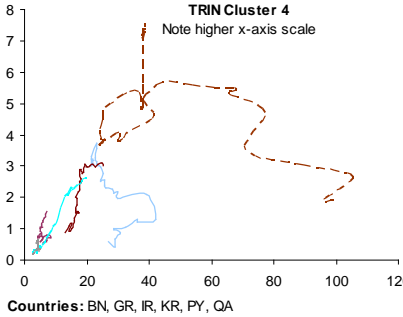
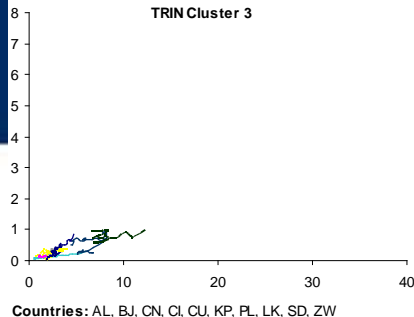
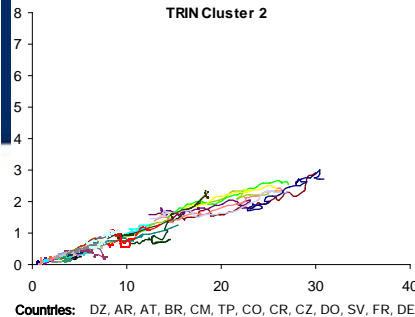
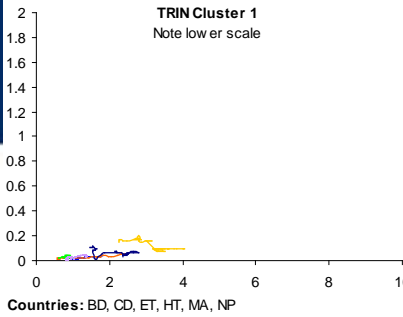
The Environmental Kuznets Curve hypothesis

Environmental harm (eg. CO₂ emissions)



SIGHT

Transport CO₂/cap vs GDP/cap in the clusters



P. Tapio, N. Fine, D. Banister, J. Luukkainen, J. Vehmas & R. Willamo (forthc.) Global decarbonisation patterns – total and transport CO₂ intensity.

So what?

- Decarbonisation patterns vary a lot
 - Very surprising countries end up in the same clusters of carbon intensity
 - Using five-year intervals each 8 categories of the decoupling diamond included cases
- According to conventional wisdom decarbonisation is clear in terms of the total economy, but negligible in the transport sector
 - This might be changing as some positive development can be observed in many clusters in terms of transport 😊
 - However, total carbon intensity stopped decreasing 2000-2005 ☹️



Links

Finland Futures
Research Centre
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FIDEA group
www.fidea.fi

