The Distributional Consequences of Tradable Carbon Permits in Personal Road Transport

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Background

- Transport emits 20% of global CO_2 emissions
- Personal road transport 10% of global CO_2
- Personal road transport 2nd biggest source (20%) of GHG emissions in the US
- Biggest growth area (2.1% annually) in the US
- Requires special attention

Policy Options : EEE

Command and control

- Emission limits > **E**ffective, Inefficient
- Standards and labelling

Market based policies

- Emission taxes > **E**ffective, **E**fficient
- Tradable emission permits

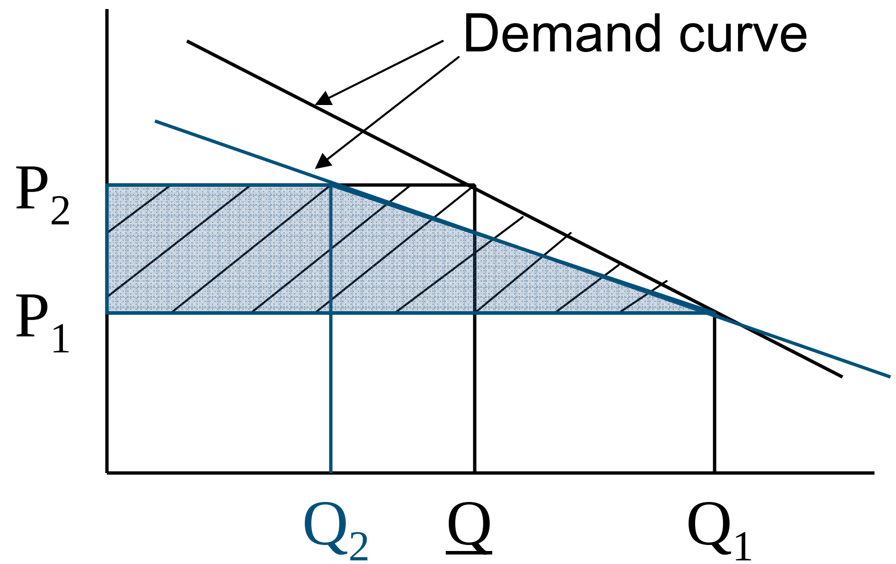
Equity??

Personal Tradable Permit Design

- Upstream vs Downstream
- Fixed amount of carbon permits, allocated to each person/ household/ allocation unit
- Trade between persons/households if excess/shortage, through ATMs, retail top-up shops, post offices etc.

Equity issues

- Price increases
- Regressive in general
- Different burden on different groups
- Demand elasticity an important determinant



The Welfare Model

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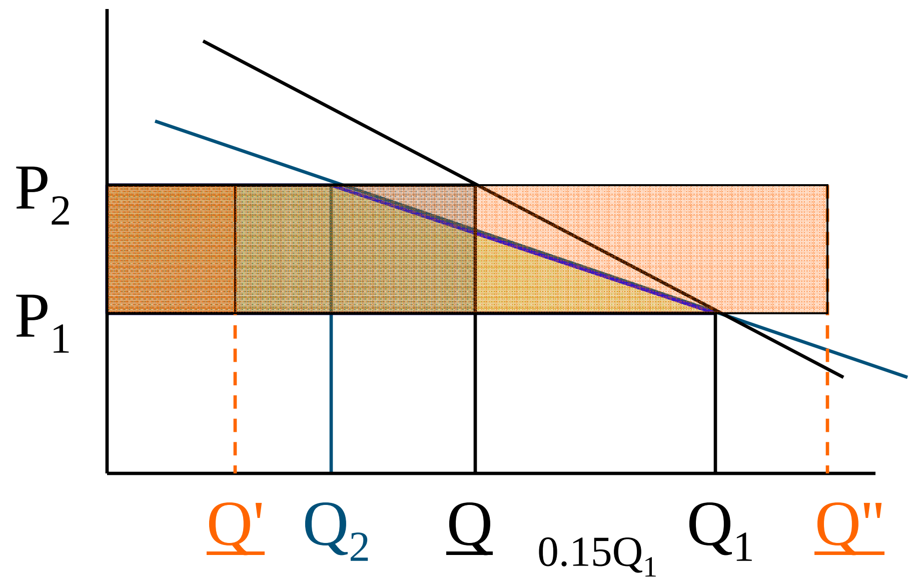
- Partial equilibrium framework
- ΔCS/Compensating Variation, using 2003 CEX data, average representative household
- Determining price from aggregate demand curve, for a chosen reduction (15%, hypothetical)



The Welfare Model

- 3 different measures of welfare loss:
  - Change in consumer surplus, no demand response
  - Compensating variation, same elasticity for all groups
  - Compensating variation, different elasticity for different groups
- 4 different allocation scheme:
  - All permits allocated to everyone equally
  - Permits calculated on per capita basis, but distributed only to vehicle owners, govt. retains the rest
  - All permits allocated only to vehicle owners, per capita
  - All permits allocated to vehicle owners, per vehicle

Results:

Petrol demand modelling

CEX Survey Summary Data for US from 1984-2003

SUR model, first order auto-correlated error

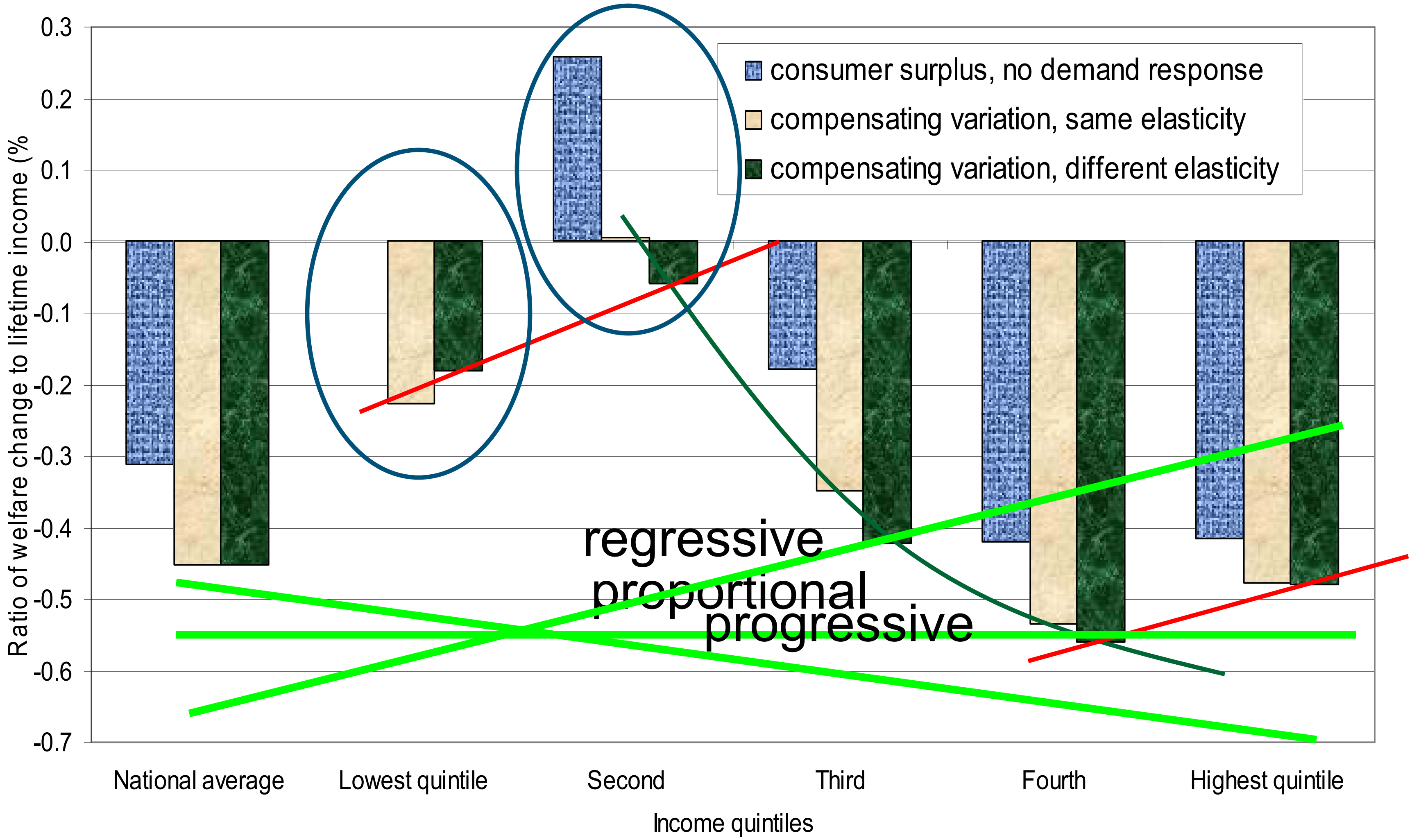
$Fuel_{it} \sim f(income_{it}, price_t, \text{vehicle stock}_{it}, \text{fuel economy}_{it})$

Elasticity estimates:

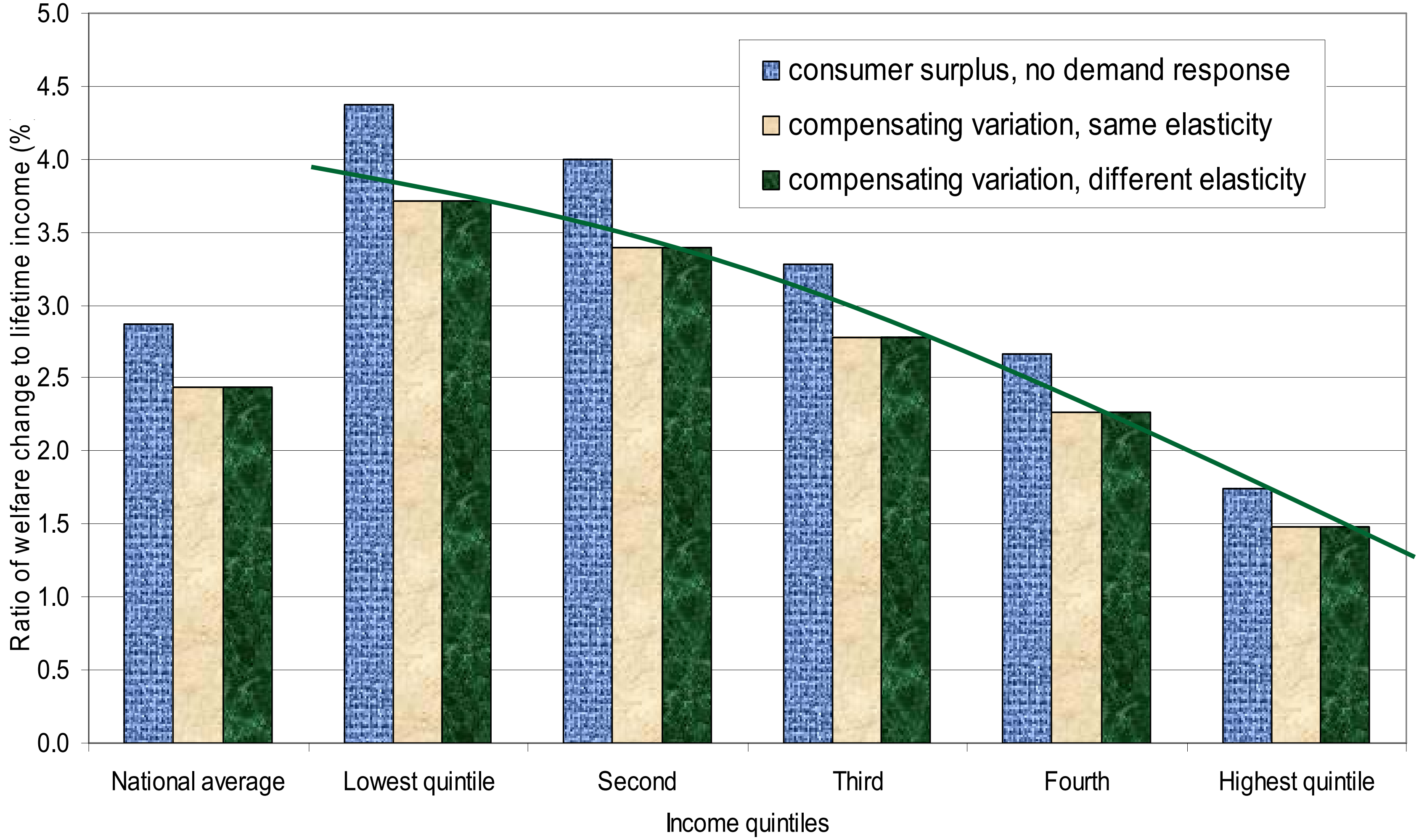
	Lowest quintile	Second quintile	Third quintile	Fourth quintile	Highest quintile	Avg.
Income	-0.067*	0.465	0.381	0.387	0.086*	0.414
Price	**-0.351**	**-0.219**	**-0.203**	**-0.263**	**-0.293**	**-0.3**

* Statistically insignificant

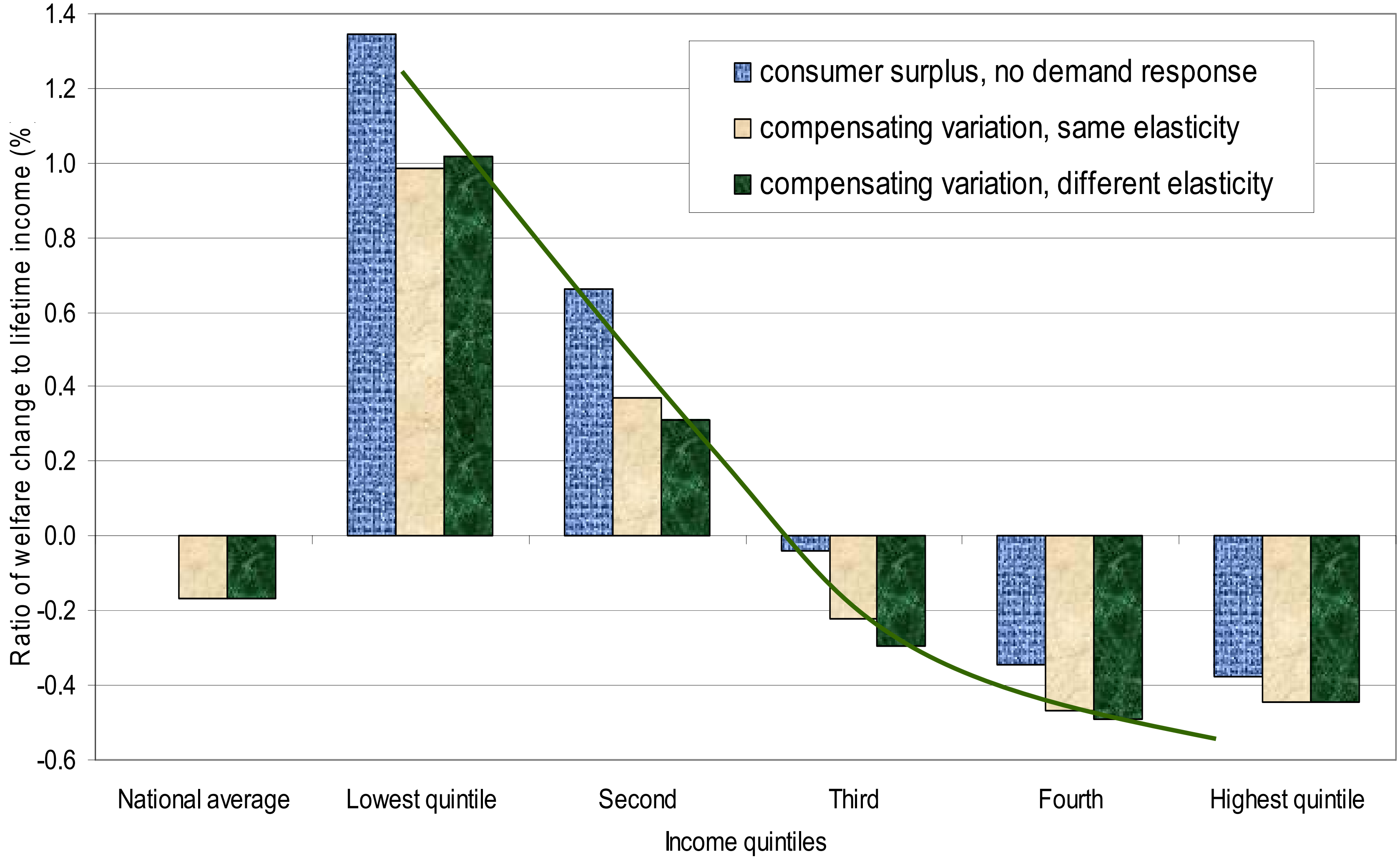
Results:
Welfare change/Income: Vehicle owning households



Results:
Welfare change/Income: Non-vehicle owning HH

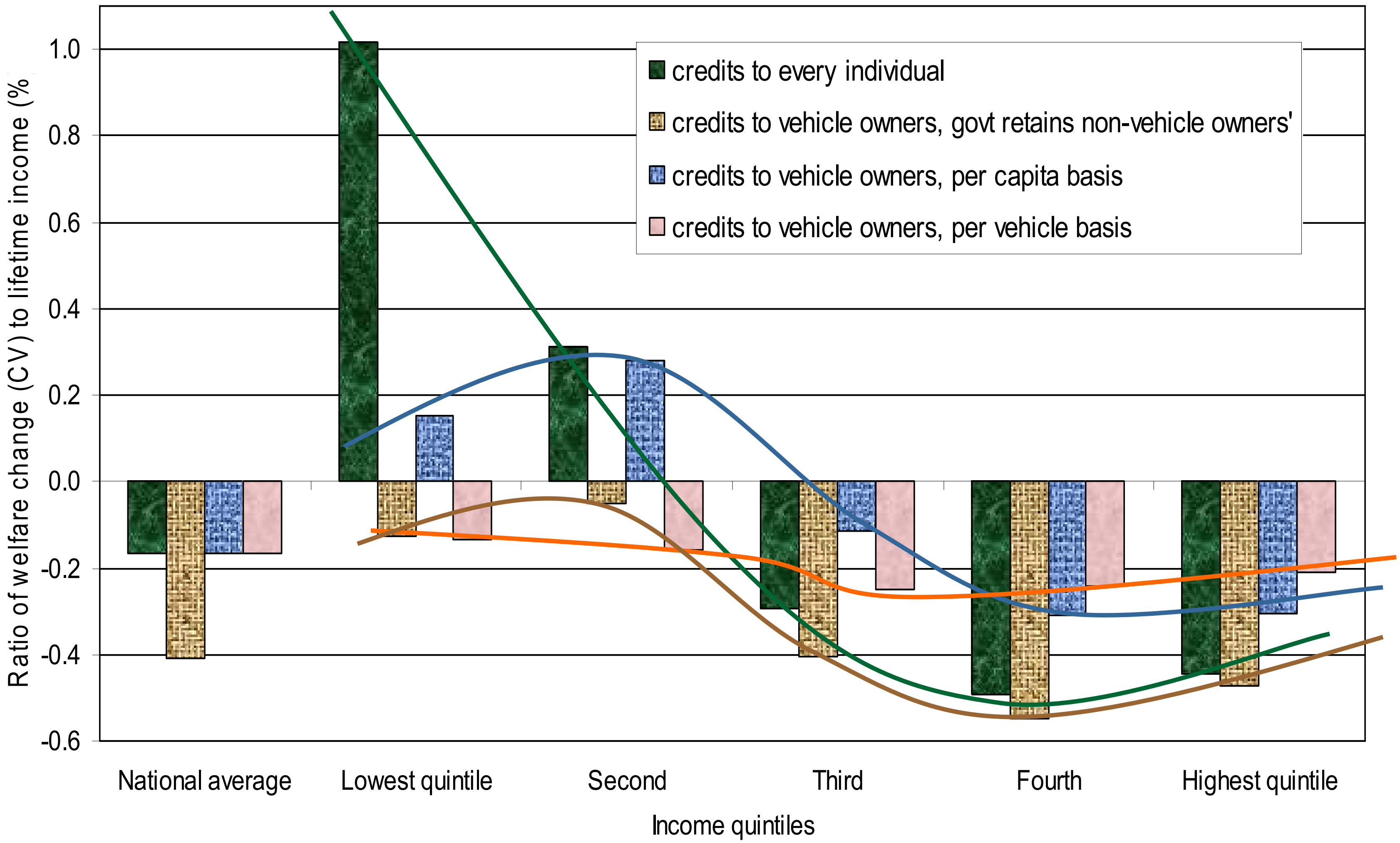


Results:
Welfare change/Income: All households

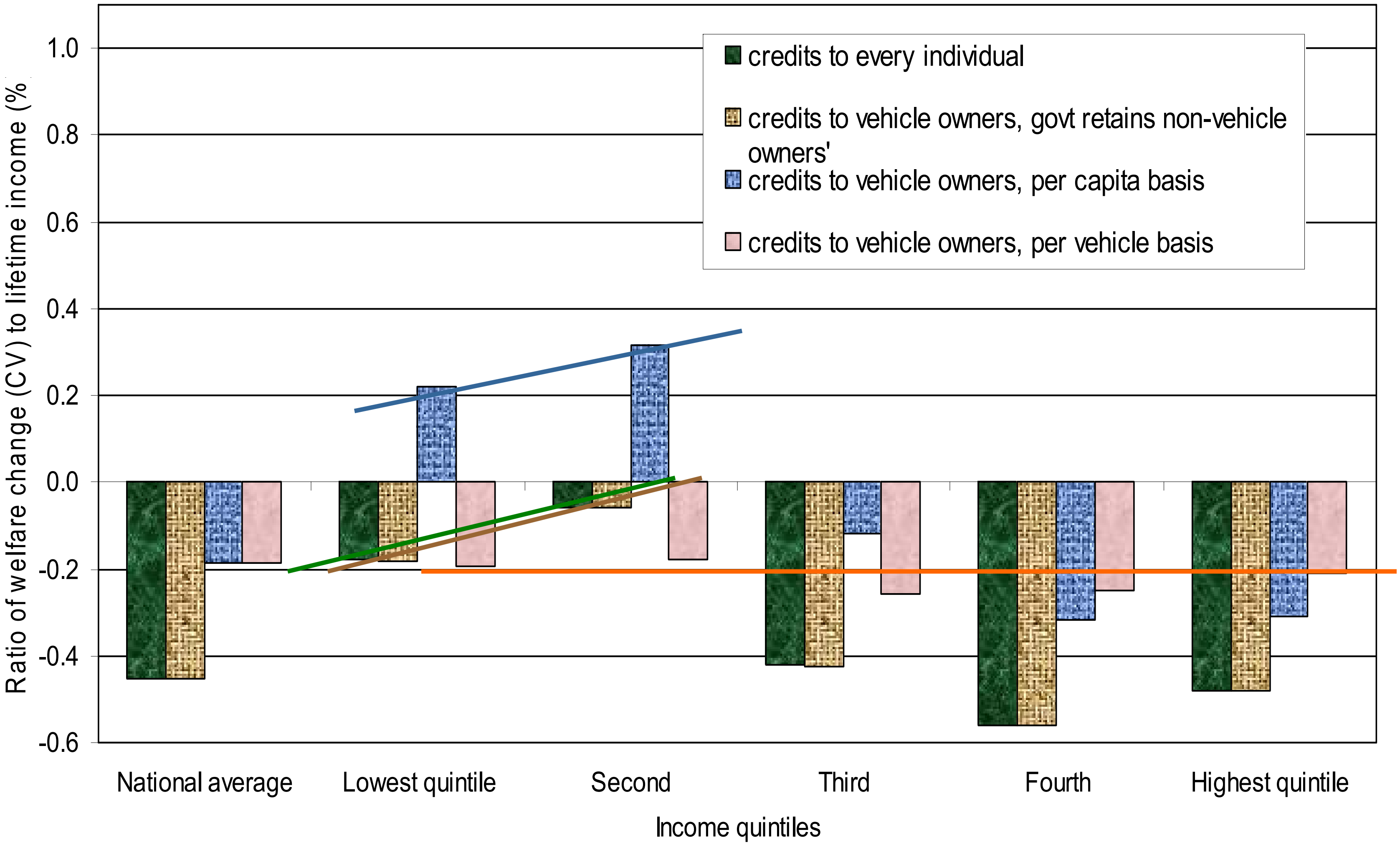


Results:

Effect of allocation units: All households



Results:
Effect of allocation units: Vehicle owning households



Conclusion

- Price elasticity changes among different income quintiles (U-shape)
- ‘No demand response’ understates welfare loss especially among lower income quintiles
- Effect of different elasticities does not have much effect on general shape of distribution, however, may have important implications in some individual groups

Conclusion

- Progressivity/regressivity depends on the permit allocation strategies
- Any allocation regressive among the vehicle owning HH in the lowest two quintiles (per vehicle least regressive)
- Any allocation regressive among the two highest income quintiles
- Overall, equal allocation to everyone progressive
- Per vehicle allocation makes the policy fairly proportional

Thank you

Questions?