Economic Analysis of Automated Driving Systems

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1. Importance of automated driving
2. Economic feature of automated driving systems
3. Benefits from mandatory installation
4. Automobile industry in Japan's industrial structure

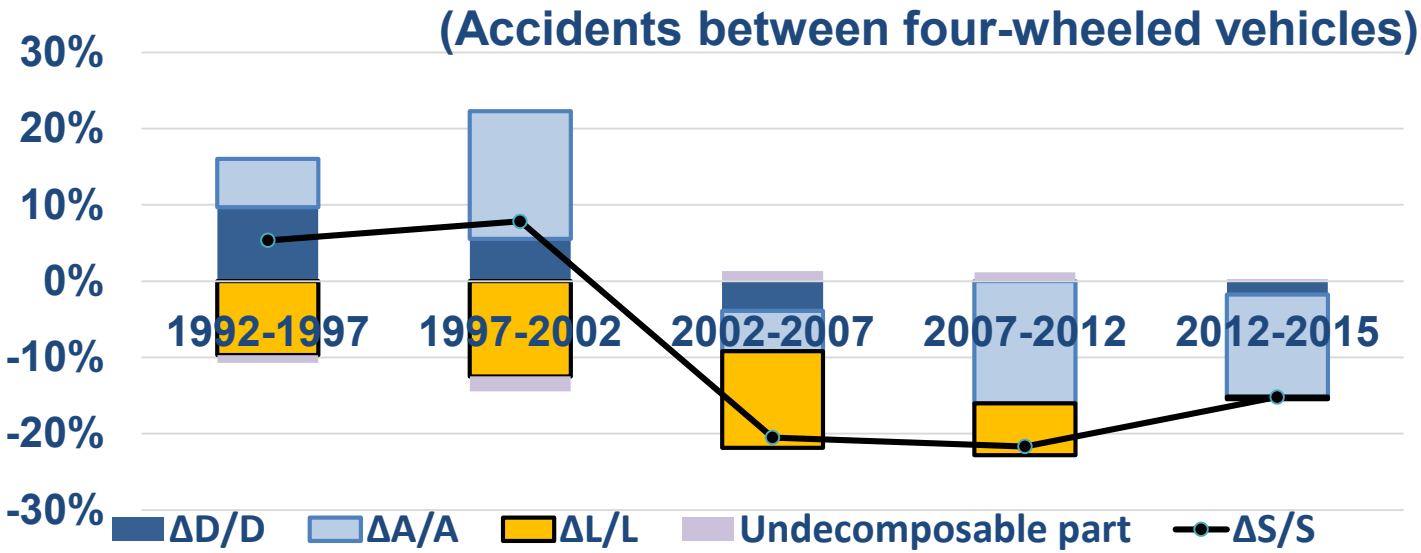
Importance of automated driving

Passive safety technologies have contributed significantly to the reduction of economic losses due to road traffic accidents in Japan.

It seems that the magnitude of additional contribution from passive safety technologies have lessened considerably in recent years.

Diffusion of active safety technologies will be needed in order to reduce the economic losses furthermore.

Decomposition of the rate of change of economic losses due to road traffic accidents in Japan



S : Economic losses due to road traffic accidents
D: Total distance traveled (billion vehicle-kilometers)
A: The number of accidents per billion vehicle-kilometers
L: Economic losses per accident

$$S=D\cdot A\cdot L \rightarrow \Delta S/S \fallingdotseq \Delta D/D + \Delta A/A + \Delta L/L$$

Note: Losses due to accidents involving special purpose vehicles are not included
Source: Miyoshi (2016) using J-TAD (macro)

Economic feature of automated driving systems

Economic benefits of the automated driving systems will be enjoyed not only by the users but also by non-users.

It can also be said that Automated Driving Systems are safety-sharing system.

Economic incentives will be necessary for facilitating diffusion of the automated driving systems in the society.

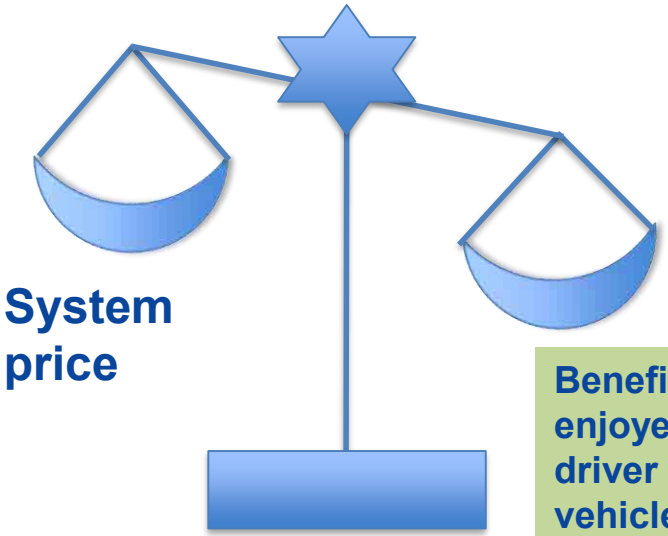
Economic feature of automated driving systems

Vehicle A is about to collide with vehicle B running ahead

Air bag system in vehicle A
protects the driver in vehicle A.

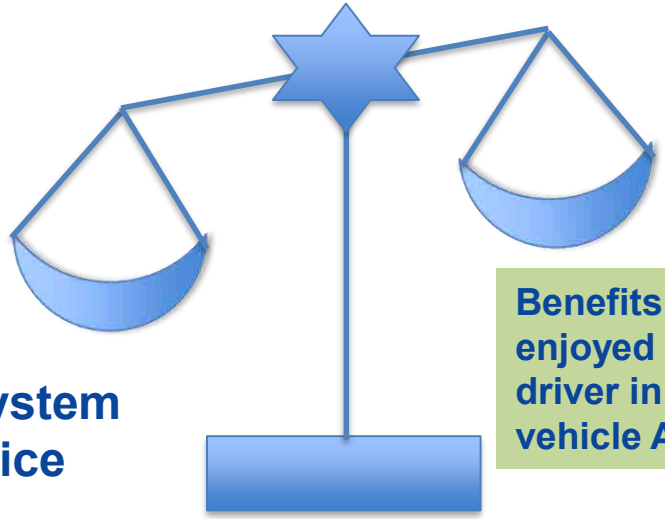
AEB in vehicle A
protects the drivers in both vehicle A and B.

Possible lack of diffusion with market mechanism



Benefits enjoyed by the driver in vehicle A

Benefits enjoyed by the driver in vehicle B



Benefits enjoyed by the driver in vehicle A

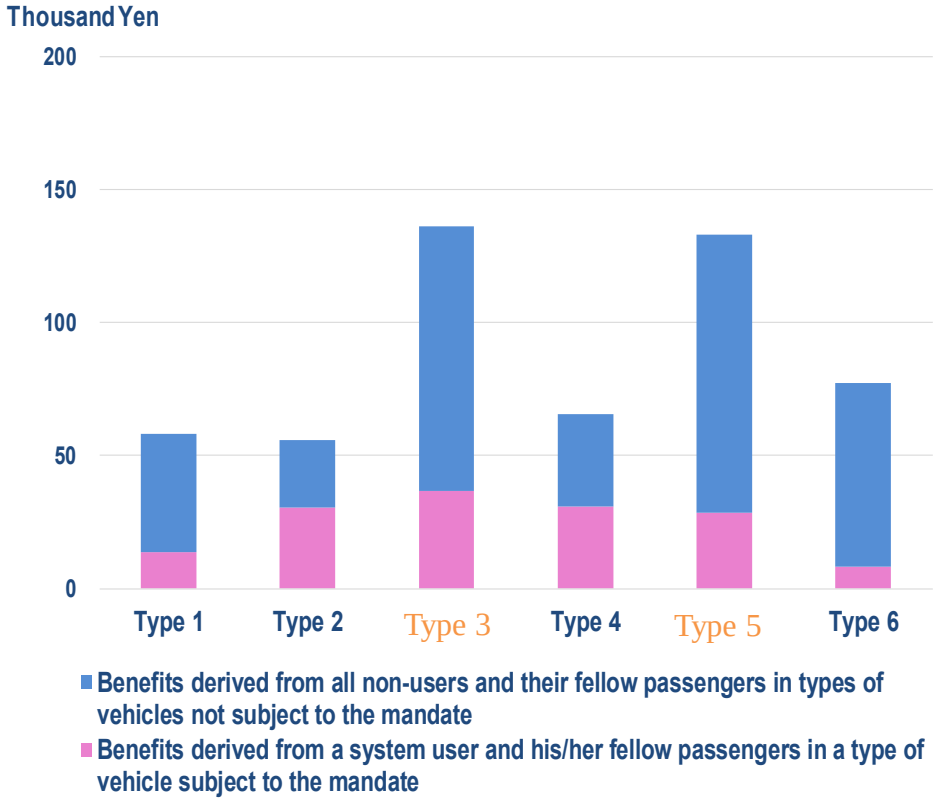
Necessity of economic incentives, etc.

Benefits from mandatory installation

Japanese safety regulations for road transport vehicles call for mandatory installation of AEB and lane-departure warning devices on new trucks at over 3.5 ton GVW and new buses with capacity for 10 or more passengers (stepwise introduction from heavy vehicles)

Our analysis finds it appropriate to assign high priority for mandatory installation of CMBS to trucks at over 3.5 ton GVW and Taxis.

Benefits from mandatory installation of AEB



Type 1: standard/small buses,

Type 2: standard/small passenger vehicle for private use,

Type 3: standard/small passenger vehicle for commercial use (taxis),

Type 4: mini vehicle,

Type 5: standard/small truck at over 3.5 ton GVW,

Type 6: standard/small truck at 3.5 ton or less GVW

Note: Estimated based on the assumption that the installation of devices is 100% effective in averting accidents.
Source: Miyoshi (2016) using 2015 J-TAD (macro)

The automobile industry in Japan's industrial structure

The automobile industry is a sector with the largest power of dispersion among Japanese industries, and changes in input and in final demand have a large impact on the Japanese economy.

3 Types of power of dispersion

- **Fist category index : Defined as relative size of influence on the entire industry (including the self-sector) in case where final demand of the industry increases by one unit,**
- **Second category index: The direct effect of 1.0 to the self-sector is excluded,**
- **Third category index: The self-sector are completely eliminated and only the effects on the other sector is considered.**

Source) Prepared by author by referring to the Ministry of Internal Affairs and Communications Website, “Indexes and their Calculation Method for Input-Output Analysis” (http://www.soumu.go.jp/toukei_toukatsu/data/io/bunseki.htm)

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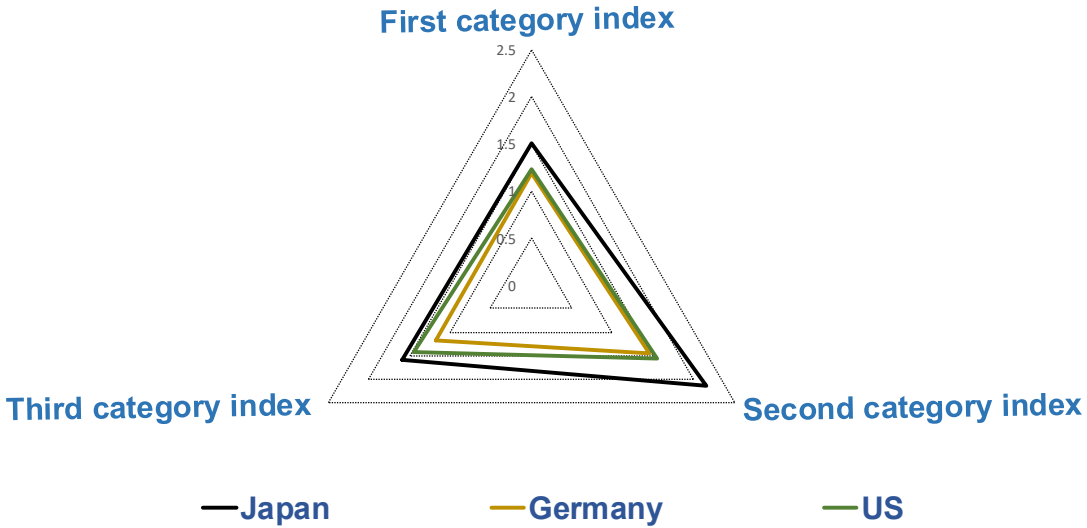
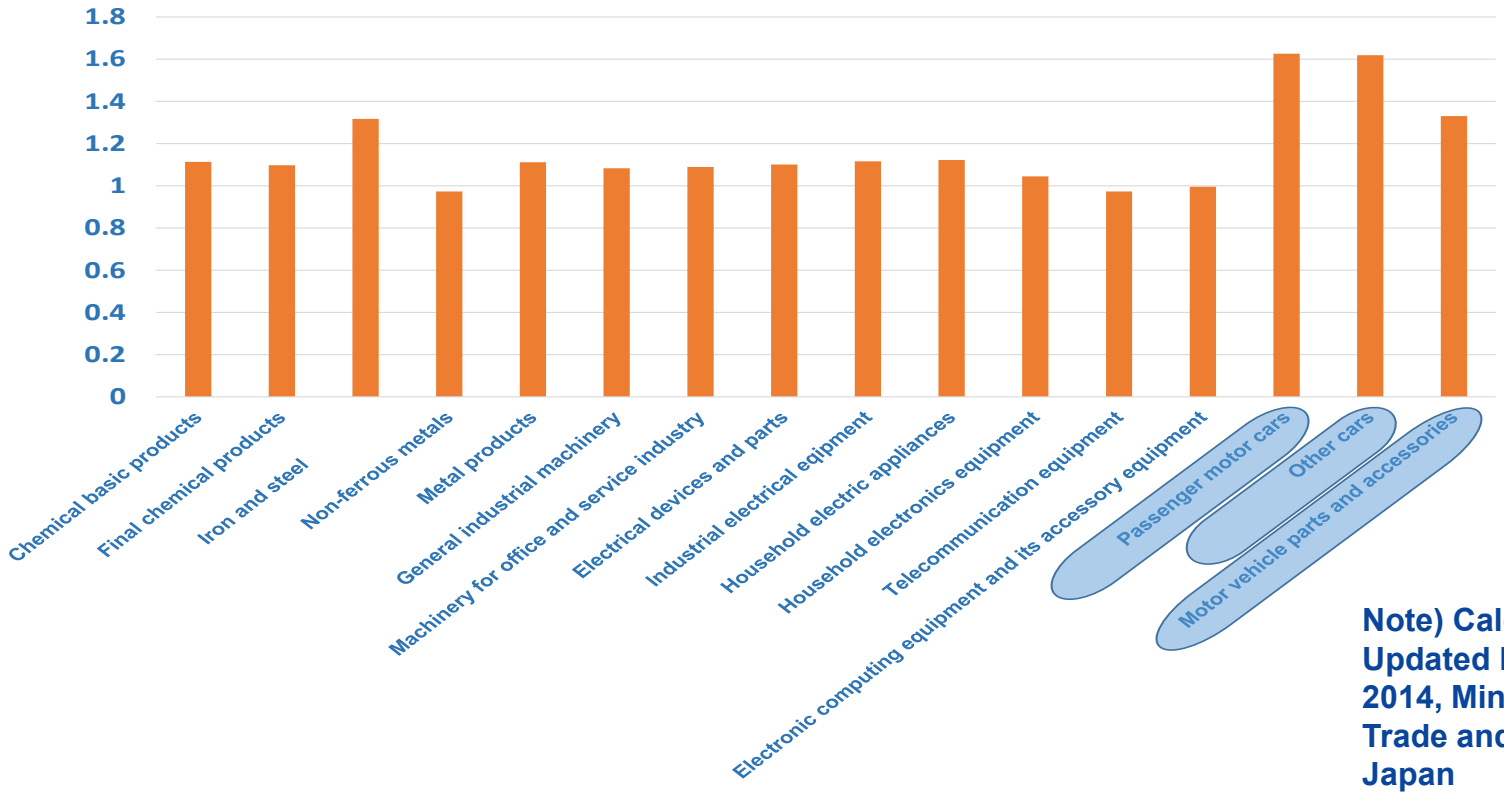
International comparison of three indexes



Note) Calculated using 2011 Input-Output Tables compiled by OECD. Stat (http://stats.oecd.org/Index.aspx?DataSetCode=IOTS)
For the automobile sector, “Motor vehicles, trailers and semi-trailers” was used

Source) Miyoshi and Kii (2017)

Sector comparison of the first category index



Note) Calculated using Updated Input-Output Tables 2014, Ministry of Economy, Trade and Industry (METI), Japan

Source) Miyoshi and Kii (2017)

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