Governance of Sustainable Technological Innovations in Automobile Industry: Regulatory Convergence of Fuel Economy Standards in Japan, Europe and the US.

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INTRODUCTION

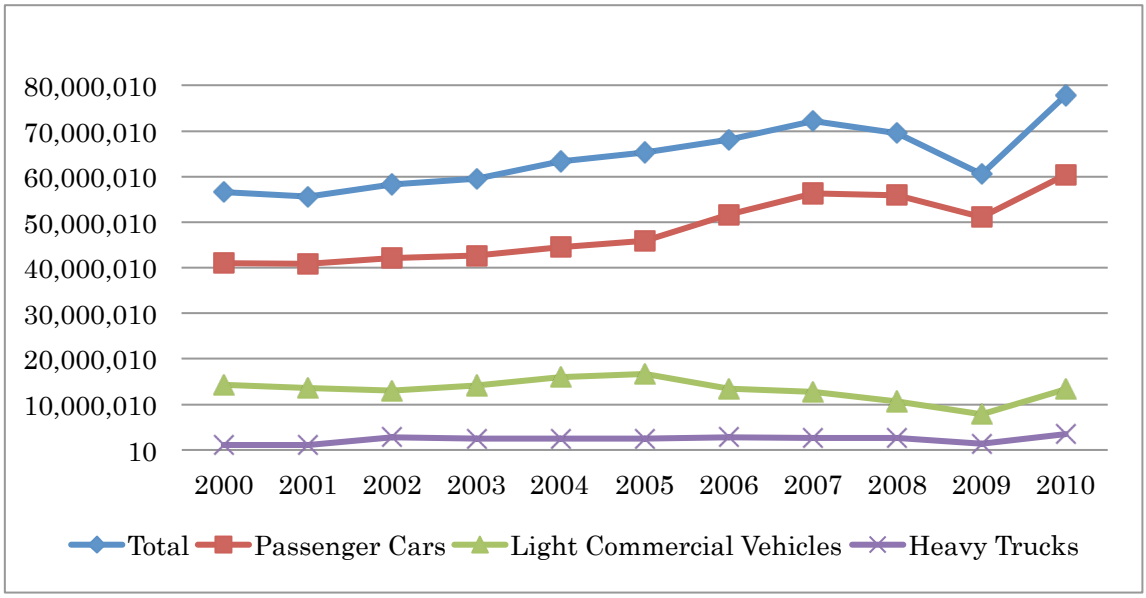
The automobile industry is expected to play a key role in global climate governance. This is because, firstly, the road transport sector is responsible for a large proportion of carbon dioxide (CO_2) emissions. The transport sector accounts for 23% of energy-related CO_2 emission in the world, with a projected increase of nearly 50% by 2030 and more than 80% by 2050 (IEA 2009b). In particular, in 2009 the road transport sector accounted for about 17% of total global CO_2 emissions (4,876.6 million tons of CO_2).[1] The U.S. ranked first for its share in road transport CO_2 emissions (1,402.8 million tonnes, equal to about 29% of the global share), followed by the EU (855.6 million tonnes, equal to about 18%), China (366.5 million tonnes equals to about 7.5%), Japan (198.2 million tonnes, equal to about 4%), Russia (136.6 million tonnes) and India (134.1 million tonnes, equals to about 2.8%) (IEA 2009b). Furthermore, the emissions from the road transport sector are likely to rise with growing automobile production. (see Figure 1).

Secondly, the global economic significance of the automobile industry gives it the potential political power to influence towards the low-carbon society. Global automobile production is dominated by four main regions of the world – China, Japan, the US and Europe (see Table 1). The structural landscape of global automobile manufacturing has changed dramatically since 2009, with China becoming the biggest automotive producer in the world, producing almost as twice as much as Japan, which dropped its position as the second biggest automotive producer in the world. However, if we focus on global automobile production in terms of individual automotive manufacturers, Japanese manufacturers (Toyota, Honda, Nissan and Suzuki), European manufacturers (Volkswagen, PSA, Fiat and Renault), and U.S. manufacturers (General Motors, Ford and Chrysler) dominate the global automobile production market (Table 2). In fact, even though China has become the biggest producer in the world, automobile manufacturers from Japan, Europe and the U.S. dominate most of the domestic production in China.

1 Other sector accounts for (all in million tonnes of CO2): 11,827.1 from electricity and heat production; 1,464.1 from other energy industry own use; 5,870.9 from manufacturing industries and construction; and 3,293.4 from other sectors including residential sector.

Therefore, if we are to observe changes towards more sustainable road transportation sector practices at the global level, the primary focus should be placed on Japan, Europe and the U.S. and how they could be the potential drivers to bring about such changes.

Figure 1. Total numbers of vehicles produced, 2000-2010.



Source: created by the author based on (OICA 2001; OICA 2002; OICA 2003; OICA 2004; OICA 2005; OICA 2006; OICA 2007b; OICA 2008b; OICA 2009b; OICA 2010b; OICA 2011).

Table 1. Global Automobile Production Share by Country, 2007-2010.

Rank	Year			
	2007 Country (share)	**2008** Country (share)	**2009** Country (share)	**2010** Country (share)
1	Japan (15%)	Japan (16%)	China (22%)	China (24%)
2	USA (15%)	China (13%)	Japan (12%)	Japan (12%)
3	China (12%)	USA (12%)	USA (9%)	USA (10%)
4	Germany (8%)	Germany (9%)	Germany (8%)	Germany (6%)
5	S.Korea (6%)	S.Korea (5%)	S.Korea (6%)	S.Korea (5%)
6	France (4%)	Brazil (5%)	Brazil (5%)	India (5%)
7	Brazil (4%)	France (4%)	India (4%)	Brazil (4%)
8	Spain (4%)	Spain (4%)	Spain (4%)	Spain (8%)
9	Canada (4%)	India (3%)	France (3%)	France (3%)
10	India (3%)	Canada (3%)	Mexico (3%)	Canada (3%)

Source: created by the author based on (OICA 2007a; OICA 2008a; OICA 2009a; OICA 2010a).

Table 2. Global Automobile Production Share by Manufactures, 2007-2010.

Rank	Year			
	2007 Group (share)	**2008** Group (share)	**2009** Group (share)	**2010** Group (share)
1	GM (13%)	TOYOTA (13%)	TOYOTA (12%)	TOYOTA (11%)
2	TOYOTA (12%)	GM (12%)	GM (11%)	GM (11%)
3	VOLKSWAGEN (9%)	VOLKSWAGEN (9%)	VOLKSWAGEN (10%)	VOLKSWAGEN (9%)
4	FORD (9%)	FORD (8%)	FORD (8%)	HYUNDAI(7%)
5	HONDA (5%)	HONDA (6%)	HYUNDAI (8%)	FORD (6%)
6	PSA (5%)	NISSAN (5%)	PSA (5%)	NISSAN (5%)
7	NISSAN (5%)	PSA (5%)	HONDA (5%)	HONDA (5%)
8	FIAT (4%)	HYUNDAI(4%)	NISSAN (5%)	PSA (5%)
9	RENAULT(4%)	SUZUKI (4%)	FIAT (4%)	SUZUKI (4%)
10	HYUNDAI (4%)	FIAT (4%)	SUZUKI (4%)	RENAULT(3%)

Source: created by the author based on (OICA 2008b; OICA 2009b; OICA 2010b; OICA 2011).

Trends

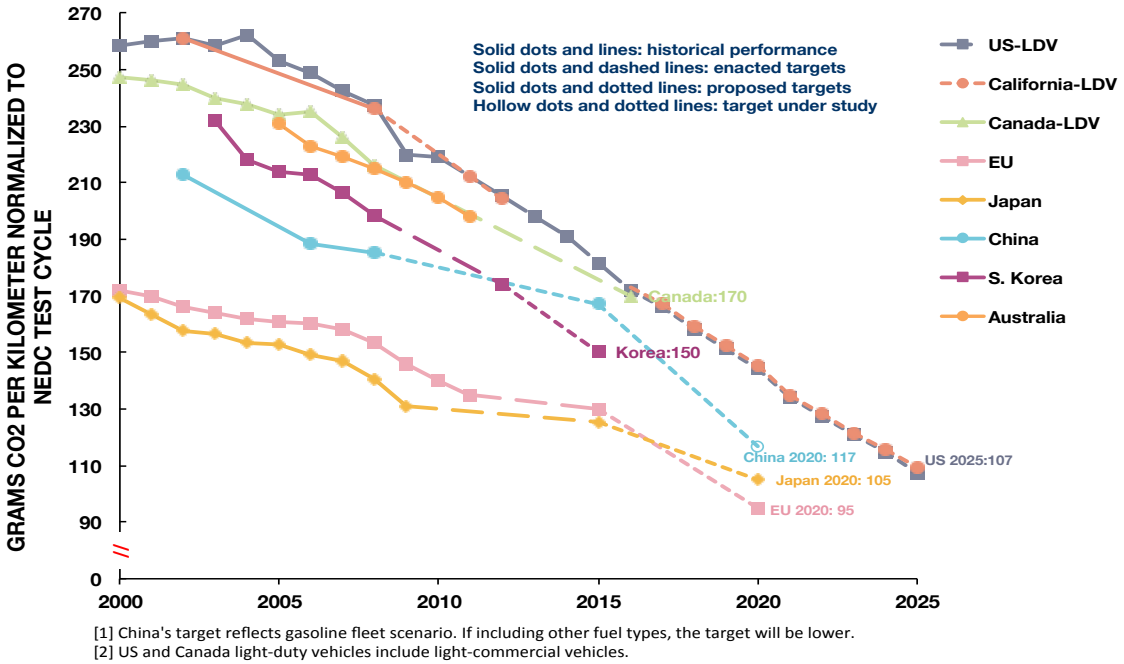
Recently, we are witnessing converging trends of fuel economy regulations among major automobile-manufacturing regions. Traditionally, Japan and Europe have had the most stringent fuel economy regulations in the world: Japan introduced 125g-CO_2/km by 2015 in 2007, and 105g/km-CO_2 by 2020 in 2011; Europe set a 120g-CO_2/km target in 2009 and is currently moving to set a mandatory 95g/km-CO_2 by 2020. The changes occurred when President Obama announced that he would improve US fuel economy regulations to 107g/km-CO_2 by 2025 (ICCT 2011b).

Based on these trends, I argue that stringent fuel economy regulation in major automobile manufacturing and importing nations, such as Japan, Europe and the U.S., would function as the international standard that emerging automobile manufacturing countries such as China and India would follow. Altogether, Japanese, European and US automobile manufacturers dominate global vehicle production, with the total numbers of passenger automobile market sales in these three regions totalling more than 20 million in 2010, out of 60 million passenger automobiles produced globally (Table 1,2, and 3). Furthermore, although China is emerging as one of the largest automotive markets in the world (Table 4), the automobile manufacturers from Japan, Europe and the U.S. dominate most of the sales in the Chinese automobile market, altogether accounting for about half of the total market sales (Reuters 2009).[2]

This suggests that, on the one hand, the fuel economy regulations in Japan, Europe and the US would encourage more low-carbon technological innovations that would be sold everywhere in the world, and, on the other hand, since all passenger cars that are sold in these regions are mandated to satisfy the highest standards in the world, any countries that wish to sell automobiles in these markets would also have to satisfy the highest standards in the world. To put it simply, the higher the fuel economy standards in these regions, the more likely the standard automatically works as the global 'de-facto' standard in the world.

[2] Passenger car market share in Chinese market in 2009 are as follows: GM (17.8%), Volkswagen (14.6%), Hyundai-Kia (8%), Nissan (7.5%), Toyota (6.7%), Honda (5.7%), Ford (4.4%), Chery (4.1%), Geely (2.2%) and others (29%). See http://articles.businessinsider.com/2010-12-28/markets/30062006_1_auto-sales-beijing-municipal-commission-auto-industry (accessed on 4th September 2012).

Figure 2. Converged trend of fuel economy between Japan, Europe and the US.



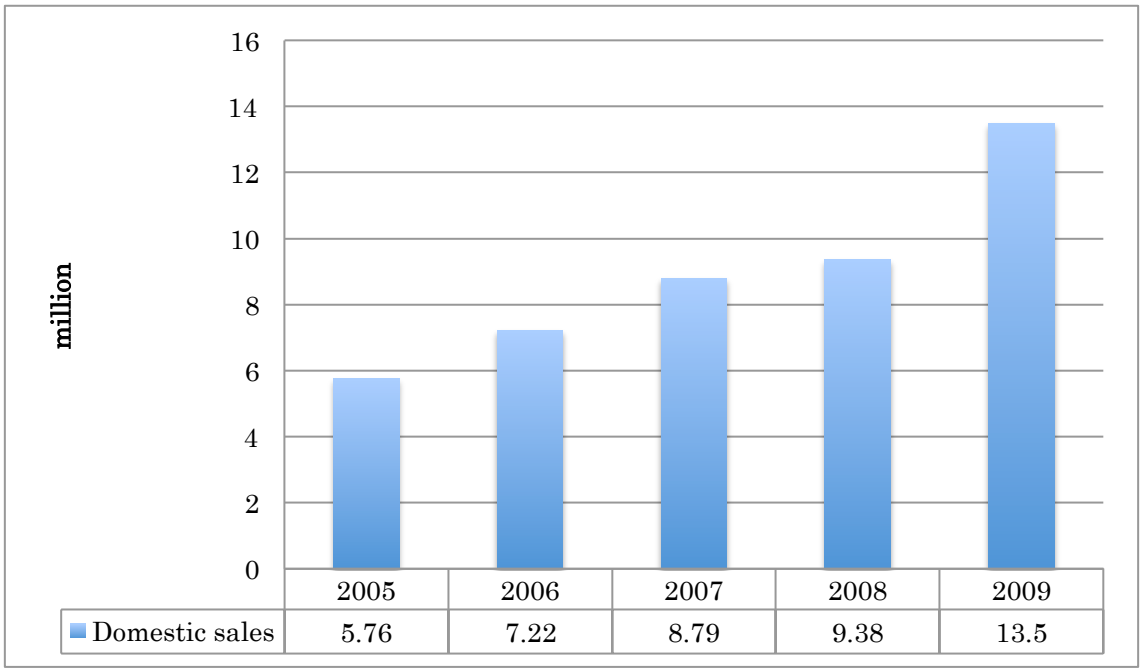
Source: (ICCT 2011b).

Table 3. Number of passenger car sales in Europe, Japan, and the US, 2007-2010.

Year/Region	EU27	Japan	US	**Total**
2007	15,596,339	1,299,168	7,562,334	**24,457,841**
2008	14,338,100	1,250,987	6,769,107	**22,35,8194**
2009	14,091,605	1,160,175	5,400,890	**20,652,670**
2010	13,305,479	1,419,909	5,635,433	**20,360,821**

Source: (ICCT 2011a; RITA n.d.; JADA n.d.)

Table 4. Chinese automobile sales, 2005-2009



Source: http://www.chinadaily.com.cn/china/2010-01/09/content_9291861.htm

Research Questions

Against these backgrounds, this thesis pursues the following research question:

> Despite the fact that fuel economy regulations have been developed differently in Japan, Europe and the U.S., why are fuel economy standards for 2020–2025 in these countries converging? What are the political dynamics behind this trend?

Data

Data used for analysis was collected through several research visits to relevant countries between 2007 and 2012, and includes primary documents with limited access, or those that have not been officially published. The main method of gathering data was semi-structured interviews conducted with relevant policy makers, directors and managers of automobile industries and its industry networks, environmental NGOs and scientists and academics. Each interview lasted from 1 to 3 hours, with topics based on

the fuel economy regulation of passenger cars, providing different perspectives on the development of actors, networks and institutions relating to the regulation. Informants were selected based on the following criteria: the person should have or at least have had a central role in the development of fuel economy regulation. The careful selection of very central informants and generous time for each interview contributed to the quality. Furthermore, excerpts from each interview were submitted to the informants for review and approval. The informants are described below. In addition, during the process of the interviews, several unpublished documents of great relevance for the study were obtained from the informants. Official government reports, media articles, policy papers by NGOs and research institutes, and other related materials were used to supplement the analysis.

Time Frame

Research was conducted from April 2009 until September 2012. As for the time frame of the topic, the thesis primarily focuses on fuel economy regulations for vehicles in each country from 2007 to 2011. This is because, first, the trend towards converging of fuel economy standards in the three regions has emerged since 2007: Europe started introducing the 120g/km target in 2007, and currently a 95/km by 2020 target is under discussion; Japan set its 2015 fuel economy target in 2007, and its 2020 target was set in 2011; and most importantly, former President Bush signed the Energy Independence and Security Bill of 2007, which improved, for the first time in past 25 years, the stagnant US fuel economy standard. The converging fuel economy standards emerged with the proposal made by President Obama in 2011.

APPROACH OF THE PAPER

As a theoretical framework, the paper adopts the constructivist theory of IR.[3] The constructivist theory of IR emphasises that the identities and interests of states are not given, but are socially constructed. These produced identities and interests are also

[3] There are different strands of constructivism. This paper adopts Holistic constructivism, characterized by Ruggie (1998) and Hall (1999). It challenges the dichotomy between international and domestic politics, and seeks to bring them together into a unified analytical perspective, focusing on a mutually constitutive relationship. Thus, it enables an explanation of the development of the normative and ideational structures in the present international system, as well as the social identity they have engendered.

reproduced and consolidated into norms and institutions and thus become structures. In turn, the structure is established as 'reality', and further defines the identities and interests of states, and therefore the behaviour of states.

The patterns of state-automobile industry relationships develop differently according to the context of each region. Therefore, differing state-automobile industry relationships and developments in each region result in different identities and interests. These identities and interests, in turn, interact with other identities and interests, thus reproducing and consolidating shared norms.

By applying the constructivist theory of IR to observe fuel economy regulations in each region, this paper analyses how different identities and interests regarding fuel economy regulations and state-automobile industry relationships have developed. Then, it analyses how these norms have interacted, and how these interactions have resulted in converging fuel economy standards – in other words, to analyse how the converging standards are a result of 'shared norms' among the three regions, and would function as a 'structure' that influences the behaviours of each state.

This paper aims to advance the study of environmental politics on three fronts. First, it adds empirical the 'Agency beyond the State' approach proposed by the Earth System Governance Project. Much of the academic attention on the Agency beyond State approach has been paid to so-called 'private governance', such as the Forestry Stewardship Council (FSC).[4] Since the automobile industry is the basic industry of each state, the industry merely coordinates its strategies internationally despite the fact that the industry operates globally. Much of the climate policies relating to the automobile industry have been made at either a national (Japan and the US) or regional level (the EU), as mentioned, and making their approach one of 'Agency *with* the States' rather than 'Agency *beyond* the States'. Therefore, first challenge is to present how the industry with large CO_2 emissions that operates globally but very much engaged with their national governments, is operating a role as 'Agency' in the Earth System Governance.

Second, given that the UNFCCC framework has been stagnant in recent years,

[4] FSC was established in 1993 in order to promote the responsible management of the world's forests, by multi-stakeholders including the World Wide Fund for Nature (WWF), Greenpeace, Friends of the Earth (FoE), retailers, trade unions and indigenous interest groups. Their main activity is to 'develop forest management and *chain of custody* standards, deliver trademark assurance and provide *accreditation* services to a global network of committed businesses, organizations and communities', which provides a link between responsible production and consumption of forest products (Philipp Pattberg 2005, 2007).

the ‘fragmented governance’ has gained increasingly importance in the issue of climate change (Biermann et al. 2009). The ‘fragmented governance’ of ‘fragmentation’ of international institution refers to growing diversity of institutional frameworks. In fact, climate change issues are characterised by divergent arrangements and multiple actors (Jagers & J Stripple 2003; Bäckstrand 2008; Philipp Pattberg & Johannes Stripple 2008). In this vein, the thesis attempts to show that the ‘de-facto standard’ of converged fuel economy standards for Japan, Europe and the US could function as one of the informal institutions that contribute to solving the climate change issue.

Third, previous academic literature that addressed the state-automobile industry relationship between Japan, Europe and the US in the context of climate change was done by Mikler (2006, 2007, 2009, 2010). Mikler has attempted to address the differences in state-automobile industry relationships in these nations from a Varieties of Capitalism approach, by classifying Japan and Europe as the Coordinated Market Economy (CME) and the US as the Liberal Market Economy (LME). Mikler argued that the CME countries are likely to have higher standards of fuel economy regulation, while, he explained, US fuel economy regulation has been stagnant because of its LME tradition. However, this account cannot explain the recent trends of converging fuel economy standards among the three. The thesis argues that the constructivist approach of IR theory can explain these trends better than the Varieties of Capitalism approach.

EUROPEAN FUEL ECONOMY REGULATION

European climate policy on cars had been relatively weak until the 1980s, but tightly progressed since the 1990s onwards. Primarily, this change in policy can be identified due to the concerns of increasing CO_2 emissions from road transport sector.

The first official communication from the European Commission to the Council regarding to a community strategy to limit CO_2 emissions from road transport sector was published in 14th October 1991, in reaction to the Council decision to stabilize CO_2 emissions in the Community in 2000 at 1990 level. It states:

“[w]ith and average of 2.2 tons of carbon per head, the Community represents

> 13% of global CO_2 emissions, compared to 23% for the U.S., 5% for Japan and 25% for Easter Europe and the USSR. Four main sectors in the Community are responsible for these emissions: power generation (31%), transport (26%), Industry (20%), and residential/ commercial (20%). During the period 1970-1985 emissions almost stabilised. During the period 1986-1990, however, this positive tendency has been reversed and emissions have grown by 4%...For the period 1990-2000, CO_2 emissions are likely to continue to grow by another 11%...Transport is currently the source of around 25% of the Community's CO_2 emissions. This share is liable to increase in the future, mainly as a consequence of the expected further growth in the volume of road traffic. Because road traffic also entails other considerable external costs (acid emissions, congestions etc.), structural policies are urgently needed at the Community level and in the Member States to encourage more environmental rational approach towards mobility" (European Commission 1991).

Therefore, the origin of the European fuel economy regulation is built on the concerns on the growing CO_2 emissions from the road transport sector, and the need of the application of best available technology to reduce the emissions and further fuel efficiency of cars was pointed out in the communication. Along with the concerns of growing CO_2 emissions, another rational that also included in this strategy paper is enhancing the industry competitiveness. According to the strategy paper, "an ambitious programme to improve the efficiency will increase energy security, improve energy efficiency of the transportation system, limit energy related air emissions other than CO_2 and can strengthen industrial competitiveness" (European Commission 1991, p.4).

In order to materialize this plan, the Commission was assigned by Directive on vehicle emissions to propose legislation to the Council of Environmental Ministers by the end of 1992. To this end, the Commission consulted with Motor Vehicle Emission Group (MVEG), which is an advisory body comprised by officials from the member states and motor industry representatives. In this process, there are at least four to seven different options were submitted from the UK, Germany, France and Italy, the Netherlands, and the European Environmental Bureau to control CO_2 emissions from the road transport. The UK government proposed a system of tradable emission credits,

in which manufactures met a specified fuel efficiency standard would sell their credits to those whose products did not. France, which produces relatively fuel efficient cars, emphasized a need for setting European level regulatory standard expressed in terms of grams of CO_2 per vehicle kilometre (g-CO_2/km). In addition, France also argued that those of which achieved the target could get financial benefits while those exceed the target would pay a fine. In contrary, German government, which produced heavy weight cars, was in favour of weight-based fuel economy regulation, insisted that CO_2 emission targets should be based on engine capacity or vehicle weight. Finally, Italian government, which produce small cars, favoured a tax incentives based on CO_2 emissions, where no tax would be payable to low-carbon vehicles. The divergent voices made it difficult for the Commission to formulate the legislation, which was expected to complete by the end of 1992.

In alternation to the 120g-CO_2/km target, the European Automobile Manufacturers' Association (ACEA) set itself a voluntary emission reduction target of 10 per cent, to be achieved between 1993 to 2005 (Keay-Bright 2000). In the following year, the European Commission proposed setting a target of 120 g CO_2/km for the domestic manufacturers' sales of new cars by 2005 (European Commission, 1995). This target was calculated by the Dutch research institute TNO based on the European car manufacturers' technological potentials, and was then released by the European Commission.[5] The ACEA heavily lobbied against this target, and it was delayed from 2005 to 'in no case beyond 2010', which appeared in a text released by the European Economic and Social Committee (EESC 1998). However, in 1998, another voluntary target was agreed between ACEA and the European Commission, which stated 140 g CO_2/km by 2008, while the 120 g target was deferred to 2012 (European Commission 1999). Japanese and Korean car manufacturers also agreed on voluntary targets with the European Commission, aiming for the target of 140 g CO_2/km by 2009, which was a stringent target for the Japanese car industry. As a result, this target may have worked as one of the driving forces that pushed improvement in the Japanese industry. On the other hand, the average fuel economy of the European car industry was in 2006 only 160 g CO_2/km, which was far from the 2008 target of 140 g CO_2/km (T&E 2007). This unsuccessful achievement of the European industry led the European

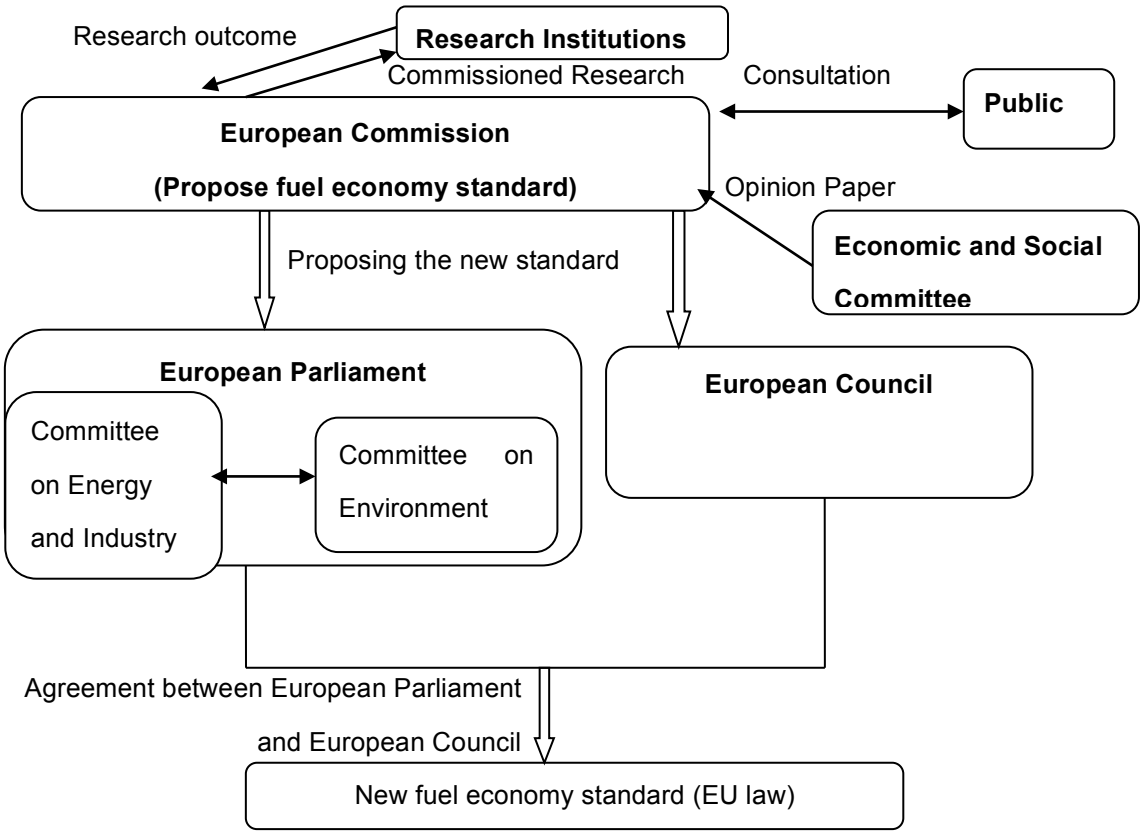
[5] Based on interview with Former Japanese representative to the European Union, 2009

Commission to move its position by proposing 120 g CO_2/km target as a legally binding target for passenger cars in February 2007 (European Commission, 2007). The European Parliament also showed its support for the policy by proposing increasingly tougher targets: 125 g CO_2/km by 2012, 95 g CO_2/km by 2020, and 70 g CO_2/km by 2025 (European Parliament 2007). In December 2008, the 120 g CO_2/km target by 2015 (130 g CO_2/km purely by technological developments), with the scope to limit to 95g CO2/km by 2020 was agreed between the European Parliament and the European Council, and it was issued as EU law (Council of European Union, 2008).

Decision-Making Procedure

The main actors in the European car climate policy include the European Commission, the European Parliament (Commissioners for Environment, and Commissioner for Industry and Entrepreneurship), the European Council, national governments, ACEA, and car manufacturers in each country. The decision-making process of the European

European fuel economy regulation



Source: created by author based on interviews to stakeholders.

car climate policy can be characterised by dynamic, diversified actors with different authority given at different levels. The authority to propose the new fuel economy standard at the EU level is conferred to the European Commission. On the other hand, national governments possess the authority on imposing taxes on cars, traffic and road safety management, and changing the driver behaviour. The proposal made by the Commission passes to the European Parliament and the European Council in parallel. European Parliament consults with stakeholders while they are debating, such as through 'public hearing', which is the formal consultation. The Council later approves the decision made by the Parliament, and hence issues as the EU law.

Analysis

The first characteristic of the EU fuel economy regulation is that addressing climate change issue have been a dominant norm that pushed the EU's fuel economy regulation for passenger cars. As mentioned, the original rationale that the Europe set 120g/km target was to reduce increasing CO_2 emissions from road transport sector. This rationale is still dominant in the EU fuel economy regulation. When the 120g/km legislation was proposed by the European Commission, a wide range of other climate policies that were being proposed at the same time for the Copenhagen Conference, such as the EU's energy and climate package. Although the car fuel economy regulation was not formally part of the package, but adopted at the same time of climate and energy package, there was a big political push to put in place for the wide range of stringent climate reducing policies including the fuel economy regulation.[6]

However, the European fuel economy regulation for passenger cars are constantly shaped and reshaped by the clash of divergent interests among its member states, mainly between France and Germany. It is especially notable that the EU's 120g-CO_2/km target was originally proposed by Germany in 1995, which, in 13 years later, strongly opposed against the legalization of the target. Much of the discussions in the Commission, the Parliament, the Council, and at the industry level were marked by the divide between France and Germany. Two factors can be identified as causes of this divide. First, while French and Italian car industries produce high fuel efficient vehicles, German (and perhaps British) car industry produce heavy, large and luxury vehicles

[6] Based on interview with a Policy Officer, Transport and Ozone Unit, Climate Action Directorate General, European Commission.

with low fuel efficiency,[7] and therefore the burden sharing of the target has became the central discussion. Second, the EU has introduced the flexible credit-trading system called the 'Carbon Allowance Crediting System' for the achievement of the 120g-CO_2/km target. It allows the manufactures to pool their emission standard with other manufactures, and gives credits to manufacturers for exceeding their target, and allows them to sell these credits to others who are below the target. This suggests that those who are producing light and high efficient vehicles would benefit from this system, while the others do not. Consequently, it suggests that the German car manufactures with an average of 165g-CO_2/km in 2008, must buy credits from French and Italian manufactures for the achievement of the legally-binding target. However, on a closer look, much of the outcomes reflect the German proposals. For example, measures such as the weight-based approach (in contrary French insisted for footprint), eco-innovation credits and phase-in of the target are inserted in the final outcome of the text as a way of reducing the stringency of the requirements.

On the other hand, while the (German) industry strongly resisted against any increase of fuel economy standards, environmental NGOs acted as 'normative entrepreneur' to push the 120g/km and 95g/k target forward. For example, the NGOs encouraged the European Parliament to push very hard for stringent 95g/km targets.[8] This target, then, formally adopted on the negotiation table since the decision-making structure of the European Union is based on the co-decision between the Commission, the Parliament, and the Council, it is important that none of these organizations can be entirely ignored. Once the number is raised formally on the negotiation table, the industry did not challenge the target itself, but put more attention to include flexibility to achieve the target. It follows, the environmental NGOs successfully influenced the fuel economy regulation target for 2020 via the European Parliament.

JAPANESE FUEL ECONOMY REGULATION

Japanese fuel economy regulation was triggered by domestic and international events.

7 The French and Italian automobile manufactures were about to clear the 140g-CO2/kmg-CO2/km voluntary target in 2008. In contrary, the average fuel economy of German automobile manufactures was 180g-CO2/km in 2006, and 165g-CO2/km in 2008. See T&E (2009).

8 Based on interview with Mr. Greg Archer, Programme Manager, Transport and Environment (T&E).

Domestic events included the growing concerns about air pollution and accompanying damage to health that eventually led to the Air Pollution Control Law of 1968, which in turn formed the basis for environmental improvements within the Japanese car industry. An important international event was the first oil crisis in the early 1970s that led to the creation of the Law Concerning the Rational Use of Energy (Energy Conservation Act) in 1976, which encouraged energy savings in factories, transportation, and buildings (MOE 2009). The second oil crisis, which unfolded in the late 1970s, in turn resulted in the Amendment of the Energy Conservation Act in 1979. This explicitly included the use of vehicles, and set the first fuel economy standard for the domestic manufactures' sales of new cars.

Since the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, Japanese fuel economy regulations have been motivated not only by energy savings but also by concerns about climate change (Miyoshi and Tanishita 2008). In the years following, a new fuel economy standard for gasoline cars was introduced for year 2000. After the Kyoto Protocol was adopted in 1997, the Guideline of Measures to Prevent Global Warming was announced by the newly established Global Warming Prevention Headquarters under the Cabinet Office of the Japanese Government. This guideline largely revised the Energy Conservation Act, with the introduction of the 'top runner method'.[9] Already the next year, the fuel economy standards were largely tightened through that method, requiring 22.8 per cent improvement for gasoline cars as compared to 1995 levels by 2010 (15.1 km/L), and 14.9 per cent (11.6 km/L) improvement for diesel cars by 2005. Notably, Japanese car manufactures achieved the 2010 target for gasoline cars already by 2007. As a result, a stricter standard, which requires 16.8 km/L (125 g CO_2/km) was introduced in 2007 for gasoline cars with the target year 2015. Japan's 16.8 km/L standard is not as strict as the EU's 120 g CO_2/km 2012 target, which was set in 2008 (ICCT 2011), but current trends indicate that the Japanese industry is in a better position regarding its potential to live up to its targets (Mikler 2010). The EU's regulation also contains the prospect of a 95 g CO_2/km target for 2020, and the new Japanese 2020 fuel economy standard for passenger cars – currently under discussion – will likely be as stringent as the EU target.

Japan was early to regulate cars' fuel efficiency based on different weight

[9] This method sets the standard based on the most efficient model – the top runner – in each of a number of weight classes; the rest of the models should follow the top runner in a given time.

segmentations, with the rationale to make competition fair in each category.[10] This can be compared with the corporate average fuel economy (CAFE) regulations in the U.S., which addresses the average fuel economy of each manufacturer's sales of passenger cars and light trucks, respectively. The implication would be that while American car manufacturers can follow a strategy of increasing the sales of light weight vehicles in order to fulfil the requirement, Japanese car manufacturers cannot follow this strategy since fuel regulations are segmented by vehicle weight. One of the results of the Japanese regulation is that it pushed the Japanese car industry to be one of the most fuel efficient industries among the major car manufacturing countries. Due to the large share of domestic brands – increasing from 65 to 87 per cent between 2002 and 2008 (JADA n.d.; JAIA n.d.) – this is also reflected in the fleet average CO_2 emissions of passenger cars sold in the three major car manufacturing regions in that period (Table below).[11] They show that Japan, along with the EU, is leading the fuel economy of passenger cars in the world.

Comparison of actual fleet average CO_2 emissions (g CO_2/km) of passenger cars sold in each region 2002–2008 (ICCT 2011)

Year	US	Canada	EU	Japan	China	South Korea
2002	261	244	166	157	213	
2003	259	239	164	156		232
2004	262	239	162	154		218
2005	253	237	161	153		214
2006	249	227	160	149	188	213
2007	243		158	147		207
2008	240		154	141	185	198

The decision-making procedure

According to Schreurs (2003) and (Mikler 2010), Japanese environmental policy heavily relies on regulations, but of a 'Japanese form', which is long rooted in close

10 It introduces fuel economy standards according to nine vehicle weight classes(Hoshi 2007).
11 Note that CO2 emissions are used as a proxy for vehicle efficiency in this chapter. Hence, they only refer to tailpipe emissions, and are not calculated based on the life cycle of fuels.

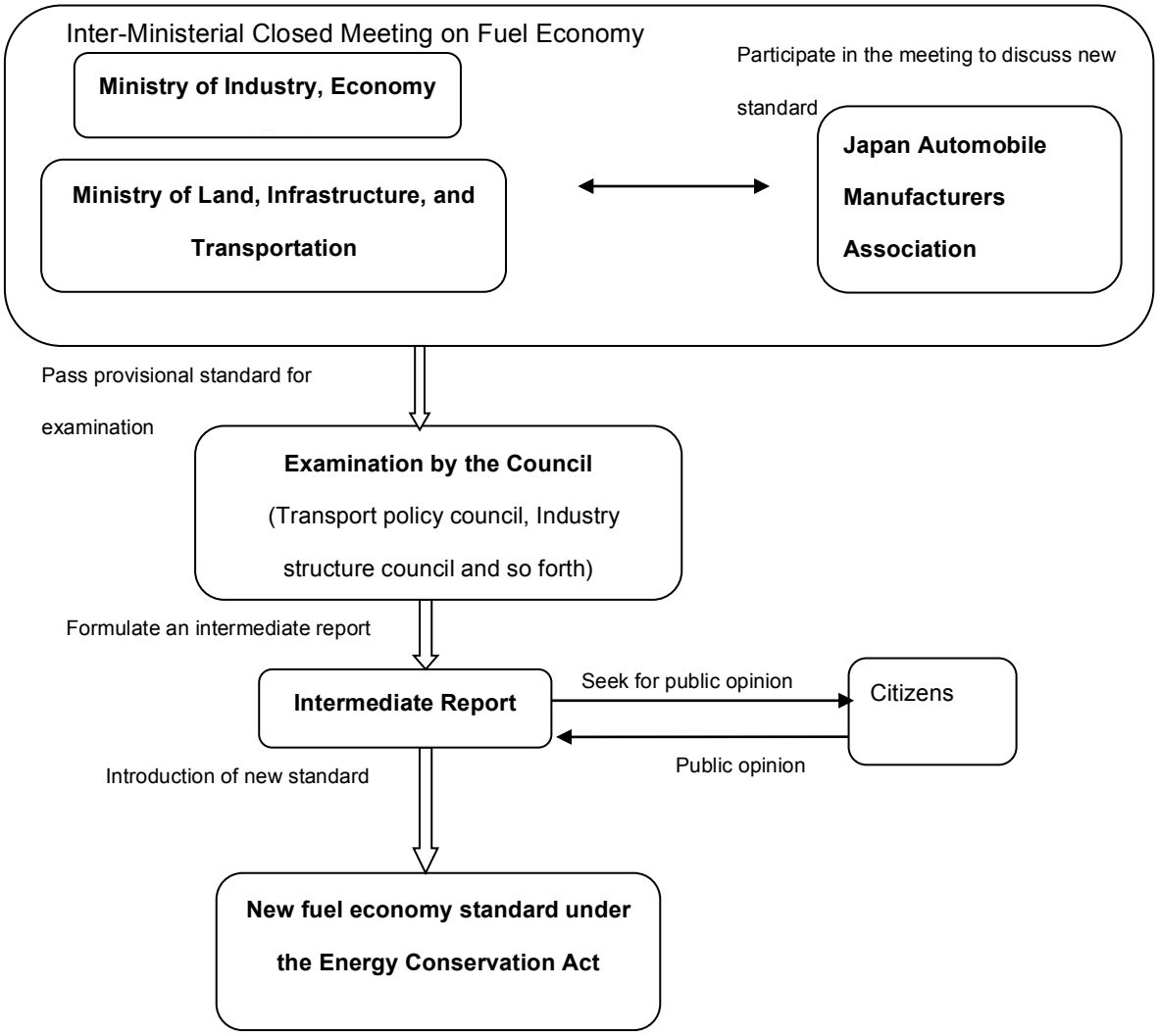
industry–government consultations: government first shows 'administrative guidance' (*gyosei shido*)[12] to the industry, by giving recommendations and advices in order to achieve a certain goal. Based on this consultation, it is commonplace that the industry follows the government's guidance through some form of self-regulation. After changes in industry can be observed, government pushes for stricter regulation. This Japanese form of regulation can be grasped by the concept of 'co-regulation'. The concept is more commonly used by practitioners than in governance literature, and there seems to be no conventional definition of the term. However, it has close linkage to what (Schmitter 1974) calls 'societal corporatism': the state and corporations negotiate policy by consultations, although the members of corporations do not have significant involvement in the process. Accordingly, the concept can be defined as the mix of government regulation and self-regulation based on collaboration between the government and the industry (Europa 2004; OFTEL 2000) or, 'regulated self-regulation' (Schulz & Held 2004).

In the case of Japanese fuel economy regulation, the concept of 'co-regulation' fits well in describing the process. The ministries of Land, Infrastructure, and Transport (MLIT), and Economy, Trade and Industry (METI) are responsible for the regulations.[13] These two Ministries held a series of closed meetings, and invited the Japanese car industry to participate (Iguchi 2009). The industry took part in the decision making process through the Japan Car Manufacturers Alliance (JAMA), which is the central industry network for the Japanese car industry.[14] After an agreement was reached in these closed meetings, it was passed on to the Council for examination. The Council consists of several meetings, including the transport policy council, and the industry structure council, and its members are generally chosen from the Japanese academia. Their role in this process is to discuss the appropriateness and feasibility of the new standard, by examining the Japanese car industry's technological potential. This means that, once the standard was agreed in the Council, it has certain legitimacy. After being examined by the Council, the agreement was published as an 'intermediate report',

12 In Article 2 of the Administrative Procedure Act from in 1993, administrative guidance is defined as 'guidance, recommendations, advice, or other acts by which an Administrative Organ may seek [...] certain action or inaction on the part of specified persons in order to realize administrative aims' (Japanese Government Secretariat 2006, p.6).
13 MLIT is the official governmental body responsible for transport matters, and METI, which is originally responsible for economic activities, is responsible for the fuel economy regulations due to its authority conferred by the Energy Conservation Act.
14 Keidanren (the central Japanese business network) does not have a role in the fuel economy regulation in this process.

which was open for public consultation. As there was not much dissenting opinion, it became the new fuel economy standard under the Energy Conservation Act.

Decision-making process for Japanese fuel economy regulation



Source: created by author based on interviews to stakeholders.

Analysis

What is distinctive about the Japanese fuel economy regulation is that unlike the European regulation, which took almost 13 years since the first announcement of the legalization of 120g/km target, Japan has been constantly raising the fuel economy regulation since the introduction of Energy Conservation Act during 1970s. Japanese

fuel economy regulation decision-making is said to formulated among limited stakeholders, and based on the co-regulation with the industry and constant increase of the fuel economy regulation. It is also notable that while both the environmental agency played significant roles in both the European (DG Climate in the Commission and the Environment Committee of the European Parliament) and the US fuel economy regulations (the US EPA), the Japanese Ministry of the Environment does not involved in the fuel economy regulation processes, despite the fact that Japanese fuel economy regulation has been fostered by the rationale to improve energy conservation and to reduce CO_2 emissions from the road transport sector. In addition, there is hardly any environmental NGOs play a role in Japanese fuel economy regulation.

While the constant increase of fuel economy regulation over years resulted Japan as one of the country with the highest fuel economy regulation, international competitiveness issue was a dominant norm to encourage its regulation. As one of the major car manufacturing countries, Japan exports great numbers of cars. In doing so, Japanese car companies have invested in considerable research and development (R&D), in order to comply with environmental regulations of importing countries – which are sometimes more stringent than the standards at home – but also for the purpose of gaining the first mover advantage. A classic example of how foreign regulation influenced the strategies of the Japanese car industry is provided by the U.S. Air pollution Act of 1970 (also known as the 'Muskie Act'), which set high standards for every car manufacturer to fulfil. In particular, it encouraged the Japanese car manufacturer Honda in inventing the CVCC (Compound Vortex Controlled Combustion) engine that made Honda the first car company to comply with the regulation (Honda n.d.).

Up until today, environmental standards in the U.S. and the EU are particularly important in encouraging technological innovation in the Japanese car industry. The U.S. is Japan's biggest car export market with 30.7 per cent of the total numbers of four-wheel cars exported in 2008, while Europe is the second biggest market with a share of 23.6 per cent (JAMA n.d.).[15] Although Asia is growing to be among the biggest export markets, its share is not yet as big as those of the U.S. or the EU. Notably, for the major Japanese manufacturers, the absolute sales in the U.S. have been larger

15 Other shares are as follows: Middle East 14.2 per cent, Asia 7.8 per cent, Oceania 6.8 per cent, Africa 5.2 per cent, Central Africa 3.8 per cent, South Africa 3.8 per cent, and others 0.2 per cent.

than in the domestic market.

Furthermore, both the U.S. and the EU are major bases for local car production of the Japanese car industry. Such production started in the 1980s, when trade frictions between Japan and the U.S. grew with the sharp increase in Japanese car exports. Since then, for more than two decades, the U.S. has been the biggest local producer of Japanese cars (Table 13). For instance, in 2002, 2.7 million cars were produced in the U.S. by the Japanese car industry (35 per cent of the industry's total overseas production), one million in the EU (14 per cent), whereas 10 million cars were produced domestically. Although the share of production located to the U.S. then decreased due to a shift in Japanese car industry's local production to Asia, it still accounted for about 25 per cent of the overseas production in 2008 (31 per cent in North America). The overseas production in Europe slightly increased its share since year 2000, and accounted for about 15 per cent in 2008 (JAMA n.d.).

In Europe, in 1998, a voluntary target was agreed between ACEA and the European Commission (see section 4.2.2 of this dissertation), which stated 140 g CO_2/km by 2008, while the 120 g target was deferred to 2012. The Japanese and Korean car manufacturers also agreed on voluntary targets with the European Commission, aiming for the target of 140 g CO_2/km by 2009, which was a stringent target for the Japanese car industry. As a result, this target may have worked as one of the driving forces that pushed improvement in the Japanese industry. On the other hand, the average fuel economy of the European car industry was in 2006 only 160 g CO_2/km, which was far from the 2008 target of 140 g CO_2/km (T&E 2007).

In the U.S., where fuel economy regulation at federal level has been stagnant (see 6.2 of this dissertation), The best example of stringent state-level regulation of cars is California's low-emission vehicle (LEV) regulation in the 1990s that required all car manufactures to include zero-emission vehicles (ZEVs) as a small percentage of their total sales in the state. Although the regulation was gradually weakened as a result of the industry's lobbying efforts, it mandated the industry to include two per cent ZEVs in 1998 and 10 per cent in 2003, including advanced-technology partially zero-emission vehicles (AT-PZEVs) such as hybrid cars. According to Yarime et al., (2008) this rigorous regulation pushed technological innovation in hybrid and fuel-cell cars in the Japanese car industry. For example, after the introduction of California's ZEV regulation in 1990, the number of Japanese patent applications on EVs and hybrid cars

increased sharply (Yarime et al. 2008).

FUEL ECONOMY REGULATION IN THE UNITED STATES

Despite the fact that the U.S. was the first to implement fuel economy regulation on cars among the three studied car manufacturing regions, fuel economy regulations at the federal level has only been pursued since the 1980s. The Energy Policy Conservation Act of 1975 set fuel economy regulations that led to the introduction of the CAFE standards in 1978 with a 18.0 mpg (miles per gallon) target for passenger cars. This target improved up to 26.5 mpg by the end of 1980s. However, since 1985 up until now, the standard has remained unchanged with 27.5 mpg. For light trucks, which are sold in almost equal quantities as cars (Mikler 2010), the target was set to 17.2 mpg in 1979 and gradually improved up to 24.1 mpg in 2011 (NHTSA 2004).[16]

In contrast to the federal level, environmental regulation of the car industry at state level has evolved significantly. The best example of stringent state-level regulation of cars is California's low-emission vehicle (LEV) regulation in the 1990s that required all car manufactures to include zero-emission vehicles (ZEVs) as a small percentage of their total sales in the state. Although the regulation was gradually weakened as a result of the industry's lobbying efforts, it mandated the industry to include two per cent ZEVs in 1998 and 10 per cent in 2003, including advanced-technology partially zero-emission vehicles (AT-PZEVs) such as hybrid cars. According to Yarime et al. (2008), this rigorous regulation pushed technological innovation in hybrid and fuel-cell cars in the Japanese car industry. For example, after the introduction of California's ZEV regulation in 1990, the number of Japanese patent applications on EVs and hybrid cars increased sharply (Yarime et al. 2008).

Furthermore, California successfully established Assembly Bill No. 1493 in 2002, which entered into force on 1 January 2006. It set fuel economy standards for two separate car categories from 2009 to 2016. For instance, it requires car manufacturers to achieve 323 g CO_2/mile in 2009, 205 g CO_2/mile in 2012, and 172 g CO_2/mile in 2016 for passenger cars. This standard was much stricter than the federal level target set by

[16] In fact, between 1986 and 1989, the target for passenger cars moved backwards, with 26.0 mpg as the lowest standard. This also happened for light trucks (in 1985 and in 1990).

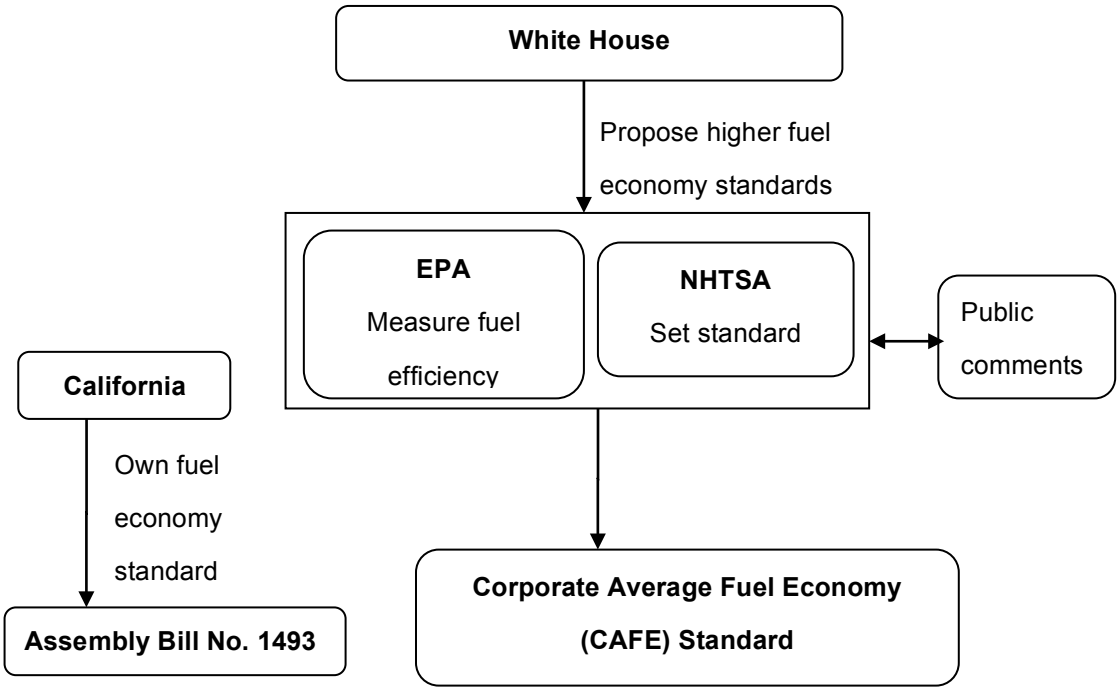
the CAFE standard, and it resulted in overlapping authority over the fuel economy regulations between California and the federal National Highway Traffic Safety Administration (NHTSA), which was conferred authority over the fuel economy regulation by the Energy Policy Conservation Act of 1975. Accordingly, American Automobile Manufacturers Association (AAM) filed a suit against the California Air Resources Board for inappropriate authority to the District Court in December 2004. Against the expectation of the industry, the Court approved California's authority over the fuel economy, which implies that other states can choose to set their own standard, as a complement to the federal CAFE standard (Inoue 2008).

At the federal level, the former President Bush signed the Energy Independence and Security Act in 2007, which requires the industry to improve fuel economy by 40 per cent (35 mpg) by 2020 (White House 2007). Under the Obama administration, this policy was advanced, with the target of 35.5 mpg (172 g CO_2/km) by the year 2016 (White House, 2009). It follows that what is happening is a synchronization of the fuel economy standards on the federal and the Californian level from 2012 onwards (ICCT 2011) .

Furthermore, EPA and NHTSA proposed stringent targets for the CAFE standard from 2017 to 2025 that call for 47–62 mpg (corresponds to 99–131 g CO_2/km) by 2025 at the most stringent level (EPA 2010; ICCT 2011).[17] Based on this calculation, President Obama upgraded the target to 54.5mpg by 2025.

Figure 3. US multiple potential fuel economy regulation

[17] They set four different scenarios for the fuel economy standard until 2025, entailing three to six per cent improvement per year.



Source: created by author based on interviews to stakeholders.

Analysis

Even though the US is the first country that introduced the fuel economy regulation in the world, its standard has been stagnant for more than 20 years primarily because of the strong industry lobby against an increase of the standard as well as the cheap oil price and subsequent lack of needs to improve the standard. Because of US industry lobby and its political influence over the Congress, in turn appropriation from Congress to NHTSA not enough to the Agency to act, cheap oil price and no motivations for government, industry and demands from customers to raise fuel economy, this formed the US identity or car culture that safety consideration more important than fuel efficiency of vehicles. Therefore US big 3 produced larger vehicles that are low fuel efficiency.

All dynamics in the context of the US fuel economy regulation changed with the Supreme Court decision to allow regulating CO_2 emissions in the context of clean air act. The California's own emission standards changed the whole dynamics in number of ways. First, it created a situation where there are overlapping authorities over the fuel economy regulations – in addition to the federal National Highway Traffic Safety Administration (NHTSA), which was conferred authority over the fuel economy

regulation by the Energy Policy Conservation Act of 1975, the EPA, California and other states with a choice to choose whether to choose California's standard or federal government's. The Supreme Court in April 2007 concluded that under the Clean Air Act, CO_2 is defined as a pollutant. Thus, the EPA gained power to regulate CO_2 under the Clean Air Act. One of the arguments against this decision was that because the Clean Air Act was written in 1970s, the Congress never anticipates using Clean Air Act to regulated GHGs. However, the Court overruled this argument, and concluded that the Act covers all pollutant whether the scientists at that time did not anticipated global warming at the time the bill has written. After this decision came out, the state of California set its own GHGs standards - they had the flexibility to set their own standard under the federal Clean Air Act to set their vehicle sold in the state of California because of their unique air pollution problems.

Second, California's own regulation raised a concern to the US automobile industry – the industry preferred not to deal with multiple regulatory obligations.[18] This is because multiple regulatory obligations suggests industry to manufacture different car models targeted for different states – for example, they have to manufacture highly fuel efficient cars for California and conventional models for other states – and it was too costly for the industry to do so. It follows, the industry gradually supported for the unified standard between federal and state levels.

Enhancing industry competitiveness especially after 2000s was also a central rational for the US to raise its fuel economy regulation. The stagnant fuel economy regulation in the US resulted in small share of the US car industry within domestic market, and the share of passenger cars are gradually taken over by foreign capitals especially by Japanese manufactures. As a result, in contrast to 1960s and late 1970s, when the US manufactures shared more than 80% of its domestic market share, 1990s and 2000s marketed significant decrease of its share, marking about 40% in 2010.

Furthermore, the increase of gasoline price during 2000s decreased the sales of bigger vehicles and therefore gradually the automobile industry had to shut down their plants. It resulted in decline of credibility of the US based automobile industry in the Congress, and allowed more space for stringent fuel economy regulation - the

[18] Based on interviews with EPA and US automobile industry

neo-conservatives argued to reduce dependence on the foreign oil and therefore created another stream of support for CAFE increase.

IMPLICATIONS

What is evident in recent years is that fuel economy regulation for passenger cars are converging between Europe, Japan and the US. This regulatory convergence in major automobile manufacturing and importing nations would function as the international standard (or shared norm) that emerging automobile manufacturing countries such as China and India would follow. Given the size of European, American and Japanese market are considerably large, the stringent fuel economy regulations in these regions would encourage more low-carbon technological innovations that would be sold everywhere in the world. On the other hand, since all passenger cars that are sold in these regions are mandated to satisfy highest standards in the world, any countries that wish to sell automobiles in these markets also have to satisfy the highest standards in the world. To put simply, higher the fuel economy standards in these regions, more likely the standard automatically works the global 'de-facto' standard in the world.

As a matter of fact, Chinese proposed fuel economy regulations are one of the highest in the world, marking 117g/km by 2020. One of the reason for this introduction of a stringent fuel economy regulation would be due to "while Chinese automotive companies are far behind their regional and Western competitors when it comes to traditional automotive technologies, they are hoping to establish a stronger position in new energy vehicles" (Kokko and Liu 2012: p.200)[19]. Namely, while China are far behind of Japanese, European and perhaps the US competitors in terms of conventional vehicle technologies, it tried to enhance its competitiveness by investing on new energy technologies, such as Hybrid Electric Vehicles. Although Chinese new energy technologies are still at an early stage of development,[20] it is clear that their intention to compete with Japan, Europe and the US manufactures are obvious.

[19] Kokko, Ari and Yingqi Liu, 'Governance of new energy vehicle technology in China', in Nilsson, M. *et al*., *Paving the Road to Sustainable Transport: Governance of innovation in low-carbon vehicles*. London: Routledge.
[20] Ibid,.

Future Tasks

While this paper focused on the case studies from Japan, Europe and the US, the next step of the research is to examine how norms shared between Japan, Europe and the US may be impacted on other automobile manufacturing nations such as China, Korea, India and other potential countries. Examination of these countries is particularly important as most of the CO_2 emissions from the road transport sector are projected to arise from these countries.

Also important is the effectiveness of the de-facto standard in influencing the behaviour of the states. As it is the informal shared norms between actors, it does not present compliance mechanisms as formal institutions do. This in turn leads us to consider the normative power discussions, namely to explain not only how the behaviours of the actors are constructed, but also to what extent norms can bind the behaviour of the states. It is therefore a further investigation on the empirical analysis of normative power is needed.

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