2. Effects on domestic automotive production due to increases in the number of automobiles in demand (prospects for 2012 domestic automotive demand)

On January 18, 2012, the Japan Automobile Manufacturers Association, Inc. (JAMA) announced prospects for 2012 domestic automotive demand, with an increase of approximately 810,000 four-wheel vehicles (passenger vehicles, trucks, and buses) being expected due to demand attributed to recovery from the Great East Japan Earthquake.

Using the 2009 Updated Input-Output Table (market valuations) (hereafter, it is referred to as the 2009 Updated Table) released recently, we will analyze the scale of production spillover effects due to an increase in demand expected based on the prospects for domestic automotive demand.

(1) Acquisition of datasets

First, the increase in automotive consumption, which is the premise for the analysis, was estimated using the figures (Table 1) released by JAMA, whose prospects for domestic demand had taken factors such as demand due to earthquake disaster reconstruction into account.

Table 1. Prospects for 2012 domestic automotive demand

		2012		2011
		Prospects	Difference from 2011	Actual figure
Number of automobiles in demand domestically	Total	**5,015,500**	**805,280**	**4,210,220**
	Passenger vehicles	4,291,000	**766,211**	3,524,789
	Standard- and small-sized	2,896,000	509,964	2,386,036
	Light	1,395,000	256,247	1,138,753
	Trucks	712,000	**37,220**	674,780
	Standard-sized	125,000	17,710	107,290
	Small-sized	202,000	16,903	185,097
	Light	385,000	2,607	382,393
	Buses	12,500	**1,849**	10,651
	Large-sized	4,100	964	3,136
	Small-sized	8,400	885	7,515

Note: Imported automobiles included

Reference: Japan Automobile Manufacturers Association, Inc.

We decided to conduct analysis on production spillover effects using the 2009 Updated table and the demand prospects mentioned above; however, to achieve this, quantity needs to be converted to monetary value, and domestic sales need to be discriminated between domestic and imported automobiles since spillover effects, by definition, only apply to domestic production (activities).

Consequently, we used the following procedure to estimate increases in domestic sales values of domestic and imported automobiles:

1) We acquired the number of automobiles sold domestically in 2011, released by JAMA, and the number of imported automobiles newly registered in 2011, released by the Japan Automobile Importers'

Association. Applying the ratio of the number of imported automobiles to the number of automobiles sold domestically in 2011, the expected increase in the number of automobiles to be sold domestically in 2012 was divided into domestic and imported automobiles.
The exception is that those light passenger vehicles and light trucks contributing to an increase in sales were regarded as domestic automobiles.

2) We calculated the monetary value of an expected increase in domestic automobile sales in Japan by multiplying the increase in the number of domestic automobiles sold in Japan, calculated in Section 1, by the 2011 average unit sales price obtained from the dynamic statistics of production survey.

3) We calculated the monetary value of an expected increase in imported automobile sales in Japan by multiplying the increase in the number of imported automobiles sold in Japan, calculated in Section 1, by the 2011 average import unit price obtained from the foreign trade statistics.

As a result, an increment of domestic sales value consists of 1.871 trillion yen for domestic automobiles, 142.8 billion yen for imported automobiles, 98.5 billion yen for domestic trucks and buses, and 2.4 billion yen for imported trucks and buses (Table 2).

Table 2. Predicted increment of domestic automobile sales in 2012

			Total	Passenger vehicles	Trucks and buses
Value (100 million yen)	Domestic sales		**13,309**	**12,300**	**1,009**
		Domestic automobiles	**11,856**	**10,871**	**985**
		Imported automobiles	**1,452**	**1,428**	**24**
Quantity	Domestic sales		805,280	766,211	39,069
		Domestic automobiles	747,788	710,490	37,298
		Importetd automobiles	57,492	55,721	1,771

Domestic activities include not only manufacturing but also activities during distribution stages. Thus, costs (commercial margin and cargo fares) of domestic distribution, which are generated with domestic sales of domestic and imported automobiles, need to be added to the increase in domestic sales value of domestic automobiles.

For this reason, the following steps were taken to calculate expenses involved during the domestic distribution stage generated due to the increase in domestic sales of automobiles. Since the 2009 Updated table does not provide information on expenses generated during the distribution stage, we referred to the 2005 Input-Output Table (basic table) (hereafter, it is referred to as the 2005 Basic Table), which covers the latest available information on distribution costs.

1) Regarding passenger vehicles, the increase in the domestic sales value (domestic and imported automobiles combined) was multiplied by the ratio of the average retail price (estimated from industrial

statistics) to the average unit sales price (based on the 2011 dynamic statistics of production survey) to reflect combined commercial margin rates and cargo fare rates. Then the commercial margin and cargo fares were calculated using the composition ratio between them referring to household consumption expenditure and gross domestic fixed capital formation (private and public) for passenger vehicles documented in the 2005 basic table.

2) Regarding trucks and buses, the increase in the domestic sales value (domestic and imported automobiles combined) was multiplied by commercial margin rates and cargo fare rates referring to gross domestic fixed capital formation (private and public) for trucks, buses and other vehicles documented in the 2005 basic table.

As a result, the increase due to domestic activities amounted to 1.4755 trillion yen for passenger vehicles and 162.8 billion yen for trucks and buses (Table 3).

The addition of 145.2 billion yen, representing the total increment of pre-tax price of imported automobiles, to 1.6383 trillion yen, representing an increment of domestic activities, amounts to 1.7835 trillion yen, which is the total increase in domestic sales value expected in the prospects for 2012 domestic automotive demand.

Table 3. Increased values of domestic activities due to the inclusion of distribution expenses

Unit: 100 million yen

		Total	Passenger vehicles	Trucks and buses
Domestic automobiles (production stage)		**11,856**	**10,871**	**985**
Commercial margines and cargo fares associated with domestic sales (domestic and imported automobiles)	Wholesale	1,912	1,472	440
	Retail	2,432	2,258	174
	Railroad	0	0	0
	Road	143	121	22
	Coastal	6	5	1
	Harbor transportation	19	16	3
	Airway	0	0	0
	Consigned forwarding	5	5	1
	Warehouse	8	7	1
Total		**16,383**	**14,755**	**1,628**

(2) Preliminary estimation of production spillover effects

1) Increment during the production stage

Of the amount of increase in domestic sales value calculated in Section (1), only the portion due to the sales of domestic automobiles in Japan was experimentally computed using the inverse of the coefficient

matrix documented in the 2009 Updated Table. According to this calculation, production inducement values due to an increase in automotive demand expected in the prospects for 2012 domestic automotive demand are: 3.6031 trillion yen for passenger vehicles and 320.4 billion yen for trucks and buses, totaling 3.9235 trillion yen. In addition, production inducement coefficients are 3.3144 for passenger vehicles, 3.2518 for trucks and buses, and 3.3092 as a whole (Table 4).

Table 4. Production inducement values associated with an increase in sales values of domestic automobiles sold in Japan

	Total		
		Passenger vehicles	Trucks and buses
Documented data (100 million yen)	11,856	10,871	985
Production inducement value (100 million yen)	**39,235**	**36,031**	**3,204**
Production inducement coefficient	3.3092	3.3144	3.2518

2) Increment due to commercial margins and cargo fares

Next, we conducted preliminary calculation of production spillover effects based on an increase in domestic activities (distribution costs associated with both sales of domestic automobiles and domestic sales [of domestic and imported automobiles]) estimated in Section (1), using the inverse of the coefficient matrix documented in the 2009 Updated table. According to this calculation, production inducement values due to an increase in automotive demand expected in the prospects for 2012 domestic automotive demand are: 4.2028 trillion yen for passenger vehicles, and 418.3 billion yen for trucks and buses, totaling 4.6211 trillion yen. In addition, production inducement coefficients are 2.8484 for passenger vehicles, 2.5701 for trucks and buses, and 2.8207 as a whole (Table 5).

Table 5. Production inducement values associated with an increase in domestic activities including distribution expenses

	Total		
		Passenger vehicles	Trucks and buses
Documented data (100 million yen)	16,383	14,755	1,628
Production inducement value (100 million yen)	**46,211**	**42,028**	**4,183**
Production inducement coefficient	2.8207	2.8484	2.5701

In terms of production spillover effects by sector, “passenger vehicles,” is top ranking due to its direct effect value of 1.0871 trillion yen.

The second rank is given to the “motor vehicle parts” sector (production inducement value: 802.7 billion yen), which is greatly influenced by spillover effects from the “passenger vehicles” and “trucks, buses and other vehicles” sectors. In addition, the “motor vehicle parts” sector is positioned in ranking above other sectors generating great production inducement values, including the 4th ranked “internal combustion engines for motor vehicles and parts” (production inducement value: 265.4 billion yen) and the 6th ranked “motor

vehicle bodies."

The third rank is given to "wholesale trade" (production inducement value: 314.3 billion yen) and "retail trade" is in the 5th rank (production inducement value: 259.7 billion yen). Since the direct effects of "wholesale trade" and "retail trade" generate 191.2 and 243.2 billion yen, respectively, these sectors generate production inducement values greater than direct effect values (Table 6).

Table 6. Sector-specific production inducement values associated with increased domestic activities including distribution expenses (top 30 sectors)

	Industrial sector	Production inducement value (100 million yen)		Industrial sector	Production inducement value (100 million yen)
1	Passenger motor cars	10,871	16	Other business services	440
2	Motor vehicle parts and accessories	8,027	17	Advertising services	371
3	Wholesale trade	3,143	18	Cold-finished steel	366
4	Internal combustion engines for motor vehicles and parts	2,654	19	Petroleum refinery products (inc. greases)	340
5	Retail trade	2,597	20	Crude steel (converters)	285
6	Motor vehicle bodies	1,813	21	Information services	284
7	Research and development (intra-enterprise)	1,242	22	Repair of machine	274
8	Trucks, buses and other cars	985	23	Goods rental and leasing (except car rental)	255
9	Plastic products	874	24	Coated steel	240
10	Financial service	865	25	Real estate rental service	235
11	Electrical equipment for internal combustion engines	805	26	Other rubber products	219
12	Road freight transport (except Self-transport by private cars)	620	27	Cast and forged materials (iron)	216
13	Worker dispatching services	532	28	Non-ferrous metal castings and forgings	208
14	Electricity	499	29	Printing, plate making and book binding	190
15	Hot rolled steel	487	30	Pig iron	190

(Note) Shaded boxes indicate sectors exerting direct spillover.

(*) The basic classification documented in the 2008 Updated Input-Output Table was consolidated into 402 sectors, and the effect on domestic production was estimated using the equilibrium output model, $X=(I-\Gamma A)^{-1}(\Gamma Y+E)$, which takes the self-sufficiency rate into account. The generation of 402 sectors out of the basic classification was achieved by the finest division possible by means of square matrix, and sectors including used paper, scrap iron, and non-ferrous metal scrap were established by setting the column vector at 0.
As a note, the value of ΓY in the model was replaced by direct estimates of consumption expenditure of households or gross domestic fixed capital formation.

I, the unit matrix; Γ, the matrix representing the self-sufficiency rate ($I-\hat{M}$); $\hat{M}$, the import coefficient matrix;
A, the input coefficient matrix; Y, final domestic demand; E, exports; X, domestic production value

(3) Preliminary estimation of number of employees

In the previous sections, we estimated production inducement values generated by spillover effects due to an increase in automotive demand expected in the prospects for 2012 domestic automotive demand. Next, we will estimate the scale of employment needed to match the expanding demand.

Since sufficient employment information cannot be acquired from the 2010 Updated Table only, the 2005 Tables on Persons Engaged in Production Activities (hereafter, they are referred to as the 2005 Employment Table) and the 2005 Basic Table were also consulted to gather the latest available information. The following steps were taken for the calculation:

1) The number of employees obtained from the 2005 employment table was divided by compensation of employees to determine an employment coefficient.
2) Compensation of employees from the 2009 Updated table was divided by domestic production value to determine the compensation rate for employees for each sector.
3) Production inducement value for each sector, estimated based on preliminary-computed production spillover effects due to an increase in automotive demand expected in the prospects for 2012 domestic automotive demand, was multiplied by the employment coefficient and the compensation rate for employees to determine the number of employees.

Thus, we concluded that the employment creation effect, due to an increase in automotive demand expected in the prospects for 2012 domestic automotive demand, would produce a total of 160,000 jobs (Table 7).

Table 7. Estimated number of employees produced due to an increase in demand expected in the prospects for 2012 domestic automotive demand

	Total		
		Passenger vehicles	Trucks and buses
Production inducement value (100 million yen)	46,211	42,028	4,183
Number of employees (thousand)	**164**	**148**	**16**