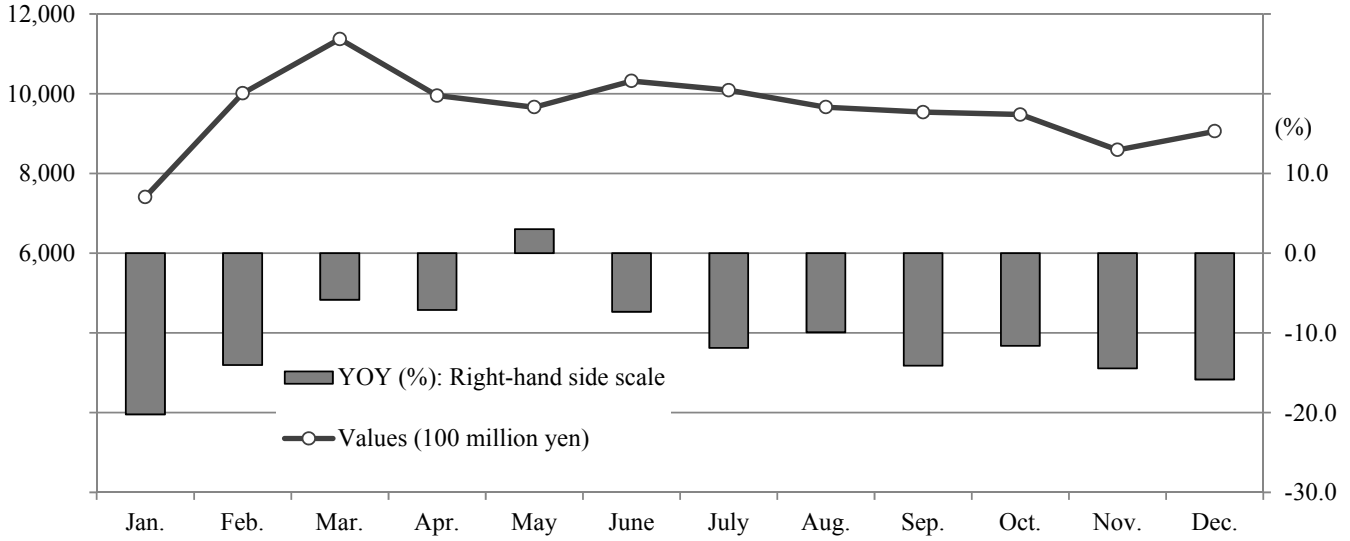
2. Impact of a fall in China-bound exports in 2012 on domestic production

According to the Trade Statistics released in January 2013, the value of Japanese exports (in yen terms) in 2012 fell 2.8% from the previous year. Exports to China, affected mostly by the economic slowdown in China, were among the hardest hit, recording a double-digit decline of 10.8% year-on-year. The monthly changes in China-bound exports in 2012 shows that shipments to China fell every month except May compared with a year earlier and the pace of decline accelerated particularly in the latter half of the year (Figure 1).

Figure 1. Monthly changes in exports to China in 2012



As shown in the structural analysis in Subsection 1, domestic production's dependence on exports to China surpassed that on exports to the U.S. in 2010, indicating China-bound exports' increasing impact on Japan's economy. Here we analyze the impact of the fall in China-bound exports in 2012 on domestic production (induced domestic production[1]) and gross domestic product, or GDP (induced gross value added), using the 2010 Updated Input-Output Table (at current price) (hereafter referred to as the 2010 Updated Table).

(1) Analysis methods

As a condition in an inter-industry analysis, we assume that the industrial structure shown in the 2010 Updated Table remains unchanged until 2012. As is the case with the structural analysis in Subsection 1, we will use export value data[2] from the export matrix by destination for the values of Japanese exports to China.

Using the total and sector-by-sector values of Japanese exports to China mentioned above, we will proceed with our analysis by taking the following steps:

(i) Calculate the changes in the value of Japanese exports to China in 2011 and those in 2012 for the total and 402 individual sectors.

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[1] The basic sector classification in the 2010 Updated Table was consolidated into 402 sectors, and the impact on domestic production was estimated using the equation output model $X=(I-\Gamma A)^{-1}(\Gamma Y+E)$, which takes into account the self-sufficiency rate. 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.

I: Identity matrix, Γ: Matrix representing the self-sufficiency rate $\left(I-\hat{M}\right)$, $\hat{M}$: Import coefficient matrix, *A*: Input coefficient matrix, *Y*: Domestic final demand, *E*: Exports, *X*: domestic production

[2] In the export matrix by destination, the destination category "China" includes Hong Kong.

(ii) Multiply the inverse matrix coefficients $[I-(I-\hat{M})A]^{-1}$ in the 2010 Updated Table by the changes in China-bound exports calculated in (i) above to calculate the changes in (induced) domestic production caused by the changes in China-bound exports for 402 individual sectors and reorganize these results into 53 sectors.

(iii) Estimate the impact on the indices of industrial production, or IIP, using the changes in (induced) domestic production calculated in (ii) above. To this end, first divide the changes in (induced) domestic production in mining and manufacturing sectors calculated in (ii) above by sector-by-sector domestic production in the 2011 Simple Updated Input-Output Table. Multiply these sector-by-sector results by corresponding industry's IIP original index in 2011 to estimate the changes in each industry's index. Calculate the weighted average of these results using IIP value added weights to estimate the changes in IIP overall index.

(iv) Multiply the changes in (induced) domestic production calculated in (ii) above by the rate of gross value added in the 2010 Updated Table to calculate the changes in GDP (induced gross value added) for 402 individual sectors. Then reorganize these results into 53 sectors to estimate the changes in GDP (induced gross value added).

(2) Estimation of production spillover effects

1) Fall in exports to China—marking 1.4634 trillion yen in 2012, down 9.6% from the previous year

According to the export matrix by destination, the value of Japanese exports in 2012 amounted to 60.4566 trillion yen, down 2.4% from the previous year. China-bound exports in particular fell by 1.4634 trillion yen to 13.8548 trillion yen, down 9.6% from 2011 (Table 1).

Table 1. Exports shown in the export matrix by destination

(100 million yen)	Exports			
	2011	2012	YOY	Difference from 2011
World total	619,468	604,566	-2.4%	-14,901
China	153,181	138,548	-9.6%	**-14,634**

Looking at the value of exports to China in 2012 by sector, the top five sectors that saw the biggest year-on-year decline all recorded a fall of over 20%. Compared to the previous year, "printing, plate making and book binding" was down 29.5%, "other cars" including trucks and buses was down 23.7%, "general machinery" including semiconductor making equipment, machinery and equipment for construction and mining, and engines was down 21.5%, "miscellaneous manufacturing products" including jewelry and adornments was down 21.2%, and "synthetic resins" including high function resins and thermoplastics resins was down 20.9%.

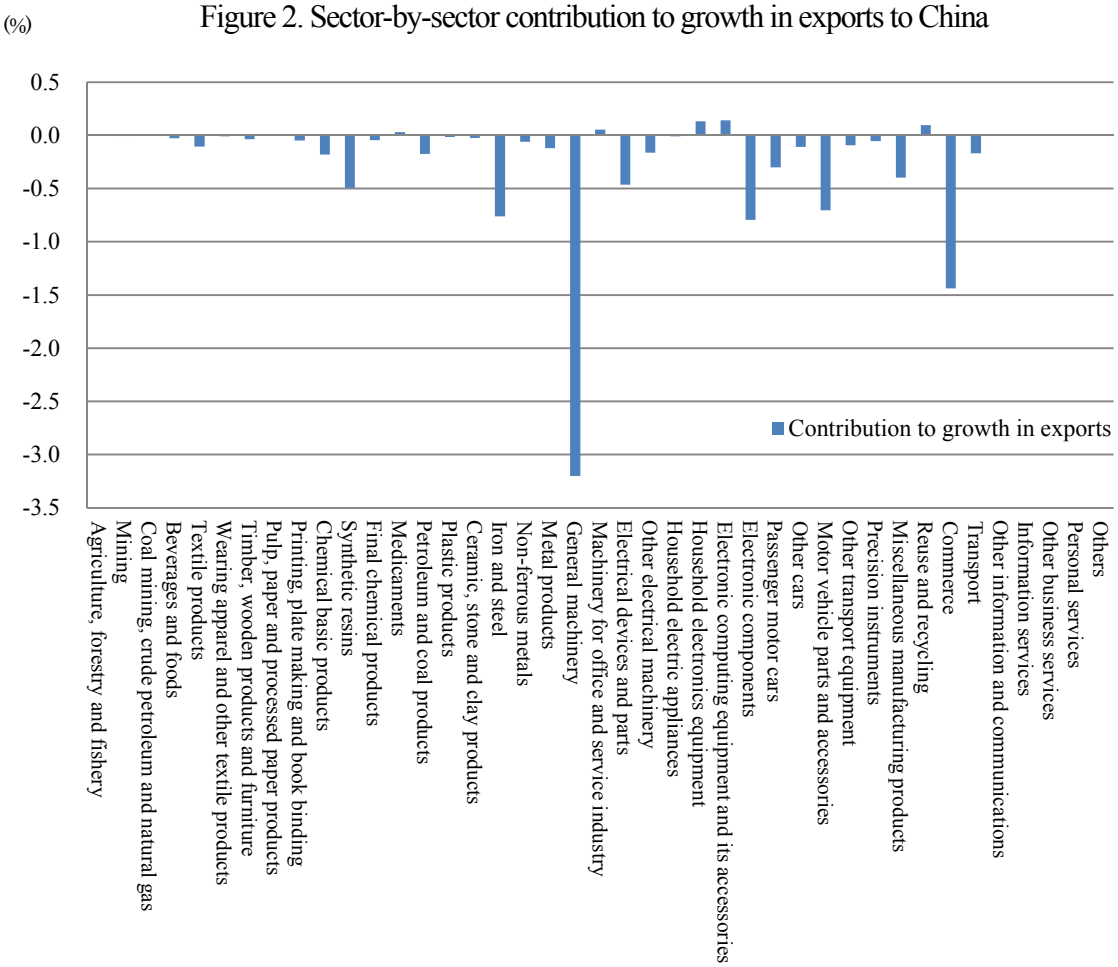
Sectors that recorded an increase in exports include: "personal services" including photographic studios with a year-on-year increase of 32.5%, "machinery for office and service industry" including copy machine with an increase of 24.3%, and "medicaments" with an increase of 13.6% (Table 2).

Table 2. Exports to China by sector

China							
	Sectors with a decline	YOY	Contribution		Sectors with an increase	YOY	Contribution
1	Printing, plate making and book binding	-29.5%	-0.05%	1	Personal services	32.5%	0.00%
2	Other cars	-23.7%	-0.11%	2	Machinery for office and service industry	24.3%	0.05%
3	General machinery	-21.5%	-3.20%	3	Medicaments	13.6%	0.03%
4	Miscellaneous manufacturing products	-21.2%	-0.40%	4	Reuse and recycling	10.0%	0.10%
5	Synthetic resins	-20.9%	-0.49%	5	Household electronics equipment	8.1%	0.13%

Looking at sector-by-sector contribution to the decline of 9.6% in China-bound exports, "general machinery" made the biggest negative contribution of 3.2%, followed by "commerce"[3] with a negative contribution of 1.4%, "electronic components" including integrated circuits with a negative contribution of 0.8%, "iron and steel" including hot rolled steel and cold-finished steel with a negative contribution of 0.8%, and "motor vehicle parts and accessories" with a negative contribution of 0.7%. These top five sectors collectively made a negative contribution of 6.9%, accounting for about 70% of the total decline of 9.6% (Figure 2).

Figure 2. Sector-by-sector contribution to growth in exports to China



[3] "Commerce" refers to trade margins paid during the transportation from the plant to the ship and agent commissions for receiving export goods.

2) Impact on (induced) domestic production—equivalent to 0.36% of domestic production

We multiplied the inverse matrix coefficients in the 2010 Updated Table by the fall in China-bound exports calculated in 1) above to calculate its impact on Japan's domestic production activities. According to the calculation, the decline in (induced) domestic production caused by the fall in China-bound exports was 3.2494 trillion yen in total. This is equivalent to 0.36% of domestic production (894.8379 trillion yen) in the 2011 Simple Updated Input-Output Table (Table 3).

Table 3. Changes in induced domestic production caused by the fall in exports to China

(100 million yen)	Changes in exports	Induced domestic production
China	-14,634	-32,494

Looking at sector-by-sector changes in (induced) domestic production caused by variations in China-bound exports, "general machinery" was down 583.5 billion yen, "iron and steel" was down 465.1 billion yen, "commerce" was down 339.0 billion yen, "motor vehicle parts and accessories" was down 235.3 billion yen, and "electronic components" was down 176.2 billion yen. The top five sectors were the same as those that ranked in the top end of the list of sectors that made the biggest negative contribution to growth in exports. However, because "iron and steel" and "motor vehicle parts and accessories" have high production spillover strengths[4], they induce more domestic production even with a lower contribution to growth and accordingly ranked higher than "commerce" and "electronic components." These top five sectors collectively account for about half of the total changes.

Looking at sectors that recorded an increase in domestic production, "electronic computing equipment and its accessories" including personal computers was up 21.9 billion yen, and "household electronics equipment" including wired communication equipment was up 20.0 billion yen (Table 4).

Table 4. Changes in sector-by-sector induced domestic production caused by the fall in exports to China

(Induced domestic production: 100 million yen)

China							
	Sectors with a decline	Induced domestic production	Production spillover strength		Sectors with an increase	Induced domestic production	Production spillover strength
1	General machinery	-5,835	2.2220	1	Electronic computing equipment and its accessories	219	1.7064
2	Iron and steel	-4,651	2.6223	2	Household electronics equipment	200	1.7157
3	Commerce	-3,390	1.5008	3	Reuse and recycling	78	1.9769
4	Motor vehicle parts and accessories	-2,353	2.8472	4	Machinery for office and service industry	77	2.2089
5	Electronic components	-1,762	1.8991	5	Medicaments	45	1.9358

3) Impact on indices of industrial production—pushing down the IIP level by 1.0 points

Next we estimated the impact of the decline in (induced) domestic production caused by the fall in China-bound exports calculated in 2) above on the IIP in 2012. According to the estimation, the fall in exports to China in 2012 pushes down the IIP level in the previous year by 1.0 points. This is equivalent to a negative contribution of 1.1% to the 0.3% year-on-year decline in the published IIP in 2012 (Table 5).

[4] Gross effects on production of the same or different sector induced directly or indirectly when final demand in one industry increases by one unit.

Table 5. Impact of the fall in exports to China on IIP

	2011	2012	YOY
Without the fall in China-bound exports (estimate)	-	**92.9**	**0.8%**
IIP	92.2	91.9	-0.3%
Impact on IIP	-	-1.0	-1.1%

Note: Impact on IIP = induced domestic production in each industry / domestic production in 2011 × 100 × weighted average (using IIP value added weights) of 2011 original indices

4) Impact on gross domestic product (GDP)—equivalent to 0.25% of GDP in 2011

We calculated the changes in induced gross value added caused by the fall in China-bound exports, using the decline in (induced) domestic production calculated in 2) above. According to the calculation, it was a decline of 1.1962 trillion yen in total. An estimation of the impact on Japan's GDP using this result reveals that the decline in induced gross value added caused by the fall in China-bound exports is equivalent to 0.25% of the GDP in 2011 (470.6232 trillion yen) (Table 6).

Table 6. Changes in induced gross value added caused by the fall in exports to China

(100 million yen)	2011	2012	YOY
Gross domestic product (GDP)	4,706,232	4,758,678	1.1%
Induced gross value added (changes)	-	-11,962	-
Changes/GDP	-0.25%	-	-

Note: Changes in induced gross value added = changes in induced domestic production caused by the fall in exports to China × rate of gross value added in the 2010 Updated Table

Looking at sector-by-sector changes in induced gross value added caused by the fall in China-bound exports (Table 7), "commerce" was down 233.2 billion yen, "general machinery" was down 197.7 billion yen, "iron and steel" was down 90.1 billion yen, "other business services" including worker dispatching services and repair of machine was down 64.5 billion yen, and "education and research" including research and development (intra-enterprise) was down 55.2 billion yen. This shows that sectors with a high rate of gross value added made up the top end of the list of sectors that recorded a decline.

Looking at sectors that recorded an increase in induced gross value added helped by the fall in China-bound exports, "electronic computing equipment and its accessories" was up 5.0 billion yen, and "household electronics equipment" was up 3.8 billion yen.

Table 7. Changes in sector-by-sector induced gross value added caused by the fall in exports to China

(100 million yen)

China					
	Sectors with a decline	Induced value added		Sectors with an increase	Induced value added
1	Commerce	-2,332	1	Electronic computing equipment and its accessories	50
2	General machinery	-1,977	2	Household electronics equipment	38
3	Iron and steel	-901	3	Reuse and recycling	37
4	Other business services	-645	4	Others	21
5	Education and research	-552	5	Machinery for office and service industry	19

(3) Summary

A fall of 1.4634 trillion yen in Japanese exports to China in 2012 caused a decline of 3.2494 trillion yen in (induced) domestic production. This is equivalent to 0.36% of domestic production in the 2011 Simple Updated Input-Output Table. By sector, sectors that made a significant contribution to the fall in China-bound exports and have high production spillover strengths, such as "general machinery" and "iron and steel," contributed to the decline in (induced) domestic production.

Looking at the impact on the IIP, the decline in (induced) domestic production caused by the fall in China-bound exports is equivalent to a negative contribution of 1.1% to the 0.3% year-on-year decline in the IIP in 2012 and the size that pushes down the IIP level in 2012 by 1.0 points.

The fall in exports to China caused a decline of 1.1962 trillion yen in induced gross value added. Looking at its impact on the GDP, the decline in induced gross value added caused by the fall in China-bound exports is equivalent to 0.25% of the GDP in 2011.