Appendix A. D&L decomposition of Eqs. (6)-(9)

As shown in de Boer (2009a) and de Boer (2009b), the additive D&L method is identical to the Shapley/Sun method in IDA, and the multiplicative D&L method is identical to the generalized Fisher index. Both versions of the D&L method follow the 'one-factor-each-time' principle, but there is no simple linkage between the additive decomposition and the multiplicative decomposition (Wang et al., 2017c). As the computation becomes complex with the number of factors increases, Dietzenbacher and Los (1998) propose a simplified version of the D&L method that is the average of a pair of mirror decomposition possibilities, which can be a good proxy to the original D&L decomposition results. With reference to Eq. (6) and to attain a simple relationship between the additive and multiplicative decompositions, we first decompose $PBE^T - PBE^0$ and $GDP^T - GDP^0$ using the simplified additive D&L method, and then transform the additive results into multiplicative results that explain ratio changes of PBE^T / PBE^0 and GDP^T / GDP^0. Taking the local production structure effect as an example. We first apply the simplified D&L method to calculate the additive effect of local production structure change on emissions as:

$$\Delta PBE_H^{local} = \sum_{\substack{r=1,\ldots,Q; \\ ij}} \frac{\left(f_i^{r,T} H_{ij}^{rr,T} Y_j^{r,0} - f_i^{r,T} H_{ij}^{rr,0} Y_j^{r,0} \right) + \left(f_i^{r,0} H_{ij}^{rr,T} Y_j^{r,T} - f_i^{r,0} H_{ij}^{rr,0} Y_j^{r,T} \right)}{2} \tag{A1}$$

which can be transformed into its multiplicative counterpart as follows:

$$D_H^{PBE,local} = \sum_{\substack{r=1,\ldots,Q; \\ i,j}} \exp\left(\frac{\left[\left(f_i^{r,T} H_{ij}^{rr,T} Y_j^{r,0} - f_i^{r,T} H_{ij}^{rr,0} Y_j^{r,0} \right) + \left(f_i^{r,0} H_{ij}^{rr,T} Y_j^{r,T} - f_i^{r,0} H_{ij}^{rr,0} Y_j^{r,T} \right) \right]}{2L\left(PBE^T, PBE^0 \right)} \right) \tag{A2}$$

where $L(\cdot,\cdot)$ is the logarithmic mean function that is defined as

$$L(a,b) = \begin{cases} \dfrac{a-b}{\ln a - \ln b}, \text{ if } a \neq b \\ a, \text{ if } a = b \end{cases}$$

Similarly, the additive effect of local production structure change on GDP can be calculated as:

$$\Delta GDP_H^{local} = \sum_{\substack{r=1,\ldots,Q;\\ ij}} \frac{\left(H_{ij}^{rr,T}Y_j^{r,0} - H_{ij}^{rr,0}Y_j^{r,0}\right) + \left(H_{ij}^{rr,T}Y_j^{r,T} - H_{ij}^{rr,0}Y_j^{r,T}\right)}{2} \tag{A3}$$

which can be transformed into its multiplicative counterpart as:

$$D_H^{GDP,local} = \sum_{\substack{r=1,\ldots,Q;\\ i,j}} \exp\left(\frac{\left[\left(H_{ij}^{rr,T}Y_j^{r,0} - H_{ij}^{rr,0}Y_j^{r,0}\right) + \left(H_{ij}^{rr,T}Y_j^{r,T} - H_{ij}^{rr,0}Y_j^{r,T}\right)\right]}{2L\left(GDP^T, GDP^0\right)}\right) \tag{A4}$$

Then the impact of local production structure change on PBI is computed as $D_H^{PBI} = D_H^{PBE,local} \big/ D_H^{GDP,local}$. All other effects in Eqs. (6)-(9) can be similarly calculated.

Appendix B. Lists and classifications of regions and sectors

Table B1. List and classification of regions

	Region	Acronym	Economies
China mainland	Northeast	NE	Liaoning, Jilin, Heilongjiang
	North Coast	NC	Beijing, Tianjin, Hebei, Shandong
	East Coast	EC	Shanghai, Jiangsu, Zhejiang
	South Coast	SC	Fujian, Guangdong, Hainan
	Middle Yellow River	MYR	Shaanxi, Shanxi, Henan, Inner Mongolia
	Middle Yangtze River	MYZR	Hubei, Hunan, Jiangxi, Anhui
	Southwest	SW	Yunnan, Guizhou, Sichuan, Chongqing, Guangxi
	Northwest	NW	Gansu, Qinghai, Ningxia, Xinjiang
Foreign regions	East Asia (mainland China excluded)	EAS	Korea Republic of, Mongolia, Rest of East Asia, Hong Kong, Taiwan
	Economies in Transition	EIT	Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria, Belarus, Croatia, Romania, Russian Federation, Ukraine, Rest of Eastern Europe, Rest of Europe, Kazakhstan, Kyrgyzstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia
	Latin America and the Caribbean	LAM	Mexico, Rest of North America, Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South, America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean
	Middle East and North Africa	MNA	Bahrain, Iran, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa
	North America	NAM	Canada, United States of America
	Pacific OECD-1990 Countries	POECD	Australia, New Zealand, Japan
	South-East Asia and the Pacific	PAS	Rest of Oceania, Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia
	South Asia	SAS	Bangladesh, India, Nepal, Pakistan, Sri Lanka, Rest of South Asia
	Sub-Saharan Africa	SSA	Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, Uganda, Zambia,

		Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, South Africa, Rest of South African Customs Union, Rest of the World
Western Europe	WEU	Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden, United Kingdom, Switzerland, Norway, Rest of EFTA, Albania

Table B2. List of sectors

No.	Sector	No.	Sector
1	Agriculture	16	General and specialist machinery
2	Coal mining	17	Transport equipment
3	Petroleum and gas	18	Electrical equipment
4	Metal mining	19	Electronic equipment
5	Nonmetal mining	20	Instrument and meter
6	Food processing and tobaccos	21	Other manufacturing
7	Textile	22	Electricity and hot water production and supply
8	Clothing, leather, fur, etc.	23	Gas and water production and supply
9	Wood processing and furnishing	24	Construction
10	Paper making, printing, stationery, etc.	25	Transport and storage
11	Petroleum refining, coking, etc.	26	Wholesale and retailing
12	Chemical industry	27	Hotel and restaurant
13	Nonmetal products	28	Leasing and commercial services
14	Metallurgy	29	Scientific research
15	Metal products	30	Other services

Appendix C.

Table C1. Sources of regional structure impacts of GVC forward linkages

	2007-2010				2010-2012			
	Total	Local	Domestic	Foreign	Total	Local	Domestic	Foreign
Northeast	2.06E-04	-17.8%	42.8%	75.0%	4.48E-04	-10.3%	65.1%	45.2%
North Coast	9.81E-04	-2.4%	40.3%	62.2%	8.93E-04	-1.3%	-18.5%	119.7%
East Coast	5.89E-04	-2.2%	30.4%	71.8%	1.03E-03	-0.8%	-41.9%	142.6%
South Coast	9.07E-05	7.0%	2.2%	90.7%	1.38E-04	-1.6%	28.8%	72.9%
Middle Yellow River	8.24E-04	-1.6%	110.2%	-8.5%	4.76E-04	0.8%	10.5%	88.6%
Middle Yangtze River	3.13E-04	0.2%	67.2%	32.6%	-4.77E-04	3.3%	172.9%	-76.2%
Southwest	4.49E-04	-0.2%	90.5%	9.7%	-4.85E-04	3.1%	81.9%	15.0%
Northwest	1.99E-05	15.2%	-59.2%	144.0%	7.98E-04	-0.3%	105.7%	-5.3%
Total	3.47E-03	-2.2%	62.7%	39.6%	2.82E-03	-3.5%	-21.0%	124.5%

Table C2. Sources of regional structure impacts of GVC backward linkages

	2007-2010				2010-2012			
	Total	Local	Domestic	Foreign	Total	Local	Domestic	Foreign
Northeast	6.18E-05	96.9%	-3.0%	6.1%	1.43E-05	-98.2%	193.0%	5.2%
North Coast	-3.59E-04	93.1%	9.1%	-2.2%	9.92E-04	88.2%	11.5%	0.3%
East Coast	3.67E-04	96.4%	1.4%	2.2%	4.81E-04	92.9%	6.6%	0.5%
South Coast	6.62E-04	99.4%	-0.3%	0.8%	-8.27E-04	108.5%	-8.0%	-0.4%
Middle Yellow River	-2.52E-04	109.8%	-7.5%	-2.3%	6.57E-04	90.4%	9.4%	0.2%
Middle Yangtze River	-3.80E-04	104.5%	-3.4%	-1.0%	9.81E-04	95.1%	4.8%	0.1%
Southwest	-1.07E-04	149.7%	-43.9%	-5.8%	8.40E-04	95.8%	4.1%	0.1%
Northwest	-3.76E-05	97.5%	7.2%	-4.7%	1.68E-04	87.3%	12.6%	0.1%
Total	-4.38E-05	300.6%	-102.1%	-98.5%	3.31E-03	87.4%	12.2%	0.4%