



Tracking mercury emission flows in the global supply chains: A multi-regional input-output analysis

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ABSTRACT

Mercury emissions from nonferrous metal production have overtaken that from energy consumption as the leading contributor of global anthropogenic mercury emissions. Though Minamata Convention has put restrictions on import or export of mercury-added products, the inter-connected global economy that features an intensive correlated supply chain still has large impacts on mercury emissions. Therefore, this study aims to track global nonferrous metal related mercury emission flows among 186 individual economies for the year of 2010, by applying an empirically validated multi-regional input-output (MRIO) model. The total amount of direct mercury emissions is 974 tonnes, to which gold production contributed a dominant proportion. However, a spectacular 2/3 of mercury emissions from nonferrous metal production were traded internationally, primarily as exports from emerging economies such as mainland China and Colombia to wealthy economies including the USA and Germany through global supply chains. Understanding the redistribution of mercury emissions along the global supply chains can facilitate international efforts to reduce mercury emissions from nonferrous metal production.

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1. Introduction

Atmospheric mercury, characterized as long range transportation and bioaccumulation in the environment, is a well-recognized global pollutant with high toxicity (US-EPA, 1997). Since the beginning of the industrial era, the concentration of mercury in air has increased by three times (Mason et al., 1994), which poses a serious threaten to living species all over the world.

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Due to the ubiquitous distribution and high toxicity to both human and environment, atmospheric mercury emissions have aroused global concern. Initiated in 2009, a global legally binding instrument on mercury was put on UNEP's agenda. After 4 years' arduous negotiations, delegations from different countries unanimously passed Minamata Convention aiming at global mercury mitigation. This event is a token that international community has reached an agreement to curb global atmospheric mercury pollution (Maxson, 2004).

Atmospheric mercury pollution is not only a hot topic in the political cycle, but also captures keen scientific attention. Studies on atmospheric mercury emissions from man-made sources have continued for over several decades. Back in the 1980s, Narigu and Pacyna compiled an inventory of global mercury emissions which

amounted to 3560 tonnes in the year of 1983 (Nriagu and Pacyna, 1988). Following this work, Pacyna and his collaborators have conducted a series of studies to improve the global mercury emissions estimation and obtain more complete and accurate inventories (Pacyna and Pacyna, 2002; Pacyna et al., 2003, 2006). In recognition of the adverse effects, UNEP also convened hundreds of experts and scientists from different organizations to update global mercury emission information from anthropogenic sources (UNEP, 2008, 2013; UNEP, 2002). Moreover, a calculation tool which is now extended to direct mercury emissions estimation all over the world was invented by UNEP (UNEP, 2005).

Based on current knowledge, anthropogenic sources for mercury emissions mainly include fossil fuel combustion, nonferrous metal production, iron and steel production, waste incineration, cement production and some other industrial activities (Streets et al., 2011). According to the latest literature (UNEP, 2013), nonferrous metal production has replaced fossil fuel combustion as the top emitter, contributing about half of global total mercury emission inventory. Without doubt, nonferrous metal production has become the forefront of combating global atmospheric mercury pollution. Under this circumstance, it is vital to reduce nonferrous metal related mercury emissions to alleviate global atmospheric mercury pollution. However, the understanding of global nonferrous metal related mercury emissions is still far from sufficient, which hinders the efficient policy implementation.

Moreover, the currently prevailing method for estimating mercury emissions is production based, which considers direct emissions only. A huge blank remains in the field of mercury emission studies, which is the absence of indirect mercury emissions linked to the ever increasing international trade. There are hot arguments about whether the direct accounting method can effectively reduce emissions, as it neglects the indirect emissions embodied in imports and exports of a specific economy (Chen and Chen, 2012; Li et al., 2013; Liu et al., 2010; Peters and Hertwich, 2008b; Su and Ang, 2011). Embodied emissions can be defined as the total emissions induced to produce a good or service, considering both direct emissions within the production process and indirect emissions as feedback from the global economic system itself (Chen et al., 2013a). Regarding this, a more comprehensive accounting method, which can draw the holistic profile of embodied mercury emissions (direct plus indirect mercury emissions), is in great need to reflect the atmospheric mercury pollution from different angles and has significant implications for global mitigation actions.

It is worth noticing that input-output analysis is a useful tool that covers not only environmental emissions and resources use by producers, but also detailed information associated with intermediate transactions that are included in the whole supply chain (Chen and Chen, 2015; Song et al., 2015; Su and Ang, 2014, 2015; Wiedmann, 2009; Zhang et al., 2014). In this context, multi-regional input-output (MRIO) analysis is able to trace both direct and indirect ecological elements for different economies as well as analyzes the effect of trade on economies' ecological element use. Because of this merit, a considerable number of literature have employed MRIO to investigate the impact of trade on GHG emissions (Davis et al., 2011; Peters and Hertwich, 2008a), energy consumption (Chen and Chen, 2011; D. Cortés-Borda et al., 2015), water use (Chen and Chen, 2013; Feng and Hubacek), land use (Chen and Han, 2015), PM emissions (Meng et al., 2015; Yang et al., 2015, 2016) and even threats to species (Lenzen et al., 2012b) at global and national scales. Notably, although there exists MRIO based analysis for atmospheric mercury footprints of nations (Liang et al., 2015) as well as China's inter-provincial mercury emission flows (Liang et al.,

2014), a specific investigation on re-allocation of mercury emission from non-ferrous metals is still lacking.

In light of the previous studies, this paper portrays global nonferrous metal related mercury emissions, i.e., embodied emissions of each economy and the international nonferrous metal related mercury emission trade, by adopting MRIO. The current study has two main goals: (1) shed light on global mercury emissions from comprehensive and systematic perspective by analyzing both the direct and indirect non-ferrous metal related mercury emissions; (2) provide insight for efficient policy design for global mercury emission reduction. This paper uses a high-resolution global multi-region input-output table in 2010 to trace mercury emissions flowing from the economy where they are produced to other economy where the final consumption happens.

2. Method and data sources

2.1. Method

MRIO analysis is founded on MRIO table, which covers international trade of intermediate products and final demand by household and governments. Assuming there are M economies and each economy has a certain number of sectors and the total number of sectors is N . Each sector can be considered as a basic unit of global economy. The embodied mercury emissions balance of Unit i can be expressed as:

$$me_i + \sum_{j=1}^N e_j \times z_{ji} = e_i \times \left(\sum_{j=1}^N z_{ij} + \sum_{r=1}^M d_{i,r} \right) \quad (1)$$

where me_i is direct mercury emissions from Unit i , e_i and e_j represent the embodied mercury intensities of Unit i and j , z_{ij} denotes intermediate inputs from Unit i to Unit j , $d_{i,r}$ stands for output from Unit i to final demand in economy r .

Introduce the following matrix notations:

$$\mathbf{E} = [e_1, e_2 \cdots e_N],$$

$$\mathbf{ME} = [me_1, me_2 \cdots me_N],$$

$$\mathbf{X} = \begin{bmatrix} z_{1,1} & z_{1,2} & \cdots & z_{1,N} \\ z_{2,1} & z_{2,2} & \cdots & z_{2,N} \\ \vdots & & \ddots & \vdots \\ z_{N,1} & z_{N,2} & \cdots & z_{N,N} \end{bmatrix},$$

and

$$\mathbf{Y} = \begin{bmatrix} \sum_{j=1}^N z_{1,j} + \sum_{r=1}^M d_{1,r} & 0 & \cdots & 0 \\ 0 & \sum_{j=1}^N z_{2,j} + \sum_{r=1}^M d_{2,r} & \cdots & 0 \\ \vdots & & \ddots & \vdots \\ 0 & \cdots & & \sum_{j=1}^N z_{i,j} + \sum_{r=1}^M d_{i,r} \end{bmatrix}$$

Then Equation (1) can be re-written as:

$$\mathbf{ME} + \mathbf{EX} = \mathbf{EY} \quad (2)$$

Given the condition that $(\mathbf{Y} - \mathbf{X})$ is reversible, $\mathbf{E}$ can be obtained from the following equation by re-ranging Equation (2):

$$\mathbf{E} = \mathbf{ME}(\mathbf{Y} - \mathbf{X})^{-1} \quad (3)$$

Then embodied mercury emissions in imports (EEI) and exports (EEE) for Unit i can be calculated as:

$$EEI_i = \sum_{j=1(i \neq j)}^N \varepsilon_j \times Z_{j,i} \quad (4)$$

$$EEE_i = \sum_{i=1(i \neq j)}^N \varepsilon_i \times Z_{i,j} \quad (5)$$

With EEE and EEI, the trade balance of embodied mercury emissions (EEB, also termed as net imports) is represented as:

$$EEB_i = EEI_i - EEE_i \quad (6)$$

Then for any economy, its emissions embodied in imports can be obtained by summing EEI of all the sectors within the economy. Likewise, each economy's EEE and EEB can be obtained by the same way. More detailed information can be referred to previous studies (Chen and Chen, 2013; E and Blair, 2009).

2.2. Data sources

Referring to existing research (Pacyna et al., 2010; Rafaj et al., 2013), this study takes five types of nonferrous metals into consideration, namely, gold, zinc, copper, lead and mercury. Data on zinc, copper and lead smelter production, gold and mercury mine production are derived from the statistics compiled by (USGS, 2015). Notably, artisanal and small-scale gold mine (ASGM) production activity is illegal in many countries, relevant data are not available in these places. As a result, it is difficult to obtain precise and complete activity data on world's gold production from ASGM. Fortunately, some specialized organizations and researchers have made efforts to collect ASGM activity information, which are used as the data source for ASGM in the current studies (Mercury-watch, 2015; Muntean et al., 2014).

Direct mercury emissions from nonferrous metals are calculated by multiplying the nonferrous metal mining or smelting data with their corresponding emissions factors, following previous research (Li et al., 2015; Pacyna et al., 2010). The mercury emission factors are provided by (Rafaj et al., 2013; UNEP, 2013), respectively. Multi-regional input-output analysis is founded on the multi-regional table, with economic intermediate and final demand input–output matrixes. Now there are several widely adopted global multi-regional input-output databases, such as Global Trade Analysis Project (GTAP, <https://www.gtap.agecon.purdue.edu/>), WIOD database (http://www.wiod.org/new_site/data.htm), EXIO-POL (<http://www.feem-project.net/exiopoli/>) and the Eora (<http://www.worldmrio.com/>). Data on international trade, monetary input-output by sectors in different regions, and environmental satellites accounts with energy and emissions can be taken from these databases. This study selects the Eora database, as it provides a high-resolution input-output table (including 186 individual economies and identifying 26 sectors for each economy, listed in Tables A1 and A2 in Appendix) (Lenzen et al., 2012a). Population and GDP data are also derived from the Eora.

3. Results

3.1. Direct emissions

3.1.1. Zinc, copper and lead related mercury emissions

Zinc, copper and lead smelting activities are also the primary contributors to global mercury emissions. In 2010, 194 tonnes of mercury are released into air via zinc, copper and lead smelting. For

these three types of nonferrous metals, zinc smelting discharges the most mercury emissions with an amount of 89 tonnes, followed by copper's 77 tonnes and lead's 28 tonnes.

Zinc, copper and lead related mercury emissions mainly happen in several economies (seen in Table A3 in Appendix). Emissions from top 20 emitters account for 80% of the global total. Mainland China, as the largest producer for all these three metals, releases an amount of 69 tonnes mercury into air. Zinc, copper and lead takes a percentage of 9%, 8% and 3%, respectively. India has the second largest emissions, with an amount of 9 tonnes. Notably, Peru ranks the fourth among all the economies even without zinc and lead related mercury emissions. That is because Peru is one of world's copper production center, which produces world's 10% copper in 2010 (USGS, 2015).

3.1.2. Mercury mine production related emissions

As mercury mine production only happens in very few economies, the data on mercury mine production are extremely limited in the statistics provided by (USGS, 2015). In 2010, mercury mine production emits 5 tonnes of mercury into air and Table A3 shows the mercury emissions from mercury mine production in different economies. Obviously, mainland China is the dominant contributor which has a significant proportion of 70%. Kazakhstan, Chile and Peru, as important mercury producers, emit 0.60, 0.42 and 0.24 tonnes of atmospheric mercury, respectively.

3.1.3. Emissions from gold production

Gold production totally discharges 774 tonnes of mercury emissions in 2010, over four fifths of which originate from ASGM activities. It was reported that the rising gold price stimulates the fast growing gold production worldwide, especially in some developing economies (Group, 2011), which, without doubt, leads to continuously increasing mercury emissions simultaneously. Mercury emissions from ASGM activities have more than doubled in just five years, increasing from 350 in 2005 (UNEP, 2008) to 770 tonnes estimated in the present study.

As world's largest gold producer in 2010, mainland China releases 167 tonnes mercury emissions, making it No.1 gold related mercury emitter. According to China Gold Statistics 2010, about two thirds of mainland China's gold mine production is from small scale enterprises and ASGM activities (Liu, 2011). Consequently, ASGM activity is the primary source for mainland China's gold related mercury emissions, contributing 85% of this economy's total emissions. The dominant role of ASGM related mercury emissions attributes to two main facts: (1) gold mines in mainland China are mainly medium or small sized ones and (2) gold resources are distributed in widely scattered regions. Objectively, these facts are inimical to large-scaled gold mining conglomerate with more sophisticated technologies. However, the reality creates beneficial conditions for medium and small sized gold production.

The top ten gold producers vary significantly from top ten atmospheric gold related mercury emitters. Australia, the USA, Russia and Canada are among the top producers of gold and they play a more important role in global gold production than Colombia and Indonesia, while the former and latter groups of economies' gold related mercury emissions show an opposite situation. Colombia alone even has more gold related mercury emissions than the sum of emissions from Australia, Canada and the USA. The key reason is that gold in those developing economies mainly come from ASGM activities, which are characterized as poor regulation and extremely high emission factors. According to Rafaj et al. (Rafaj et al., 2013), the emission factor of ASGM is about dozens of times as that of large scaled gold production.

3.1.4. Total nonferrous metal related mercury emissions

The detailed direct emissions from different sources are summarized in Table A3 in Appendix. Total nonferrous metal related mercury emissions sums up to 947 tonnes, which gold (ASGM), zinc, copper, lead and mercury production activities take a percentage of 79% (66%), 9%, 8%, 3% and 1%, respectively. Among all the economies, mainland China solely discharges about 240 tonnes, as it is the largest individual producers of all the nonferrous metals (Shown in Fig. 1). Colombia, Indonesia, Ghana, Philippines and Peru are also among the top emitters and each of them has remarkable emissions of over 30 tonnes resulted from nonferrous metal production activities. According to the calculated results, it is found that direct mercury emissions from nonferrous metal mining and smelting concentrate in a small number of economies. The top ten emitters are responsible for 60% of global nonferrous metals related mercury emissions. In general, most of the regions with remarkable emissions are characterized as developing economies, mainly due to 1) their abundant nonferrous metal resources reservation and active production and smelting activities, especially ASGM activities 2) high emission factors resulted from the low production technology level. Another conspicuous problem that brings serious nonferrous metal related mercury pollution in these developing economies is their poor environmental regulations, which are powerless to constrain frequent and widespread illegal nonferrous metal mining and smelting. Moreover, compared with developed economies, developing economies in Asia, Africa and Latin America have much lower air pollutant emission standard. Taking mainland China as an example, China's National Annual Mean Ambient Air Quality Standard is more than double the prevailed air pollutants emission level in the US even before Clean Air Act passed in the 1970s (Chen et al., 2013b). Notably, the direct emission intensities for 186 economies are also shown in Fig. 1. It is clear that eastern and southern Asia, South Africa

and Latin America, which is home to most of the emerging economies, have higher direct emission intensities than that of richer economies.

3.2. Sectoral embodied mercury emission intensities

All of the 186 economies' detailed embodied nonferrous metal related mercury emission intensities of each economic sector are summarized in Table A4. To draw a holistic picture of the global economy, the averaged embodied nonferrous metal related mercury emissions intensities for 26 basic economic sectors are presented in a histogram (Fig. 2). Evidently, Sector 3 (Mining and Quarrying), as the solitary producer of nonferrous metals, holds the top emission intensity of 483.50 g/million USD among all the sectors. Sector 8 (Metal Products) has the second highest embodied emission intensity with a value of 76.41 g/million USD, which is only equivalent to about 1/7 of Sector 3's intensity. Sector 13 (Electricity, Gas and Water) and 7 (Petroleum, Chemical and Non-metallic minerals)'s embodied intensities are very close to Sector 8's embodied intensity, ranking the third and fourth, respectively. From the perspective of three primary industries, secondary industry has the highest embodied nonferrous metal related mercury emission intensity while tertiary industry has the lowest one.

It should be noted that except for Sector 3 (Mining and Quarrying), indirect emission contributes 100% to the rest of 25 sectors' embodied emission intensities. This interesting phenomenon reflects that although those 25 economic sectors do not directly produce nonferrous metal related mercury emissions, they also directly or indirectly consume nonferrous metal inputs from Sector 3 via inter-industrial supply chain. That is to say, a large proportion of Sector 3's direct mercury emissions are attributed to other sectors' nonferrous metal demand.

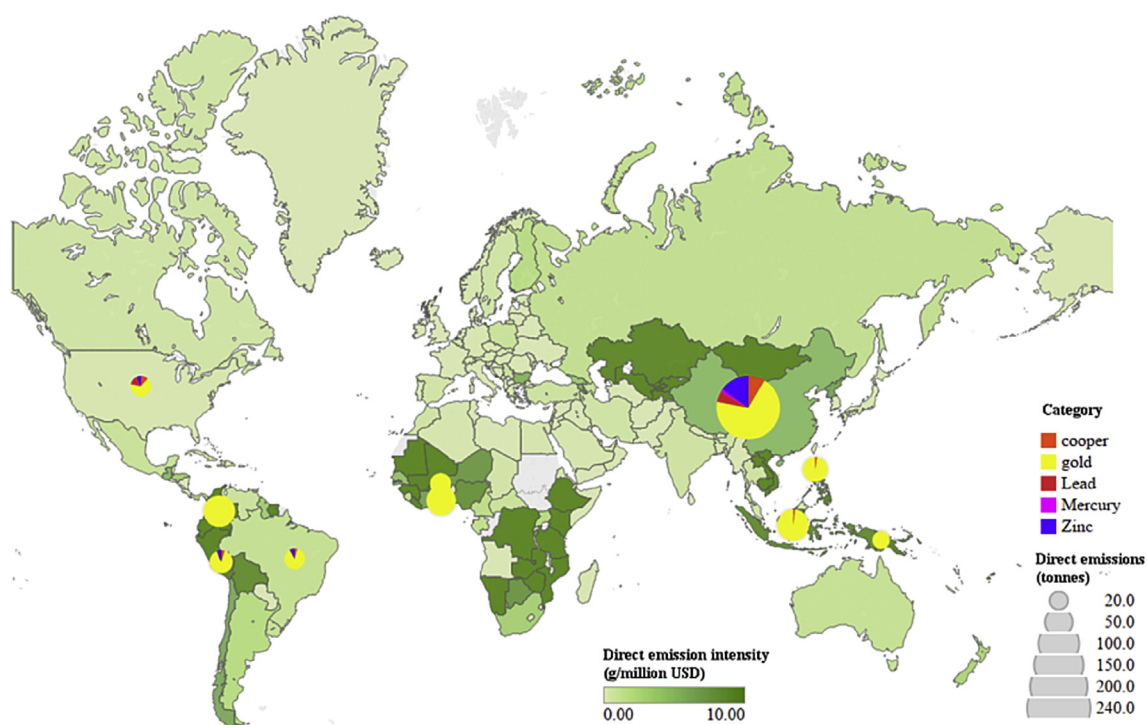


Fig. 1. The largest 10 direct emitters and 186 economies' direct emission intensities.

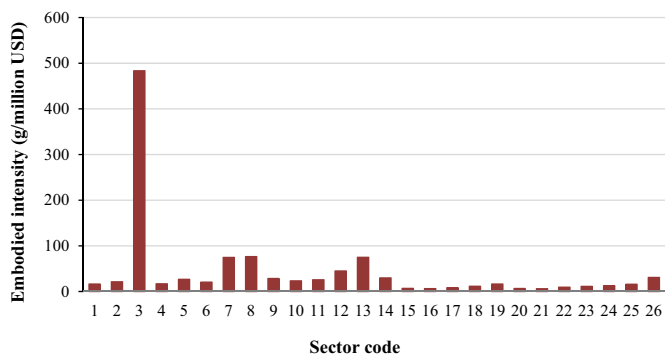


Fig. 2. Sectoral embodied nonferrous metal related mercury emission intensities.

3.3. Mercury emissions embodied in international trade

In 2010, the total amount of nonferrous metal related mercury emissions embodied in trade sums up to 647 tonnes, which is equivalent to 67% of world's direct emissions. In other words, two thirds of global nonferrous metal related mercury emissions are linked to exports to other economies. That is to say, the majority of world's nonferrous metals are produced to meet the demand outside the economy where they are extracted or smelted. The result implies that there exists huge discrepancy between the spatial distribution of nonferrous metal resources and nonferrous metal demand. For comparison, over two fifths of world's raw materials (Wiedmann et al., 2015), about one third of global water withdrawal (Chen and Chen, 2013), a quarter of world's CO₂ emissions are associated with international trade (Eurostat, 2011).

Fig. 3 depicts the largest international embodied mercury emission fluxes between different economies (≥ 4 tonnes). It can be observed that mainland China, the USA, Japan and EU are the global

trading centers of nonferrous metal related mercury emissions. Especially, mainland China and Japan, Philippine and Japan the Indonesia and South Korea show close bilateral trade relationships in the terms of embodied mercury emissions. Besides, several South African economies and Colombia, as the important nonferrous metal suppliers, also play important role in global nonferrous metal related mercury emissions trade.

Major exporting and importing economies are also identified in this work. In 2010 mainland China has the largest EEE in quantity, accounting for 10% of that embodied in trade. It is well-known the remarkable success of mainland China's economy is greatly attributed to exports. In 2010, the monetary value of mainland China's exports is equal to about a quarter of its GDP (CSY, 2011). As world's factory, mainland China manufactures and exports massive industrial products such as machinery and electronics, which require heavy nonferrous metals inputs, thus the nonferrous metal related mercury emission content of mainland China's exports is very high. The results also show the US, Colombia and Indonesia are the second to fourth largest exporters, with 30, 29 and 28 tonnes of exported embodied nonferrous metal related mercury emissions, respectively. For imports, the US hold the top position as it receives 132 tonnes embodied nonferrous metal related mercury emissions, 1.5 times as large as that of Japan. Notably, mainland China is also ranked with the top three receivers of embodied nonferrous metal related emissions. That is because on one hand, as the manufacturing center, mainland China has huge demand of nonferrous metal related products, on the other hand, mainland China's indigenous resources reservation is not able to satisfy its huge demand for different kinds of nonferrous metals.

After combining EEI and EEE, 186 individual economy's EEB can be obtained. Economies have positive EEB are defined as net importer and net exporters are vice versa. There are 127 net importers amongst the 186 economies and the rest are net exporters, shown in Table A5. 10 selected individual economies listed in Fig. 4 are the top five net importers and exporters. The USA, Japan and

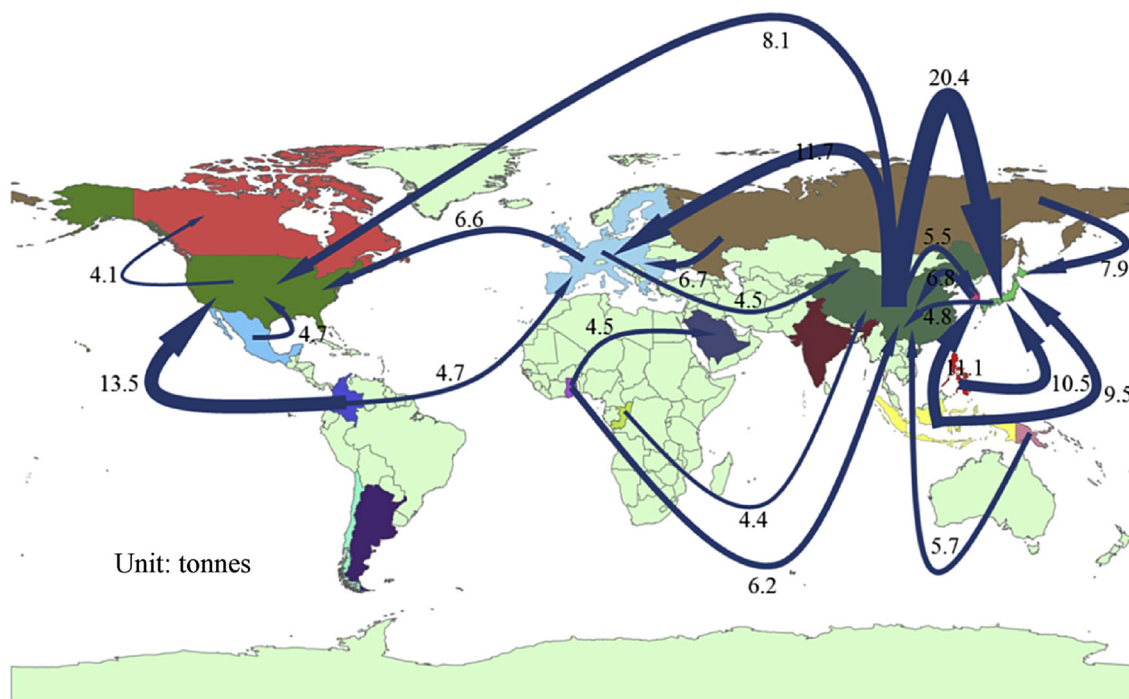


Fig. 3. Embodied mercury fluxes (≥ 4 tonnes) between trading centers.

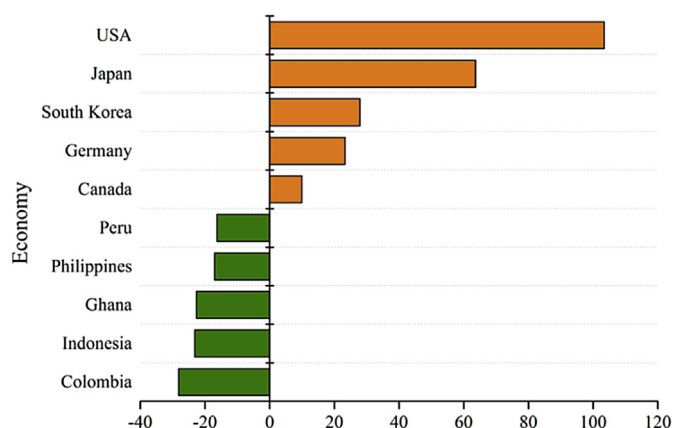


Fig. 4. The largest five net exporters and importers (Unit: tonnes).

Germany are net importers, their imported mercury emissions are about several times larger than exports in the opposite direction as their counterparts. On the contrary, Colombia, Indonesia and Philippine's imbalance of trade is obtained by exports exceeding their imports by a big margin. Surprisingly, mainland China's imbalance of traded nonferrous metal related mercury emissions is comparatively smaller, despite of its high ranking in both exports and imports. That is because the mainland China's large exports are majorly offset by its considerable imports. Apparently, the top net importers are developed economies while the top net exporters are all underdeveloped economies, reflecting the huge gap between the mercury emission intensities of wealthy and financially-challenged economies. Generally, economies like Indonesia and Philippine supply primary nonferrous metal resources that are high mercury-intensive but low valued for high-end industrial manufacturing in rich economies. In contrast, wealthy economies import nonferrous metals in the form of concentrates rather than ores to make high-tech machines, by using modern and low-emission technologies. Then rich economies export those machines that are low mercury-intensive but high valued to developing economies in turn. In this way, the producers gain low profits at a high cost of heavy mercury pollution while the consumers reap the fruits and avoid the massive mercury emissions.

3.4. Regional embodied mercury emissions for economies

Integrated the net effect of EEB with direct emissions, embodied nonferrous metal related mercury emissions by each economy can be calculated, as presented in Table A5 in Appendix. At economy level, mainland China's embodied nonferrous mercury emissions amount to 230 tonnes, which account for approximately one quarter of global total, making mainland China world's No.1 emitter by far, as presented in Fig. 5. Second to mainland China is the USA, which causes 129 tonnes nonferrous related mercury emissions via its economic activities in 2010. Japan has the third largest quantity of embodied mercury emissions among all the economies, with an amount of 71 tonnes. The top three emitters are also the three largest economies all over the world. Followed are Indonesia's 37 tonnes, Colombia's 32 tonnes, respectively, as these economies have comparatively large direct nonferrous metal related mercury emissions. Moldova, Belarus and Greenland are among the economies with the lowest embodied nonferrous metal related mercury emissions, due to their low direct emissions and embodied emissions in trade imbalance.

Fig. 5 also presents the embodied nonferrous metal related mercury emission intensities in different economies. Embodied nonferrous metal related mercury emission intensity of GDP is the greatest in Burkina Faso (2982 g/million USD, which is nearly 300 times as large as that of world's average), due to the high ratio of its embodied emissions to the small GDP. Belgium has the lowest embodied emission intensity, with a value of 0.85 g/million USD. The embodied mercury emissions intensities are disproportionately low in affluent economies such as Netherlands and Qatar. Mainland China's embodied emission intensity is nearly 50 g/million USD, ranking the 46th among the 186 economies while the USA and Japan rank after 120th. Generally, poor economies have much larger embodied mercury emission intensities than that of rich economies, due to rich economies' robust low emission intensive technologies and service dominated industrial structure.

For a per capita basis, the world's per capita embodied nonferrous metal related emission is around 0.15 g, which is the same as the per capita direct emissions. As the populations in each economy and embodied emissions are distributed extremely imbalanced, each economy's per capita embodied emissions vary significantly from each other. The highest per capita embodied emission appears in Guyana with an amount of 16 g per consumer, 5 orders of magnitude larger than the lowest one of Belarus. Even though mainland China has much larger embodied emissions than that of the USA and Japan, its per capita embodied emissions only account for about 1/3–1/2 of that of the USA and Japan, suggesting that consumption by individual American and Japanese lead to several times more nonferrous metal related mercury emissions than that induced by per Chinese's consumption.

4. Discussion

The major contribution of this current study is that it distinguishes the different global nonferrous metal related mercury emissions pictures portrayed by using two different calculation tools. From the sectoral perspective, nonferrous metal related mercury emissions only come from Sector 3 (Mining and Quarrying) based on the direct accounting approach, while each economic sector causes a certain amount of mercury emissions by directly or indirectly using nonferrous metals. For instance, zinc is indispensable element for automobile manufacture and machinery making industries, whilst the sector of manufacturing does not smelt zinc itself. In this context, a large quantity of direct mercury emissions by Sector Mining and Quarry are attributed to other sectors that consume zinc. The difference between sectoral direct and embodied mercury emissions can be interpreted as policy implications for emission reduction among basic economic sectors. In addition to controlling the direct emissions from Sector Mining and Quarry with large direct emissions, it is of equal importance to reduce one sector's indirect emissions that are allocated to other sectors via supply chain. A series of solutions to indirect emissions reduction among economic sectors can be put forward from various aspects. First of all, it is key to restrict excessive use of mercury-intensive products such as metal products in major consumer sectors like Sectors Construction and Manufacturing. Economic instruments, e.g., properly raising the tax rate of mercury-intensive products are also helpful for reducing sectoral nonferrous metal related mercury emissions. The concepts of circular utilization and minimizing waste that can reasonably limit the use of nonferrous metal products should be advocated in all the economic sectors.

The present study also well proves that direct mercury



Fig. 5. The largest 10 embodied emitters and 186 economies' embodied emission intensities.

emissions by local nonferrous metal production are greatly driven by demand across the world. Similar to the case of GHG emissions, much evidence shows that nonferrous metal related mercury emissions are transferred from one economy to another along with the tremendous economic international trade flows. More specifically, mercury emissions embodied in international trade mainly flow from developing economies to developed economies. The results reflect the mismatch in the distribution of nonferrous metal resources and distribution of nonferrous metal demand. A quintessential example can be cited, Japan is one of world's manufacturing centers for automobile, ships, household electrical appliances, etc., which require significant amount of nonferrous metals. However, Japan is extremely lack of indigenous natural resources and has to turn to imports from economies such as Philippines and Indonesia that are rich in nonferrous metal resources. Consequently, the direct emissions supposed to happen in Japan are displaced to its trade partners such as Philippines and Indonesia.

As existing inventories accounts for direct mercury emissions only, previous reduction policies and strategies were also formulated on the basis of direct emission information. Under the guidance of these policies, the reduction targets assigned to each economy is to lower its direct nonferrous metal related mercury emissions. In this context, each economy just needs to make efforts to reduce mercury emissions within its own territory separately. Given the significant role of trade in reallocating mercury emissions, the direct emissions based policies might result in mercury emissions spillover. To achieve the reduction goal, some economies just simply need to cut down their own nonferrous metal production and increase imports to fill the blank left by local production cut. If the imports have higher mercury emission intensity, then more mercury is released into air at the global scale even the total amount of nonferrous metal produced does not change. As a result, an absurd situation called "local reduction, overall rise" would occur. Under this circumstance, mercury emission spillover

will make global mercury emission reduction an impossible mission for the whole world to fulfill.

To abate nonferrous metal related mercury emissions at global scale, measures should be implemented from different perspectives. The first and crucial step for combatting global nonferrous metal related atmospheric mercury pollution is to limit direct emissions, especially in key regions such as mainland China, Southeast Asia, Latin America. With respect to the significant mercury emissions from ASGM activities, stringent law rules should be made to forbid illegal gold production. Local government can use administrative tools, such as closing down heavily polluting nonferrous metal production enterprises using obsolete technologies, enhancing mandatory command to install end-of-pipe removal facilities in mining and quarrying industry. Financial tools are also effective for reducing mercury emissions. For factories which upgrade their production or emission control equipment, the government can offer financial assistance or award them with subsidies so that the major emitters will be more motivated to reduce mercury emissions.

Nevertheless, overall reduction of nonferrous metal related mercury emissions cannot be achieved without integrating indirect mercury emissions. Actions can start from the reasonable emission responsibility assignment. As clearly stated by the results, affluent economies have benefited from international trade. The low pollution level and well-protected environment are not only founded on its more advanced technologies, but also to some extent are being maintained by pollution produced and environmental damage in developing and poor economies. By re-allocating nonferrous metals production activities to less developed economies, affluent economies avoid substantial mercury emissions within their own boundaries. In terms of global equality, economies which benefit from international trade should bear some responsibility in the case of GHG emissions and energy use (Li et al., 2014a, 2014b; Li and Chen, 2013; Shue, 1999). In this context, developed and rich economies should take some responsibility due

to its consumer role in the international trade. Additionally, the economies with large net inflow of embodied nonferrous metal related mercury emissions can properly limit the imports of mercury-intensive products, or turn to imports with comparatively lower emission intensity instead. Raising consumers' awareness in affluent economies that the products they buy are the drivers of global mercury emissions will also contribute overall mercury emission reduction.

5. Conclusion

The notorious atmospheric mercury pollution has become a global issue associated with social unrest. Nonferrous metal production has replaced fossil fuel combustion as the top emitter of global atmospheric mercury emissions. To address this issue, the current study comprehensively investigates atmospheric mercury emissions related to nonferrous metals by both direct accounting method and MRIO analysis.

This paper focuses exclusively on direct atmospheric mercury emissions from nonferrous metals, namely, gold, zinc, copper, lead and mercury production. In 2010, global emissions amount to 974 tonnes, a dominant share of which comes from gold production, especially ASGM activities. Mainland China, Colombia and Indonesia are the top three individual emitters. As the complete and detailed inventory on nonferrous metal related mercury emissions identifies the key contributors, it is essential for both policy-makers and researchers to figure out solutions to on-site atmospheric mercury pollution.

In light of MRIO analysis, this study presents sectoral embodied mercury emission intensities and embodied mercury profile of 186 economies. The study also shows a significant amount of embodied nonferrous metal related mercury emission flows via international trade, indicating that imbalance between spatial distribution of nonferrous metal resources and spatial distribution of demand. Furthermore, this paper highlights the major exporting economies such as mainland China, and major importing economies such as the USA. Trade balance shows that 127 economies receive embodied mercury emissions surplus while the rest have deficits. The USA has the largest net imports (132 tonnes), in contrast to mainland China's largest net exports (71 tonnes). By combining the direct and indirect effects, economies with the largest embodied emissions, highest embodied emission intensities and per capita emissions are also revealed.

As demonstrated by this study, emissions transfer from rich economies to poor economies whose technology lags behind results in huge emission spillover. Moreover, exports of mercury-intensive products will further exacerbate pollution in those less developed economies. Therefore, the rich economies with net inflows are suggested to bear consumer responsibility and the international community needs to join hands to form a reasonable and appropriate mitigation mechanism. The stakeholders should bear in mind that, the way to alleviate atmospheric mercury pollution caused by nonferrous metal production as the whole world's magnificent goal is to comprehensively reduce both direct and indirect emissions in each economy.

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Appendix

Table A1

Codes and names of 186 individual economies.

Code	Economy	Abbr.	Code	Economy	Abbr.
1	Afghanistan	AFG	39	Chile	CHL
2	Albania	ALB	40	China, Mainland	CHN
3	Algeria	DZA	41	China, Hong Kong	HKG
4	Andorra	AND	42	China, Macao	MAC
5	Angola	AGO	43	China, Taiwan	TWN
6	Antigua	ATG	44	Colombia	COL
7	Argentina	ARG	45	Congo	COG
8	Armenia	ARM	46	Costa Rica	CRI
9	Aruba	ABW	47	Croatia	HRV
10	Australia	AUS	48	Cuba	CUB
11	Austria	AUT	49	Cyprus	CYP
12	Azerbaijan	AZE	50	Czech Republic	CZE
13	Bahamas	BHS	51	Cote d'Ivoire	CIV
14	Bahrain	BHR	52	DR Congo	COD
15	Bangladesh	BGD	53	Denmark	DNK
16	Barbados	BRB	54	Djibouti	DJI
17	Belarus	BLR	55	Dominican Republic	DOM
18	Belgium	BEL	56	Ecuador	ECU
19	Belize	BLZ	57	Egypt	EGY
20	Benin	BEN	58	El Salvador	SLV
21	Bermuda	BMU	59	Eritrea	ERI
22	Bhutan	BTN	60	Estonia	EST
23	Bolivia	BOL	61	Ethiopia	ETH
24	Bosnia and Herzegovina	BIH	62	Fiji	FJI
25	Botswana	BWA	63	Finland	FIN
26	Brazil	BRA	64	France	FRA
27	British Virgin Islands	VGB	65	French Polynesia	PYF
28	Brunei	BRN	66	Gabon	GAB
29	Bulgaria	BGR	67	Gambia	GMB
30	Burkina Faso	BFA	68	Gaza Strip	PSE
31	Burundi	BDI	69	Georgia	GEO
32	Cambodia	KHM	70	Germany	DEU
33	Cameroon	CMR	71	Ghana	GHA
34	Canada	CAN	72	Greece	GRC
35	Cape Verde	CPV	73	Greenland	GRL
36	Cayman Islands	CYM	74	Guatemala	GTM
37	Central African Republic	CAF	75	Guinea	GIN
38	Chad	TCD	76	Guyana	GUY
77	Haiti	HTI	115	Mongolia	MNG
78	Honduras	HND	116	Montenegro	MNE
79	Hungary	HUN	117	Morocco	MAR
80	Iceland	ISL	118	Mozambique	MOZ
81	India	IND	119	Myanmar	MMR
82	Indonesia	IDN	120	Namibia	NAM
83	Iran	IRN	121	Nepal	NPL
84	Iraq	IRQ	122	Netherlands	NLD
85	Ireland	IRL	123	Netherlands Antilles	ANT
86	Israel	ISR	124	New Caledonia	NCL
87	Italy	ITA	125	New Zealand	NZL
88	Jamaica	JAM	126	Nicaragua	NIC
89	Japan	JPN	127	Niger	NER
90	Jordan	JOR	128	Nigeria	NGA
91	Kazakhstan	KAZ	129	North Korea	PRK
92	Kenya	KEN	130	Norway	NOR
93	Kuwait	KWT	131	Oman	OMN
94	Kyrgyzstan	KGZ	132	Pakistan	PAK
95	Laos	LAO	133	Panama	PAN
96	Latvia	LVA	134	Papua New Guinea	PNG
97	Lebanon	LBN	135	Paraguay	PRY
98	Lesotho	LSO	136	Peru	PER
99	Liberia	LBR	137	Philippines	PHL
100	Libya	LYB	138	Poland	POL
101	Liechtenstein	LIE	139	Portugal	PRT
102	Lithuania	LTU	140	Qatar	QAT
103	Luxembourg	LUX	141	Romania	ROU
104	Madagascar	MDG	142	Russia	RUS
105	Malawi	MWI	143	Rwanda	RWA
106	Malaysia	MYS	144	Samoa	WSM

(continued on next page)

Table A1 (continued)

Code	Economy	Abbr.	Code	Economy	Abbr.
107	Maldives	MDV	145	San Marino	SMR
108	Mali	MLI	146	Sao Tome and Principe	STP
109	Malta	MLT	147	Saudi Arabia	SAU
110	Mauritania	MRT	148	Senegal	SEN
111	Mauritius	MUS	149	Serbia	SRB
112	Mexico	MEX	150	Seychelles	SYC
113	Moldova	MDA	151	Sierra Leone	SLE
114	Monaco	MCO	152	Singapore	SGP
Code	Economy	Abbr.			
153	Slovakia	SVK			
154	Slovenia	SVN			
155	Somalia	SOM			
156	South Africa	ZAF			
157	South Korea	KOR			
158	Spain	ESP			
159	Sri Lanka	LKA			
160	Suriname	SUR			
161	Swaziland	SWZ			
162	Sweden	SWE			
163	Switzerland	CHE			
164	Syria	SYR			
165	Tajikistan	TJK			
166	Tanzania	TZA			
167	Thailand	THA			
168	TFYR Macedonia	MKD			
169	Togo	TGO			
170	Trinidad and Tobago	TTO			
171	Tunisia	TUN			
172	Turkey	TUR			
173	Turkmenistan	TKM			
174	Uganda	UGA			
175	Ukraine	UKR			
176	UAE	ARE			
177	United Kingdom	GBR			
178	United States	USA			
179	Uruguay	URY			
180	Uzbekistan	UZB			
181	Vanuatu	VUT			
182	Venezuela	VEN			
183	Viet Nam	VNM			
184	Yemen	YEM			
185	Zambia	ZMB			
186	Zimbabwe	ZWE			

Table A2

Basic economic sectors for each economy.

Sector code	Sector content	Sector code	Sector content
1	Agriculture	14	Construction
2	Fishing	15	Maintenance and repair
3	Mining and quarrying	16	Wholesale trade
4	Food and beverages	17	Retail trade
5	Textiles and wearing apparel	18	Hotels and restaurants
6	Wood and paper	19	Transport
7	Petroleum, chemical and non-metallic mineral products	20	Post and telecommunications
8	Metal products	21	Financial intermediation and business activities
9	Electrical and machinery	22	Public administration
10	Transport equipment	23	Education, health and other services
11	Other manufacturing	24	Private households
12	Recycling	25	Others
13	Electricity, gas and water	26	Re-export and re-import

Table A3

Direct emissions for world economy from different nonferrous metal production (Unit: tonnes).

Economy code	Cooper	Lead	Zinc	Mercury	Gold		
					ASGM	Large scale	ASGM + Large scale
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
3	—	0.015	0.210	—	0.204	0.000	0.204
4	—	—	—	—	—	—	—
5	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—
7	—	0.246	0.301	—	4.500	1.425	5.925
8	0.038	—	—	—	0.414	0.138	0.552
9	—	—	0.000	—	—	—	—
10	2.050	0.612	3.535	—	5.576	1.394	6.970
11	0.461	0.072	—	—	—	—	—
12	—	—	—	—	0.393	0.131	0.524
13	—	—	—	—	—	—	—
14	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—
16	—	—	—	—	—	—	—
17	—	—	—	—	—	—	—
18	0.593	0.363	1.820	—	—	—	—
19	—	—	—	—	—	—	—
20	—	—	—	—	0.006	0.000	0.006
21	—	—	—	—	—	—	—
22	—	—	—	—	—	—	—
23	—	—	—	—	1.322	0.441	1.763
24	—	—	—	—	—	—	—
25	0.120	—	—	—	0.860	0.000	0.860
26	1.121	0.336	1.750	—	16.875	5.625	22.500
27	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—
29	1.423	0.243	0.616	—	0.724	0.241	0.965
30	—	—	—	—	26.894	0.000	26.894
31	—	—	—	—	0.207	0.000	0.207
32	—	—	—	—	2.813	0.938	3.750
33	—	—	—	—	0.441	0.000	0.441
34	1.749	0.819	4.839	—	1.680	0.420	2.100
35	—	—	—	—	—	—	—
36	—	—	—	—	—	—	—
37	—	—	—	—	0.017	0.000	0.017
38	—	—	—	—	0.028	0.000	0.028
39	7.799	—	—	0.420	2.419	0.806	3.225
40	20.500	12.600	36.120	3.840	150.201	16.689	166.890
41	—	—	—	—	45.000	15.000	60.000
42	—	—	—	—	11.993	0.000	11.993
43	—	—	—	—	0.041	0.014	0.055
44	—	—	—	—	—	—	—
45	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—
47	—	0.090	—	—	—	—	—
48	—	—	—	—	1.599	0.000	1.599
49	0.075	0.027	0.525	—	—	—	—
50	—	—	—	—	—	—	—
51	—	—	—	—	0.265	0.066	0.331
52	—	—	—	—	—	—	—
53	—	—	—	—	0.103	0.034	0.138
54	—	—	—	—	13.164	4.388	17.552
55	—	—	—	—	0.713	0.000	0.713
56	—	—	—	—	—	—	—
57	—	—	—	—	0.008	0.000	0.008
58	—	0.030	—	—	—	—	—
59	—	—	—	—	3.309	0.000	3.309
60	—	—	—	—	0.384	0.128	0.512
61	0.755	—	2.150	0.040	1.544	0.386	1.930
62	—	0.264	1.141	—	0.331	0.083	0.414
63	—	—	—	—	—	—	—
64	—	—	—	—	0.220	0.000	0.220
65	—	—	—	—	0.220	0.000	0.220

Table A3 (continued)

Economy code	Cooper	Lead	Zinc	Mercury	Gold		
					ASGM	Large scale	ASGM + Large scale
66	—	—	—	—	0.414	0.138	0.552
67	2.956	1.215	1.155	—	—	—	—
68	—	—	—	—	52.612	0.000	52.612
69	—	0.012	—	—	0.110	0.028	0.138
70	—	—	—	—	—	—	—
71	—	—	—	—	1.861	0.620	2.482
72	—	—	—	—	4.196	0.000	4.196
73	—	—	—	—	9.484	3.161	12.645
74	—	—	—	—	—	—	—
75	—	—	—	—	0.455	0.152	0.607
76	—	—	—	—	—	—	—
77	—	—	—	—	—	—	—
78	—	—	—	—	—	—	—
79	3.280	0.939	4.790	—	0.840	0.280	1.120
80	1.384	0.054	—	—	43.748	14.583	58.330
81	1.400	0.225	0.455	—	0.083	0.028	0.110
82	—	—	—	—	—	—	—
83	—	0.060	—	—	—	—	—
84	—	0.075	—	—	—	—	—
85	—	0.447	0.700	—	0.099	0.025	0.124
86	—	—	—	—	—	—	—
87	—	0.774	4.018	—	1.655	0.414	2.068
88	—	—	—	—	—	—	—
89	1.855	0.309	2.232	0.600	6.192	2.064	8.256
90	—	0.002	—	—	5.630	0.000	5.630
91	—	—	—	—	—	—	—
92	—	—	—	—	3.785	1.262	5.046
93	—	—	—	—	1.047	0.349	1.396
94	—	—	—	—	—	—	—
95	—	—	—	—	—	—	—
96	—	—	—	—	—	—	—
97	—	—	—	—	0.221	0.000	0.221
98	—	—	—	—	—	—	—
99	—	—	—	—	—	—	—
100	—	—	—	—	—	—	—
101	—	—	—	—	—	—	—
102	—	—	—	—	—	—	—
103	—	—	—	—	0.019	0.000	0.019
104	—	—	—	—	—	—	—
105	—	0.213	—	—	0.600	0.200	0.800
106	—	—	—	—	—	—	—
107	—	—	—	—	15.203	0.000	15.203
108	—	—	—	—	—	—	—
109	—	—	—	—	2.758	0.000	2.758
110	—	—	—	—	—	—	—
111	0.790	0.630	2.100	0.050	5.063	1.688	6.750
112	—	—	—	—	—	—	—
113	—	—	—	—	4.249	1.416	5.665
114	—	—	—	—	—	—	—
115	—	0.143	—	0.020	0.331	0.000	0.331
116	—	—	—	—	2.358	0.786	3.143
117	—	—	—	—	—	—	0.100
118	0.100	—	1.062	—	0.738	0.000	0.738
119	—	—	—	—	—	—	—
120	—	0.051	1.848	—	—	—	—
121	—	—	—	—	—	—	—
122	—	—	—	—	—	—	—
123	—	0.027	—	—	2.868	0.717	3.585
124	—	—	—	—	—	—	—
125	—	—	—	—	0.469	0.000	0.469
126	—	0.015	—	—	14.165	0.000	14.165
127	—	—	1.042	—	—	—	—
128	—	—	—	—	—	—	—
129	0.070	—	—	—	—	—	—
130	0.085	0.009	—	—	—	—	—
131	—	—	—	—	0.269	0.090	0.358
132	—	—	—	—	14.022	4.674	18.696
133	—	—	—	—	—	—	—
134	1.565	—	1.834	0.240	21.188	7.063	28.250
135	1.081	0.120	—	—	27.188	9.063	36.250

Table A3 (continued)

Economy code	Cooper	Lead	Zinc	Mercury	Gold		
					ASGM	Large scale	ASGM + Large scale
136	2.733	0.336	1.043	—	0.088	0.029	0.117
137	—	0.009	—	—	—	—	—
138	—	—	—	—	—	—	—
139	—	—	—	—	—	—	—
140	—	—	—	—	—	—	—
141	—	0.033	—	—	0.083	0.028	0.110
142	4.150	0.267	1.820	0.120	7.875	2.625	10.500
143	—	—	—	—	0.006	0.000	0.006
144	—	—	—	—	—	—	—
145	—	—	—	—	—	—	—
146	—	—	—	—	—	—	—
147	—	0.114	—	—	0.931	0.310	1.241
148	—	—	—	—	1.346	0.000	1.346
149	0.180	0.003	0.000	—	0.149	0.050	0.199
150	—	—	—	—	—	—	—
151	—	—	—	—	0.031	0.010	0.041
152	—	—	—	—	—	—	—
153	0.233	—	—	—	0.075	0.019	0.094
154	—	0.042	—	—	—	—	—
155	—	—	—	—	—	—	—
156	0.380	0.174	0.630	—	9.026	3.009	12.034
157	1.275	0.375	3.507	—	0.772	0.193	0.965
158	—	—	—	—	—	—	—
159	—	—	—	—	2.541	0.847	3.388
160	—	—	—	—	—	—	—
161	0.895	0.183	—	—	1.103	0.276	1.379
162	—	0.024	—	—	—	—	—
163	—	—	—	—	—	—	—
164	—	0.105	—	—	—	—	—
165	—	—	—	0.070	2.250	0.750	3.000
166	—	0.210	0.700	—	1.034	0.345	1.379
167	—	—	—	—	—	—	—
168	—	—	—	—	—	—	—
169	—	—	—	—	—	—	—
170	—	—	—	—	—	—	—
171	0.150	0.018	—	—	3.516	1.172	4.688
172	—	—	—	—	—	—	—
173	—	—	—	—	0.441	0.000	0.441
174	—	0.021	—	—	—	—	—
175	—	0.006	—	—	—	—	—
176	—	0.882	—	—	0.038	0.009	0.047
177	—	—	—	—	11.582	0.000	11.582
178	3.005	3.750	1.743	—	13.359	3.340	16.698
179	—	—	—	—	0.414	0.138	0.552
180	0.460	—	0.280	—	3.613	1.204	4.818
181	—	—	—	—	—	—	—
182	—	0.090	—	—	3.232	1.077	4.309
183	0.040	—	—	—	2.813	0.938	3.750
184	—	—	—	—	—	—	—
185	2.450	0.003	—	—	0.938	0.000	0.938
186	—	—	—	—	4.482	0.000	4.482
Others	10.080	0.790	4.930	—	37.800	12.600	50.400
Total	77.277	28.471	88.895	5.400	647.914	126.112	774.026

"—" means zero emissions or no data.

Table A4

Sectoral embodied emission intensity for 186 economies (Unit: g/million USD).

Sector	Economy							
	1	2	3	4	5	6	7	8
Sector 1	15.69	13.16	3.91	31.24	17.51	31.94	12.45	14.61
Sector 2	118.73	80.87	17.52	186.36	53.44	265.25	11.10	52.14
Sector 3	56.97	14.03	316.71	46.14	75.64	39.07	537.59	2421.10
Sector 4	25.40	17.43	5.15	35.42	23.59	46.08	14.26	17.07
Sector 5	50.63	30.48	11.20	67.60	34.74	78.95	13.96	30.50
Sector 6	27.82	22.02	6.32	34.86	23.01	40.82	13.93	18.14
Sector 7	28.55	26.47	50.70	56.77	130.88	46.74	72.14	77.96
Sector 8	43.68	31.20	12.19	41.54	48.01	46.20	34.83	74.32
Sector 9	25.86	17.19	6.97	25.40	22.08	29.63	16.75	18.45
Sector 10	43.00	23.24	9.05	36.21	26.67	38.01	16.46	21.65
Sector 11	48.62	32.93	10.17	49.72	33.53	64.25	17.34	26.34
Sector 12	111.87	92.64	26.37	106.94	78.09	166.93	17.21	504.80
Sector 13	45.29	16.83	9.90	45.49	50.91	29.80	70.53	131.55
Sector 14	20.84	11.64	5.06	11.80	22.91	17.89	30.36	32.41
Sector 15	91.24	42.92	5.93	47.47	19.95	57.45	6.61	44.38
Sector 16	17.81	6.29	1.60	7.63	7.08	15.39	10.53	8.29
Sector 17	19.86	6.40	1.42	8.54	4.81	24.19	5.04	12.24
Sector 18	25.68	8.70	3.17	14.37	12.94	22.58	11.2171	30.65
Sector 19	18.33	6.17	4.49	18.31	20.00	17.89	10.61	46.87
Sector 20	13.03	7.32	1.91	15.84	5.38	16.72	6.13	10.94
Sector 21	11.98	2.74	0.69	5.23	4.19	10.70	6.85	7.25
Sector 22	23.35	7.43	3.14	12.11	13.06	21.05	5.29	14.41
Sector 23	18.97	6.52	1.96	10.21	9.97	20.99	7.25	10.94
Sector 24	114.99	52.51	8.43	56.09	22.48	62.40	1.84	59.05
Sector 25	74.95	40.56	4.12	66.75	14.63	113.54	1.84	79.38
Sector 26	217.61	107.13	236.90	67.62	111.93	71.58	26.05	126.68
	9	10	11	12	13	14	15	16
Sector 1	408.88	7.04	3.93	8.24	9.70	35.02	5.95	12.57
Sector 2	1608.40	6.77	10.55	31.62	79.23	248.67	17.74	111.81
Sector 3	55.12	171.26	131.75	464.63	23.02	28.52	11.06	14.79
Sector 4	67.74	10.09	4.58	7.37	14.70	23.68	5.52	20.18
Sector 5	165.12	8.63	4.56	16.38	25.41	48.58	11.52	38.52
Sector 6	42.53	9.12	4.96	9.11	13.37	24.29	6.03	19.67
Sector 7	224.45	36.07	7.07	47.72	40.73	39.11	22.80	32.87
Sector 8	234.41	41.48	5.20	18.95	19.35	39.09	11.58	23.26
Sector 9	81.00	16.00	4.90	8.13	9.03	18.28	6.79	19.87
Sector 10	128.90	13.80	5.69	10.61	13.15	27.47	9.34	22.88
Sector 11	70.05	15.20	4.55	13.05	21.88	39.97	9.85	30.85
Sector 12	158.35	12.86	4.62	128.98	57.83	131.80	21.20	73.29
Sector 13	25.49	38.36	5.34	18.34	18.02	16.20	9.56	16.21
Sector 14	23.20	12.12	5.68	7.00	7.83	17.01	5.34	13.50
Sector 15	95.24	7.06	3.52	17.29	32.90	91.30	7.15	41.86
Sector 16	13.66	8.12	3.62	2.85	4.04	11.41	1.85	7.20
Sector 17	13.25	6.19	3.46	3.01	4.50	10.58	2.01	9.30
Sector 18	16.50	6.66	3.61	4.91	6.91	18.75	3.21	9.73
Sector 19	38.52	7.68	3.74	10.56	7.25	17.92	4.78	9.09
Sector 20	21.71	6.70	3.80	2.39	4.70	13.49	2.08	8.93
Sector 21	8.32	5.73	3.49	1.69	1.81	4.77	0.89	3.97
Sector 22	12.10	6.06	3.52	4.25	4.93	13.69	3.16	10.57
Sector 23	10.87	5.48	3.21	3.32	4.58	9.62	2.50	8.17
Sector 24	110.37	4.79	2.10	18.26	40.92	104.48	9.70	49.36
Sector 25	842.84	5.86	3.19	6.20	28.11	67.03	6.50	44.91
Sector 26	43.77	22.66	7.23	38.03	90.45	383.07	112.78	77.73
	17	18	19	20	21	22	23	24
Sector 1	14.9067	5.2445	15.5128	7.1458	68.1488	5.8067	8.1798	2.7382
Sector 2	20.7945	4.9835	102.8067	69.5658	273.5845	53.2773	9.0999	26.4496
Sector 3	20.6431	488.6045	67.894	87.6486	110.2728	52.4314	402.4455	6.2205
Sector 4	23.7187	6.3545	45.1964	15.4545	73.6708	31.2866	13.7278	6.4694
Sector 5	58.3177	6.7918	89.1236	56.1046	107.2556	131.7297	15.7437	15.2205
Sector 6	29.6574	6.3809	48.0099	19.1291	72.6734	57.0041	16.7277	9.2139
Sector 7	34.4157	12.5242	224.7491	57.3813	95.0878	88.1254	13.6216	18.9095
Sector 8	29.0289	10.6084	57.3954	23.2563	96.1543	204.2825	20.6351	14.4993
Sector 9	20.4331	6.9052	34.6865	14.6609	43.766	49.4308	19.0458	7.9291
Sector 10	33.5653	6.4467	46.1418	19.9491	58.6717	81.138	19.0461	10.3005
Sector 11	31.9353	23.616	67.9217	27.6588	99.701	116.1201	27.6285	12.9004
Sector 12	32.9361	5.5933	154.1652	74.1159	190.3909	213.0134	27.6283	28.0057
Sector 13	17.6488	5.7495	94.4114	35.4188	80.5041	16.932	11.3387	6.6817
Sector 14	14.4841	8.2753	47.7584	13.3061	36.1705	23.7534	34.2882	5.6419
Sector 15	23.4595	4.6473	65.0573	30.8715	122.5901	117.695	9.5906	21.0129
Sector 16	11.8936	5.7637	19.2209	5.5722	25.7541	40.2771	9.5905	2.6912
Sector 17	8.5041	4.3909	19.8831	5.201	26.7801	40.5022	9.5905	2.6846

Sector 18	17.6756	5.2862	29.2803	8.4794	41.3838	50.4398	10.5198	4.2021
Sector 19	16.633	5.2769	29.6532	11.3608	38.8053	38.1902	13.8216	3.882
Sector 20	19.4053	3.8505	24.6898	6.4886	32.0996	35.5343	10.2296	3.2802
Sector 21	8.766	3.7795	13.2719	4.0545	13.8224	21.5484	8.12	1.5485
Sector 22	10.4787	3.3873	29.7756	11.5264	26.7743	35.9693	9.1369	3.9155
Sector 23	8.5522	3.4928	30.1256	9.0107	20.0451	35.1863	10.4449	3.0701
Sector 24	24.3707	1.8627	71.4255	39.7752	147.9182	114.8939	3.0844	28.3204
Sector 25	8.0749	4.8069	107.4127	36.6015	79.1159	102.8024	12.3208	17.4464
Sector 26	12.9183	13.2615	80.8894	78.4482	175.8794	87.0734	6.3558	89.7827
	25	26	27	28	29	30	31	32
Sector 1	31.84	17.21	85.70	15.50	95.18	4066.10	4.73	174.14
Sector 2	70.77	16.85	477.17	96.76	59.93	1991.60	49.14	131.47
Sector 3	2789.80	342.41	104.59	8.69	5725.50	468,280.00	5398.40	20,517.00
Sector 4	87.84	16.49	101.52	13.61	67.22	4069.20	23.89	207.87
Sector 5	65.14	13.12	157.96	19.98	147.08	6744.20	100.39	486.13
Sector 6	61.38	13.77	91.50	11.81	68.16	3648.30	47.95	256.85
Sector 7	298.60	75.13	97.11	17.88	330.48	30,126.00	496.42	1208.40
Sector 8	155.88	48.48	104.79	15.03	245.00	14,010.00	192.63	433.38
Sector 9	64.17	20.78	58.95	8.84	50.15	2605.20	87.26	128.72
Sector 10	74.29	21.29	79.92	13.12	45.34	3347.60	101.99	122.58
Sector 11	150.09	17.41	116.94	19.43	58.63	3750.90	105.08	173.73
Sector 12	684.39	16.04	299.01	57.80	1008.50	59,646.00	232.51	4172.90
Sector 13	344.64	13.08	103.69	7.62	460.84	39,657.00	740.30	4501.10
Sector 14	131.24	26.09	37.16	8.30	61.29	8293.30	152.30	334.46
Sector 15	33.31	6.41	119.11	57.82	30.59	2881.70	128.40	116.76
Sector 16	17.29	6.41	26.74	7.73	18.93	1020.40	67.09	84.18
Sector 17	21.61	6.41	19.14	10.80	18.00	1528.30	36.99	129.29
Sector 18	38.54	10.11	45.56	11.91	35.04	3617.30	54.16	214.77
Sector 19	73.58	13.07	44.55	10.76	74.41	12,348.00	129.13	344.82
Sector 20	23.47	6.97	34.08	8.28	18.13	972.98	61.23	102.52
Sector 21	13.47	5.13	16.14	2.56	14.21	304.43	29.06	105.37
Sector 22	80.60	7.01	34.23	6.16	38.37	3853.10	112.92	132.53
Sector 23	37.13	8.41	30.03	4.63	34.29	1743.60	77.65	239.45
Sector 24	46.21	7.31	121.34	53.78	74.42	617.17	125.56	134.86
Sector 25	38.88	7.30	72.17	28.84	32.69	1762.20	75.21	139.55
Sector 26	86.92	38.69	56.72	156.05	118.38	313.42	75.18	89.69
	33	34	35	36	37	38	39	40
Sector 1	10.05	15.70	7.54	42.29	3.00	3.28	32.12	29.95
Sector 2	29.42	15.59	35.14	144.10	52.88	45.07	25.90	29.44
Sector 3	1454.20	133.76	31.10	40.28	337.16	186.40	899.31	516.34
Sector 4	15.09	15.45	19.50	57.99	15.29	13.56	29.13	34.67
Sector 5	24.35	12.96	44.64	103.79	59.67	44.17	31.27	48.27
Sector 6	35.84	17.49	27.25	64.14	25.15	19.13	26.73	52.40
Sector 7	84.76	84.45	28.06	142.54	65.86	44.50	119.70	128.16
Sector 8	32.83	51.55	36.39	81.72	48.39	36.57	319.96	124.56
Sector 9	14.30	17.85	25.03	36.80	31.83	19.18	112.41	69.62
Sector 10	18.45	13.81	31.93	67.86	41.78	26.54	51.96	61.28
Sector 11	24.71	15.47	40.97	93.53	52.41	37.24	71.02	55.21
Sector 12	136.87	18.43	57.74	155.41	97.38	111.07	84.74	8.02
Sector 13	62.90	17.79	22.45	26.11	61.65	36.44	40.19	140.44
Sector 14	23.95	23.61	18.04	15.78	30.53	25.27	73.01	83.15
Sector 15	20.96	5.57	49.26	44.12	66.30	39.02	28.42	27.16
Sector 16	5.53	5.57	12.01	9.33	19.38	8.16	28.42	27.16
Sector 17	6.09	5.57	17.39	9.12	20.69	9.22	28.42	27.16
Sector 18	9.45	6.41	17.89	15.65	22.01	12.63	23.46	32.93
Sector 19	13.48	9.31	12.46	16.85	26.45	20.45	34.12	41.10
Sector 20	6.94	4.85	9.62	10.22	24.78	17.94	13.92	22.56
Sector 21	5.04	5.19	11.93	4.01	19.47	9.61	19.46	24.32
Sector 22	12.30	6.15	19.48	9.09	29.74	17.02	11.71	24.58
Sector 23	10.96	6.48	17.60	7.64	28.50	14.93	12.83	45.67
Sector 24	29.07	0.46	56.57	38.71	73.05	47.30	14.88	35.71
Sector 25	21.00	0.46	207.18	34.66	73.84	61.11	3.48	24.58
Sector 26	79.55	80.93	122.01	39.28	84.39	62.73	75.87	150.18
	41	42	43	44	45	46	47	48
Sector 1	69.69	19.89	42.47	12.28	5.14	10.80	4.69	232.51
Sector 2	98.95	76.17	95.03	18.40	8.05	44.84	4.50	110.61
Sector 3	3297.70	9482.40	162.03	27.84	6.83	15.51	20.87	4203.80
Sector 4	91.10	50.30	25.42	13.56	5.45	9.58	5.84	145.48
Sector 5	126.89	72.47	37.20	19.98	8.64	18.02	5.44	112.00
Sector 6	150.77	63.90	21.12	12.67	5.54	12.44	5.34	271.01
Sector 7	809.01	405.40	132.61	60.39	25.93	29.17	6.63	470.17
Sector 8	588.89	138.61	32.00	18.06	11.10	16.86	6.95	176.06
Sector 9	148.07	56.82	27.07	11.70	7.20	10.43	5.60	59.13
Sector 10	158.17	58.59	23.88	13.36	9.06	13.99	6.19	62.29
Sector 11	260.52	74.67	28.66	13.84	8.37	16.77	5.65	87.19

Sector 12	57.56	290.59	118.07	31.34	17.06	29.31	7.19	1230.30
Sector 13	534.77	62.29	55.29	20.86	7.09	12.55	6.97	468.41
Sector 14	288.34	91.85	21.23	9.30	5.52	8.23	6.25	130.01
Sector 15	29.93	65.25	17.14	8.89	3.75	18.33	4.22	74.29
Sector 16	29.93	26.61	5.78	3.80	1.68	3.70	3.99	28.75
Sector 17	29.93	29.67	6.73	3.38	1.73	3.89	3.40	31.42
Sector 18	69.81	38.49	12.76	6.69	2.73	6.07	4.69	64.51
Sector 19	141.67	70.90	17.80	6.85	5.53	6.79	4.47	128.08
Sector 20	66.23	28.47	7.19	3.87	2.23	4.29	3.67	32.28
Sector 21	43.10	29.67	4.18	2.98	1.01	1.94	4.37	18.92
Sector 22	43.41	47.75	11.37	5.14	3.39	4.90	3.58	62.59
Sector 23	71.18	52.35	11.35	5.31	3.32	3.98	3.99	43.40
Sector 24	159.79	78.03	23.52	11.33	5.22	21.04	3.89	96.04
Sector 25	59.75	64.40	14.94	7.19	3.80	15.55	3.63	58.16
Sector 26	46.82	104.52	88.44	79.95	25.48	53.24	4.28	124.11
	49	50	51	52	53	54	55	56
Sector 1	8.27	22.75	9.33	34.09	8.78	120.12	6.96	29.69
Sector 2	16.25	39.44	12.48	226.91	23.52	249.99	27.22	55.14
Sector 3	1333.50	448.22	45.67	52.00	196.29	1612.60	153.84	67.15
Sector 4	16.35	68.93	12.52	58.49	13.41	147.90	7.43	26.47
Sector 5	34.98	95.81	17.97	98.28	24.36	124.08	17.13	39.98
Sector 6	20.93	84.53	12.19	57.39	12.60	193.66	10.23	27.08
Sector 7	107.43	580.50	36.38	70.09	54.45	1313.80	30.96	148.13
Sector 8	52.47	199.90	18.64	72.96	34.97	246.62	19.54	58.53
Sector 9	25.60	95.46	17.72	51.37	17.81	121.03	9.78	23.53
Sector 10	28.74	90.86	20.23	66.91	16.46	246.42	12.84	28.73
Sector 11	29.44	108.41	12.87	86.72	22.55	191.92	14.35	35.60
Sector 12	91.44	166.02	15.02	152.15	99.03	191.93	62.14	73.60
Sector 13	54.52	199.01	21.76	40.20	38.59	426.45	24.47	71.83
Sector 14	26.04	104.56	9.48	27.91	13.55	254.41	8.94	24.35
Sector 15	33.71	42.61	4.39	51.23	21.56	181.54	15.69	21.42
Sector 16	23.77	30.74	6.06	21.97	4.55	181.54	3.40	9.35
Sector 17	24.93	32.90	4.03	24.70	4.86	181.54	15.30	8.63
Sector 18	24.28	48.90	6.25	32.22	9.74	106.55	6.16	15.09
Sector 19	49.29	127.27	8.40	16.23	11.49	356.85	5.51	23.35
Sector 20	22.49	53.50	5.02	13.84	4.48	38.75	3.88	8.38
Sector 21	7.96	45.81	3.70	18.53	2.81	123.96	1.82	3.69
Sector 22	15.42	62.52	1.95	33.10	10.74	73.34	9.04	13.22
Sector 23	14.11	85.50	4.05	30.76	6.93	47.48	4.50	10.28
Sector 24	30.99	54.61	1.56	54.30	22.52	7.51	25.25	24.57
Sector 25	22.95	56.39	4.70	120.91	10.78	36.98	26.88	21.72
Sector 26	48.61	69.58	48.94	57.76	124.00	9.32	359.64	47.95
	57	58	59	60	61	62	63	64
Sector 1	4.31	6.72	232.95	41.61	6.14	5.05	9.07	6.97
Sector 2	64.42	6.46	51.08	683.73	3.92	3.38	100.01	52.03
Sector 3	229.69	78.21	8742.70	6835.50	2942.70	90.10	15.76	360.39
Sector 4	17.58	8.54	161.74	167.45	9.54	5.64	12.97	12.23
Sector 5	60.05	7.52	240.85	198.29	6.42	5.20	25.15	22.48
Sector 6	25.98	7.74	154.32	154.99	19.54	5.14	14.86	17.36
Sector 7	67.56	15.92	846.77	582.84	36.79	8.55	18.09	23.97
Sector 8	50.78	10.25	322.11	233.36	53.35	9.64	17.34	15.98
Sector 9	29.61	8.22	115.91	66.35	9.93	5.56	12.37	10.02
Sector 10	40.15	7.93	123.51	72.90	10.73	6.49	17.52	13.97
Sector 11	53.77	7.60	126.92	110.62	10.71	5.19	19.39	19.10
Sector 12	123.43	9.30	1175.40	1369.20	15.45	2.01	50.34	60.66
Sector 13	72.81	16.38	1078.70	1271.70	83.95	8.46	12.83	8.01
Sector 14	13.97	8.66	197.20	201.73	35.14	5.65	8.99	8.93
Sector 15	56.25	5.28	39.06	70.08	6.46	3.59	37.56	24.80
Sector 16	11.47	5.71	36.29	36.82	10.29	3.78	5.72	3.31
Sector 17	13.20	4.93	49.14	64.07	6.76	3.35	5.97	3.55
Sector 18	17.06	6.28	89.77	72.00	7.57	4.07	8.69	5.47
Sector 19	14.41	6.34	159.04	79.62	6.25	3.98	7.37	5.90
Sector 20	12.42	4.21	39.32	28.42	5.97	3.55	6.80	4.76
Sector 21	12.05	4.55	39.63	31.79	8.07	3.12	2.93	2.92
Sector 22	22.33	5.14	97.09	134.55	5.64	3.65	7.09	6.42
Sector 23	20.52	5.09	87.89	128.42	6.29	3.15	5.27	5.40
Sector 24	65.93	8.84	42.91	77.27	3.59	1.84	44.43	34.69
Sector 25	81.29	6.20	50.66	95.25	6.53	3.29	34.81	24.16
Sector 26	81.91	8.40	65.05	72.59	15.71	11.92	94.15	97.15
	65	66	67	68	69	70	71	72
Sector 1	5.65	6.54	14.56	2496.70	3.77	6.97	81.29	9.14
Sector 2	22.73	13.79	12.03	766.81	2.72	11.62	35.67	45.64
Sector 3	12,593.00	1244.60	420.39	97,066.00	61.04	44.03	4366.60	13,323.00
Sector 4	38.89	15.86	12.02	1672.80	5.09	10.23	52.56	39.35
Sector 5	150.77	9.20	16.40	1119.20	4.70	66.55	86.70	59.41

Sector 6	123.19	9.90	11.08	2543.60	4.75	114.58	46.50	54.75
Sector 7	1300.30	109.08	62.82	5680.10	8.67	217.18	238.21	265.99
Sector 8	375.59	379.66	67.99	2449.00	7.76	27.76	95.22	90.28
Sector 9	181.42	50.12	17.21	651.35	5.47	27.76	30.35	44.28
Sector 10	154.21	59.99	20.07	675.12	4.11	27.76	33.86	52.34
Sector 11	134.60	52.32	14.89	982.17	4.66	27.76	45.26	56.07
Sector 12	806.58	52.32	12.74	29,708.00	8.35	27.76	980.48	370.28
Sector 13	1622.70	75.46	29.72	10,877.00	10.13	9.26	387.34	138.37
Sector 14	293.43	43.95	13.18	1616.70	7.57	11.66	61.43	117.51
Sector 15	48.48	8.31	3.01	647.66	3.08	7.94	20.52	39.87
Sector 16	31.19	6.59	3.02	337.35	3.89	7.48	10.70	14.50
Sector 17	34.78	8.48	3.01	425.63	3.49	8.26	17.30	16.93
Sector 18	55.85	6.59	4.74	872.90	4.40	9.64	27.38	21.80
Sector 19	163.22	5.54	7.63	835.96	4.10	9.04	35.18	50.64
Sector 20	46.02	7.09	3.23	222.54	3.02	7.02	11.24	18.38
Sector 21	179.17	7.03	1.52	146.89	3.12	7.84	6.36	17.74
Sector 22	248.29	4.81	3.00	726.53	4.22	5.77	21.49	55.46
Sector 23	305.81	8.51	2.65	340.80	3.24	5.91	21.67	33.99
Sector 24	65.64	23.66	0.10	658.69	2.45	8.30	15.95	55.72
Sector 25	100.03	9.71	0.10	603.82	3.39	8.30	20.92	57.96
Sector 26	44.88	5.60	109.68	235.67	9.06	14.69	61.78	76.35
73	74	75	76	77	78	79	80	
Sector 1	24.07	5.37	61.06	5.35	5.37	5.51	5.27	12.24
Sector 2	20.39	49.46	97.98	4.65	5.84	56.77	4.34	11.44
Sector 3	2327.40	32.04	3367.90	52.82	7.68	12.50	155.98	739.03
Sector 4	26.05	15.64	43.24	5.50	6.17	11.37	9.08	14.42
Sector 5	36.26	38.05	75.86	3.80	5.94	17.80	18.36	43.19
Sector 6	40.21	20.64	40.00	5.09	5.74	11.72	11.10	39.13
Sector 7	182.76	30.21	175.89	13.97	10.38	29.40	27.00	295.87
Sector 8	94.01	32.51	61.01	9.64	6.59	27.14	24.47	226.29
Sector 9	25.70	19.91	28.78	7.76	5.99	13.46	16.37	71.96
Sector 10	27.65	27.34	31.54	4.51	5.63	16.31	15.06	47.34
Sector 11	34.88	35.71	44.21	5.82	5.95	18.32	17.02	54.54
Sector 12	641.26	63.09	482.56	5.82	5.58	38.93	19.93	84.00
Sector 13	277.00	30.16	252.29	3.59	10.85	12.90	18.56	397.23
Sector 14	54.49	8.15	47.40	9.41	5.62	9.06	20.11	123.28
Sector 15	13.21	45.73	27.17	3.79	4.62	14.61	6.49	22.46
Sector 16	9.41	7.52	11.76	3.79	4.51	4.28	6.49	22.46
Sector 17	49.95	8.47	14.34	3.79	4.14	3.86	6.49	22.46
Sector 18	16.67	12.27	23.05	3.79	4.58	4.99	8.70	12.82
Sector 19	28.60	11.52	39.55	3.79	4.56	10.49	13.03	41.67
Sector 20	10.57	8.79	14.47	3.04	3.49	6.90	6.08	16.56
Sector 21	8.95	8.07	10.29	3.14	3.80	2.68	5.13	18.92
Sector 22	21.88	14.84	23.97	3.56	3.16	5.81	1.84	66.89
Sector 23	19.11	13.00	21.10	3.40	3.87	4.73	7.41	35.22
Sector 24	12.98	57.83	33.93	3.04	24.31	19.80	9.36	24.60
Sector 25	24.06	49.87	27.25	3.04	4.39	10.60	9.36	24.60
Sector 26	94.53	77.48	84.47	24.67	8.21	35.57	13.48	116.98
81	82	83	84	85	86	87	88	
Sector 1	5.16	4.60	4.70	8.60	3.81	9.93	8.90	17.57
Sector 2	6.36	39.36	2.61	7.82	3.85	18.51	12.34	52.06
Sector 3	55.84	5.07	38.33	26.24	87.61	8.69	230.62	28.91
Sector 4	4.63	12.61	5.53	7.49	5.60	10.53	9.57	19.56
Sector 5	7.23	31.71	4.97	8.48	5.69	13.45	13.24	20.56
Sector 6	7.83	20.81	4.78	9.37	5.85	10.49	11.55	14.83
Sector 7	9.63	22.34	6.06	10.86	11.30	23.91	60.04	31.58
Sector 8	7.38	18.35	6.45	11.91	9.14	21.63	77.95	23.61
Sector 9	5.91	8.68	6.92	7.32	6.59	9.80	22.85	15.03
Sector 10	7.16	10.87	4.62	8.30	6.79	13.19	25.82	19.31
Sector 11	6.36	26.75	21.64	72.61	6.91	14.70	18.81	21.21
Sector 12	6.18	34.90	4.40	9.32	6.40	25.20	63.61	35.63
Sector 13	5.35	9.10	14.59	27.45	10.02	8.75	39.92	32.91
Sector 14	11.32	5.52	5.78	7.17	6.24	8.74	18.88	14.91
Sector 15	9.23	29.69	3.14	4.55	4.80	16.47	3.48	24.70
Sector 16	9.23	2.56	4.19	4.55	4.82	4.01	3.03	5.98
Sector 17	9.23	20.66	4.55	4.55	4.60	4.46	3.91	3.69
Sector 18	13.93	5.16	4.64	6.61	4.31	6.50	7.75	9.06
Sector 19	4.16	4.15	4.49	4.88	4.64	7.01	14.15	8.47
Sector 20	10.16	2.99	4.32	4.16	3.94	4.90	3.28	5.41
Sector 21	8.25	0.72	3.79	3.80	3.51	2.54	4.56	3.36
Sector 22	12.05	4.60	5.10	5.47	3.96	7.05	4.72	8.18
Sector 23	6.76	2.04	4.04	4.46	3.27	5.64	7.72	8.16
Sector 24	3.68	61.80	2.73	3.13	2.56	22.19	7.22	32.45
Sector 25	3.68	27.53	4.31	3.13	3.48	13.18	10.15	17.09
Sector 26	46.94	85.75	7.53	18.06	15.10	58.15	24.79	112.12

	89	90	91	92	93	94	95	96
Sector 1	10.32	4.48	12.97	118.75	239.24	6.19	9.43	25.41
Sector 2	10.20	3.88	46.37	159.36	329.98	5.63	26.44	125.34
Sector 3	1331.60	15,121.00	0.42	12,585.00	12,520.00	7.40	33.45	104.59
Sector 4	20.26	6.83	12.28	215.22	194.10	5.48	12.67	58.65
Sector 5	14.89	6.69	38.17	131.51	374.55	6.16	16.67	88.70
Sector 6	52.41	6.83	28.93	92.43	317.59	5.80	16.42	70.14
Sector 7	82.89	8.12	3.37	1131.40	1067.90	7.96	40.31	87.15
Sector 8	666.03	9.23	15.57	8472.90	407.39	7.83	21.77	83.72
Sector 9	154.72	9.23	22.75	3218.40	126.69	6.58	12.28	55.70
Sector 10	195.32	9.23	32.95	3895.20	147.07	6.94	16.07	75.68
Sector 11	92.22	6.59	7.29	2624.90	202.59	7.15	17.98	101.08
Sector 12	135.60	6.59	14.43	2624.90	3554.30	9.09	33.32	146.65
Sector 13	233.84	3.97	2.27	815.20	1091.20	4.05	30.86	61.25
Sector 14	42.73	7.98	9.84	1792.50	241.47	6.59	9.74	59.47
Sector 15	44.33	5.50	1.82	220.07	101.46	4.47	12.16	148.96
Sector 16	44.33	5.50	1.82	220.06	46.16	4.45	3.53	51.86
Sector 17	44.33	5.50	1.82	220.06	53.76	4.44	4.26	48.93
Sector 18	34.19	4.23	5.97	76.29	114.25	4.85	6.72	68.05
Sector 19	50.03	5.62	10.59	323.40	291.46	4.75	7.81	69.44
Sector 20	37.39	4.71	3.53	199.33	81.87	3.16	4.55	62.79
Sector 21	85.75	3.99	2.18	222.69	102.14	4.10	2.40	25.09
Sector 22	7.81	5.54	8.71	130.21	168.73	4.54	6.12	46.16
Sector 23	28.01	4.01	10.91	358.59	215.29	4.02	5.34	41.65
Sector 24	12.27	4.00	99.09	220.07	162.30	7.76	15.37	155.12
Sector 25	12.27	4.00	8.78	220.07	191.97	5.35	12.61	99.55
Sector 26	62.12	7.56	170.68	268.86	111.89	11.65	101.64	135.29
	97	98	99	100	101	102	103	104
Sector 1	263.65	3.63	29.18	5.58	24.41	10.93	13.02	36.24
Sector 2	486.21	28.02	124.47	8.61	750.30	64.95	26.99	68.88
Sector 3	7911.10	14.38	36.50	6.47	241.22	27.57	139.40	120.04
Sector 4	161.60	4.52	26.50	6.68	61.22	15.14	11.00	71.58
Sector 5	229.15	8.73	52.59	5.78	37.66	18.71	17.53	119.84
Sector 6	141.58	4.43	27.04	5.47	83.16	15.27	12.39	66.80
Sector 7	881.95	11.96	18.76	18.04	214.68	33.80	23.84	369.17
Sector 8	233.40	6.70	27.18	7.00	136.52	20.42	18.13	110.58
Sector 9	124.63	4.23	15.93	6.39	49.24	16.28	10.91	58.54
Sector 10	188.32	6.36	26.53	5.83	48.95	20.21	16.00	68.27
Sector 11	164.73	7.17	42.70	6.31	41.14	20.77	20.34	88.29
Sector 12	370.22	17.08	103.31	5.59	114.97	42.74	81.23	212.49
Sector 13	985.04	4.50	24.12	7.01	116.85	15.01	28.94	164.51
Sector 14	198.88	2.95	15.32	7.16	25.29	14.36	11.13	74.35
Sector 15	97.74	11.54	89.70	4.74	33.36	19.94	23.33	73.98
Sector 16	53.27	1.87	12.07	4.56	22.75	5.93	4.29	24.09
Sector 17	58.36	1.89	12.36	4.00	47.60	5.13	4.57	29.32
Sector 18	112.09	3.31	19.71	4.39	16.22	9.91	6.47	47.30
Sector 19	249.56	3.23	16.18	5.87	27.88	8.60	4.73	72.18
Sector 20	62.60	1.78	14.42	3.38	49.37	6.32	3.56	33.59
Sector 21	34.46	0.92	6.18	3.81	13.49	3.34	2.89	20.34
Sector 22	109.20	2.11	11.49	3.96	7.19	9.81	7.00	49.35
Sector 23	70.65	1.80	9.12	3.83	12.28	6.71	5.80	52.37
Sector 24	105.07	16.70	108.87	5.87	9.47	27.18	30.11	88.26
Sector 25	221.77	6.84	56.75	4.47	36.94	10.28	22.43	87.02
Sector 26	113.43	85.59	115.70	12.98	345.06	18.96	79.79	120.15
	105	106	107	108	109	110	111	112
Sector 1	11.12	21.63	284.28	4.58	16.45	6.42	5.75	38.94
Sector 2	12.96	119.27	486.77	6.63	86.04	8.71	12.13	97.14
Sector 3	37.84	69.50	59,281.00	11.58	53,641.00	10.40	234.82	46.47
Sector 4	17.50	37.17	1012.40	5.47	180.94	7.85	7.77	30.12
Sector 5	24.22	57.96	2529.50	5.25	180.11	7.73	8.30	51.75
Sector 6	14.34	41.45	1712.70	5.42	135.34	6.99	8.53	31.99
Sector 7	41.12	41.36	10,359.00	7.05	1417.80	10.37	62.51	21.30
Sector 8	40.95	48.44	4862.60	6.67	326.79	10.07	22.41	31.71
Sector 9	23.92	28.01	1540.10	6.38	111.94	8.26	11.33	18.71
Sector 10	24.93	39.43	1783.70	4.11	126.52	7.64	9.14	29.78
Sector 11	25.01	66.37	2185.10	5.15	160.31	7.93	11.67	44.94
Sector 12	29.68	125.62	35,753.00	8.02	2023.90	6.88	12.33	79.15
Sector 13	9.15	48.14	6689.00	5.30	291.55	10.21	17.84	37.06
Sector 14	31.68	27.63	2425.70	5.55	288.76	11.78	13.80	11.96
Sector 15	3.37	57.71	818.31	3.46	170.96	4.95	4.30	60.29
Sector 16	3.37	10.29	402.21	3.16	62.29	5.10	4.30	6.64
Sector 17	3.37	12.00	564.01	3.11	48.42	4.49	4.30	8.00
Sector 18	11.11	18.69	832.03	4.66	107.37	5.58	4.65	12.80
Sector 19	14.18	19.61	1756.10	5.25	337.61	7.79	7.37	13.42
Sector 20	6.99	15.00	646.35	4.34	80.28	4.72	4.43	11.06
Sector 21	5.89	12.70	458.83	3.58	38.21	4.97	4.40	4.63

Sector 22	8.31	23.17	1449.80	3.21	157.18	4.43	4.29	10.08
Sector 23	7.28	22.76	1317.20	3.54	124.22	5.15	4.04	8.10
Sector 24	17.83	63.20	1241.50	7.07	93.20	7.08	1.88	78.71
Sector 25	10,204.00	120.84	1515.20	4.12	96.16	5.15	1.88	60.92
Sector 26	34.52	69.44	180.00	14.41	89.42	5.22	10.14	112.14
113	114	115	116	117	118	119	120	
Sector 1	8.48	20.79	20.09	158.91	0.50	55.68	8.65	5.82
Sector 2	105.86	307.17	54.91	98.69	4.20	42.71	51.08	3.91
Sector 3	6854.50	72.54	501.28	25,667.00	0.58	7090.90	13.99	76.20
Sector 4	32.76	59.62	19.48	185.34	0.58	135.82	12.96	6.25
Sector 5	116.41	129.87	33.68	165.21	0.86	121.02	23.00	5.50
Sector 6	48.77	78.25	14.27	166.51	0.53	90.98	15.60	4.97
Sector 7	212.90	69.30	66.46	1027.50	0.38	865.67	22.52	11.35
Sector 8	95.51	94.88	24.06	493.39	0.52	253.66	38.05	8.37
Sector 9	45.30	68.53	18.18	143.14	0.37	77.62	13.82	5.78
Sector 10	51.75	90.34	14.90	157.80	0.56	92.22	18.95	6.05
Sector 11	60.43	119.13	17.72	141.11	0.81	106.17	25.41	4.76
Sector 12	648.94	171.60	105.53	4154.90	2.67	1551.10	33.40	5.81
Sector 13	306.72	60.43	54.16	2113.30	1.17	784.85	11.03	23.82
Sector 14	79.67	56.47	15.52	338.72	0.34	187.98	7.89	5.82
Sector 15	36.29	152.46	23.74	78.27	1.92	65.38	27.20	3.90
Sector 16	14.44	40.39	4.53	56.38	0.27	33.51	4.01	3.85
Sector 17	26.63	45.77	4.30	78.41	0.29	48.16	4.24	3.62
Sector 18	44.46	53.00	9.36	139.27	0.39	75.61	6.62	4.22
Sector 19	56.03	42.19	13.45	226.23	0.43	147.18	7.15	4.17
Sector 20	27.86	50.91	4.83	56.49	0.26	44.87	4.86	3.72
Sector 21	24.01	23.82	2.52	58.97	0.44	33.49	2.80	3.38
Sector 22	66.29	46.44	6.42	163.54	0.40	93.66	6.38	3.58
Sector 23	44.07	39.90	4.72	160.19	0.29	70.49	5.19	3.42
Sector 24	35.75	181.67	36.21	68.34	3.61	76.88	39.11	2.10
Sector 25	109.64	154.78	14.83	77.96	2.43	87.98	23.09	5.15
Sector 26	122.46	208.93	228.88	69.11	83.90	113.11	152.81	10.37
121	122	123	124	125	126	127	128	
Sector 1	11.25	27.14	15.53	24.43	40.44	4.22	6.58	40.05
Sector 2	11.25	195.89	25.22	38.87	35.42	20.78	6.26	122.92
Sector 3	9.46	30.29	1154.20	25.75	1866.10	3576.50	20.44	54.02
Sector 4	10.06	23.98	25.77	20.19	87.08	12.15	8.08	42.20
Sector 5	9.37	54.27	31.92	26.40	122.56	19.61	5.13	73.38
Sector 6	9.35	25.16	22.02	20.01	118.03	17.59	6.49	41.68
Sector 7	10.08	26.17	61.65	64.94	1284.20	57.30	10.85	41.85
Sector 8	10.08	50.68	56.74	25.13	440.32	30.63	11.52	45.65
Sector 9	9.82	15.08	32.30	18.96	149.72	15.82	6.61	27.10
Sector 10	7.96	24.17	31.97	22.46	141.88	20.42	7.50	40.13
Sector 11	10.01	43.56	43.64	25.67	162.31	23.52	6.40	63.54
Sector 12	10.01	125.40	36.16	40.96	310.14	139.29	16.59	102.98
Sector 13	9.79	23.79	46.32	19.32	538.05	68.57	3.41	40.75
Sector 14	13.65	14.62	30.43	19.54	172.98	26.29	5.77	26.82
Sector 15	7.37	91.22	36.91	27.33	51.18	29.43	4.36	105.29
Sector 16	7.37	10.86	62.85	8.85	47.83	4.09	5.06	17.94
Sector 17	7.37	11.38	12.13	9.48	34.48	5.16	4.55	20.01
Sector 18	10.33	17.70	10.74	10.16	67.35	9.39	5.05	28.10
Sector 19	8.23	13.98	10.03	15.63	108.84	9.84	5.90	22.91
Sector 20	8.18	12.32	7.17	13.24	53.96	2.79	5.55	20.60
Sector 21	6.71	4.46	14.27	6.76	49.82	6.83	4.44	7.47
Sector 22	6.34	10.52	13.39	16.97	116.26	11.85	4.20	19.56
Sector 23	9.30	8.55	13.95	15.24	107.33	293.23	3.46	14.77
Sector 24	27.55	111.44	12.52	59.16	62.57	43.01	2.17	123.78
Sector 25	9.27	87.35	12.52	15.41	39.98	11.27	3.78	80.25
Sector 26	6.23	207.62	13.48	42.51	89.52	363.06	10.90	170.39
129	130	131	132	133	134	135	136	
Sector 1	4.88	7.41	33.41	599.93	5.86	31.19	20.53	11.42
Sector 2	31.62	28.70	229.00	172.30	12.24	95.49	27.49	12.27
Sector 3	22.15	40.03	748.11	38,861.00	8.15	3021.70	13,277.00	313.40
Sector 4	7.94	8.07	31.89	358.83	7.15	64.99	26.24	12.07
Sector 5	14.04	19.33	66.42	205.06	6.93	59.73	18.51	9.29
Sector 6	10.62	8.17	34.80	246.62	6.90	132.43	43.48	10.87
Sector 7	49.94	37.49	144.76	1033.30	11.03	532.75	591.79	39.94
Sector 8	21.37	13.63	66.54	442.25	8.60	1162.30	2058.30	22.06
Sector 9	9.23	7.52	29.72	135.41	8.34	285.21	126.11	12.64
Sector 10	13.39	10.28	42.39	131.10	8.33	230.95	387.78	10.64
Sector 11	15.24	12.50	48.46	193.10	9.24	334.56	127.28	10.76
Sector 12	61.42	34.83	446.63	1978.70	9.24	419.16	215.03	13.34
Sector 13	20.21	18.14	125.85	1967.30	6.13	113.76	172.64	62.88
Sector 14	8.11	7.78	39.82	325.92	11.68	265.58	400.74	14.07
Sector 15	12.39	13.89	31.98	165.77	5.71	29.11	5.19	7.37

Sector 16	2.05	2.76	14.72	121.72	5.71	29.11	5.19	8.64
Sector 17	2.64	3.16	17.21	106.27	5.71	29.11	5.19	7.48
Sector 18	4.93	5.07	21.49	236.38	7.24	27.60	15.67	10.03
Sector 19	6.34	6.19	33.96	392.71	8.04	65.16	105.70	10.43
Sector 20	2.26	3.20	13.23	104.71	5.46	65.15	15.72	7.82
Sector 21	1.45	1.86	9.67	54.25	4.60	54.39	32.83	10.18
Sector 22	4.36	4.24	21.39	209.48	5.46	47.78	454.67	5.59
Sector 23	2.99	4.09	20.49	231.08	5.54	53.65	46.73	8.87
Sector 24	46.54	19.59	45.98	115.57	5.72	64.68	20.13	5.40
Sector 25	16.31	10.69	31.78	68.19	5.72	36.27	20.13	9.07
Sector 26	300.69	193.25	128.14	102.59	10.09	128.97	103.50	17.83
	137	138	139	140	141	142	143	144
Sector 1	6.25	12.63	14.37	241.38	4.76	3.92	4.55	34.62
Sector 2	4.99	33.19	30.24	383.58	18.90	3.86	131.97	942.77
Sector 3	15.56	1.06	31.34	334.57	28.61	1237.90	379.54	74.38
Sector 4	8.02	4.61	19.27	272.03	5.40	5.15	26.57	65.23
Sector 5	7.74	4.86	48.04	316.23	5.38	11.78	128.14	114.95
Sector 6	7.60	2.76	45.47	359.20	5.81	7.58	47.29	61.66
Sector 7	26.69	7.17	110.01	308.65	11.08	5.99	301.60	57.05
Sector 8	11.15	3.86	137.92	308.81	18.06	22.88	117.53	74.77
Sector 9	8.45	2.44	51.15	292.34	8.17	12.82	54.44	50.94
Sector 10	8.57	3.34	45.95	357.77	7.92	243.42	79.27	70.65
Sector 11	8.77	4.64	58.11	367.81	5.54	11.59	118.43	91.03
Sector 12	10.13	23.61	0.00	358.08	19.31	9.07	629.28	167.62
Sector 13	27.20	1.45	157.30	317.08	14.34	6.14	179.62	43.67
Sector 14	12.95	1.24	41.55	280.59	7.42	6.45	42.89	27.92
Sector 15	7.75	2.64	8.90	378.13	5.38	1.95	127.81	62.50
Sector 16	7.02	0.45	8.90	256.39	4.03	1.95	17.51	29.44
Sector 17	5.30	0.63	8.90	253.97	3.47	1.95	21.53	33.04
Sector 18	7.95	1.13	16.49	332.24	4.74	73.37	28.95	37.61
Sector 19	7.43	1.92	32.06	261.25	6.23	3.65	35.30	37.32
Sector 20	6.76	0.61	9.75	254.21	3.77	98.48	21.20	28.61
Sector 21	5.09	0.32	7.75	189.76	5.05	4.51	14.80	28.14
Sector 22	4.99	1.05	42.91	280.55	4.44	482.85	35.84	42.60
Sector 23	5.55	0.60	16.38	256.02	5.55	4.57	36.75	43.06
Sector 24	4.68	7.37	21.62	383.05	13.07	3180.40	154.95	72.69
Sector 25	6.54	2.45	39.30	388.32	45.15	3180.40	163.42	127.27
Sector 26	121.20	107.03	50.43	400.15	13.78	37.11	260.87	76.63
	145	146	147	148	149	150	151	152
Sector 1	89.86	56.57	10.42	50.61	49.30	26.01	8.55	5.03
Sector 2	673.38	689.99	13.61	30.50	96.57	77.51	35.06	5.89
Sector 3	89.21	307.40	74.77	4490.20	385.78	34.78	562.33	7.10
Sector 4	31.32	192.10	11.94	70.49	55.56	44.37	25.18	5.33
Sector 5	87.16	377.75	18.93	66.47	77.11	57.11	60.87	5.38
Sector 6	29.57	198.30	14.42	61.39	57.18	36.59	39.51	4.34
Sector 7	16.31	164.25	127.01	395.61	92.80	50.48	248.03	7.50
Sector 8	28.60	241.89	23.06	114.41	68.95	47.88	82.47	6.19
Sector 9	13.05	149.08	14.30	49.32	44.76	40.51	52.67	4.12
Sector 10	27.15	220.52	16.44	51.02	56.52	39.73	53.58	4.59
Sector 11	58.24	305.31	18.13	64.64	69.78	51.17	61.14	6.34
Sector 12	185.94	479.69	48.60	589.76	112.93	90.37	86.21	6.23
Sector 13	86.01	184.12	41.66	351.59	111.52	45.00	124.08	5.50
Sector 14	22.16	100.11	16.73	108.87	47.45	29.89	61.45	4.10
Sector 15	74.75	361.38	7.04	20.69	92.26	60.56	54.04	3.24
Sector 16	14.35	61.87	4.07	17.10	31.57	16.45	25.06	3.24
Sector 17	17.37	81.88	5.42	36.28	30.80	18.20	22.45	3.24
Sector 18	29.26	96.34	8.74	28.35	44.03	22.29	29.23	3.57
Sector 19	25.84	107.81	9.20	39.83	40.16	16.98	37.31	3.71
Sector 20	29.23	88.29	4.01	22.94	34.73	21.14	20.75	3.60
Sector 21	7.28	71.87	2.47	15.33	19.77	14.81	8.85	3.17
Sector 22	15.32	110.60	12.13	58.36	32.77	27.14	39.47	4.22
Sector 23	13.48	100.22	6.94	46.96	29.39	24.31	37.39	3.10
Sector 24	86.74	405.97	9.43	29.05	114.83	68.82	58.92	1.87
Sector 25	94.14	453.49	6.47	32.59	71.83	65.23	90.93	3.89
Sector 26	69.83	519.38	92.21	58.51	166.02	75.50	93.08	1.88
	153	154	155	156	157	158	159	160
Sector 1	6.93	5.06	3.40	13.10	11.44	12.66	181.35	14.59
Sector 2	144.67	6.74	56.84	13.10	8.81	35.41	66.64	88.70
Sector 3	327.24	67.38	37.26	383.24	491.73	14.96	50,843.00	72.51
Sector 4	7.18	4.97	17.69	18.05	10.04	7.65	679.71	36.75
Sector 5	5.82	4.63	68.63	28.75	8.23	18.29	285.87	58.64
Sector 6	7.71	4.45	25.45	20.60	8.71	7.34	554.65	34.55
Sector 7	10.70	6.58	35.19	74.63	18.16	54.10	3619.20	154.48
Sector 8	13.12	5.34	49.54	80.76	20.68	14.75	12,083.00	64.43
Sector 9	7.06	5.59	35.94	43.70	10.43	8.37	566.46	32.92

Sector 10	6.53	6.83	49.42	29.59	11.45	11.03	569.16	39.94
Sector 11	7.23	6.06	61.66	95.82	8.78	12.26	402.17	53.01
Sector 12	7.80	5.88	102.14	38.55	13.86	43.38	3940.00	244.00
Sector 13	11.17	13.05	42.35	36.44	51.65	17.71	8243.30	111.21
Sector 14	8.19	6.17	25.93	22.82	11.17	5.35	1638.60	45.83
Sector 15	6.46	3.54	87.44	7.32	10.74	12.34	162.83	56.09
Sector 16	5.44	3.87	21.19	7.32	7.07	1.78	193.75	19.00
Sector 17	5.31	4.14	22.70	7.32	5.89	1.72	318.60	24.98
Sector 18	5.86	4.14	22.65	7.29	6.19	3.99	603.57	23.04
Sector 19	6.22	4.03	16.61	10.27	7.61	5.90	1271.30	20.74
Sector 20	4.33	2.97	19.71	6.57	5.71	2.55	261.58	21.61
Sector 21	5.35	3.74	16.66	7.03	5.64	1.27	343.93	13.83
Sector 22	5.20	4.46	27.04	4.63	4.88	3.04	828.80	36.65
Sector 23	4.72	4.40	23.99	11.27	4.77	3.31	637.89	31.34
Sector 24	37.71	5.16	99.57	13.26	8.05	18.62	159.94	70.67
Sector 25	8.90	3.81	84.89	13.26	8.05	8.48	636.03	100.62
Sector 26	90.42	6.46	118.52	638.46	22.93	208.01	118.37	82.03
161	162	163	164	165	166	167	168	
Sector 1	7.03	4.20	15.78	14.08	281.31	14.79	3.83	10.94
Sector 2	5.09	4.20	60.58	14.14	129.51	11.62	7.28	49.02
Sector 3	828.53	9.13	23.93	143.12	48,493.00	222.69	9.89	81.58
Sector 4	6.01	5.06	19.00	15.10	415.12	12.28	5.63	73.92
Sector 5	5.63	5.19	26.30	43.01	1105.30	12.60	5.84	136.76
Sector 6	7.36	4.44	17.54	21.27	480.20	13.87	6.01	117.69
Sector 7	9.83	5.43	42.06	77.12	2439.60	26.15	10.24	775.41
Sector 8	25.93	4.84	24.21	36.36	1445.50	49.99	16.11	146.46
Sector 9	6.61	5.58	14.79	34.58	255.37	24.20	7.21	107.75
Sector 10	6.10	5.74	19.92	31.21	267.61	29.94	7.34	120.70
Sector 11	11.25	4.80	26.76	69.01	340.83	30.00	6.85	157.63
Sector 12	10.18	8.63	58.49	35.41	5328.00	18.22	6.97	152.34
Sector 13	8.39	5.54	17.03	57.27	11,346.00	85.81	13.54	47.16
Sector 14	18.25	5.50	10.31	29.44	672.31	27.83	7.54	151.74
Sector 15	4.65	4.98	33.56	5.85	166.97	4.46	4.55	68.81
Sector 16	8.23	3.20	4.45	6.30	163.39	4.52	5.40	40.83
Sector 17	7.55	3.20	4.31	5.68	287.18	4.41	7.78	48.01
Sector 18	4.48	5.58	8.39	10.50	354.15	11.73	5.82	67.17
Sector 19	5.45	3.99	10.32	16.80	612.09	11.86	6.88	73.96
Sector 20	3.90	3.51	6.11	5.78	224.90	3.96	5.15	51.24
Sector 21	5.34	3.93	1.99	6.25	215.51	7.55	5.26	37.97
Sector 22	4.81	2.75	6.86	3.73	316.83	0.06	4.90	104.48
Sector 23	4.08	5.44	5.05	6.83	455.00	6.17	6.22	120.91
Sector 24	2.37	4.94	53.39	0.46	178.94	8.62	5.31	80.29
Sector 25	4.05	5.19	23.92	5.50	456.12	22.28	5.77	87.33
Sector 26	9.41	5.68	178.35	115.38	356.08	55.54	7.77	85.32
169	170	171	172	173	174	175	176	
Sector 1	26.27	10.33	3.73	6.40	145.34	14.48	18.73	4.12
Sector 2	291.12	24.02	4.33	19.70	89.38	13.94	23.10	4.31
Sector 3	1105.70	18.16	509.86	30.66	1336.00	52.20	55.55	20.42
Sector 4	18.58	11.42	6.39	11.25	143.70	32.26	19.84	6.14
Sector 5	24.83	25.20	6.63	25.71	173.18	22.21	34.08	6.60
Sector 6	17.47	14.10	9.99	12.84	133.37	58.68	21.55	5.17
Sector 7	43.73	47.65	30.26	56.90	1096.90	57.41	187.68	9.98
Sector 8	35.54	16.46	18.88	30.43	259.77	39.92	60.36	8.83
Sector 9	17.99	12.96	9.26	17.62	112.83	31.54	22.86	6.63
Sector 10	21.79	15.02	9.23	21.52	122.13	39.43	26.11	6.88
Sector 11	26.67	16.56	9.52	22.49	151.32	29.42	29.71	6.13
Sector 12	60.48	34.95	9.43	32.94	673.71	28.66	110.71	5.94
Sector 13	22.22	17.92	15.75	56.32	493.50	38.03	90.79	14.91
Sector 14	14.72	11.30	13.96	15.69	146.51	23.19	26.96	5.82
Sector 15	30.37	13.84	9.01	23.14	58.65	7.55	10.54	3.92
Sector 16	8.50	4.94	6.51	10.47	33.24	7.55	7.02	4.07
Sector 17	8.04	4.68	4.52	11.94	44.03	7.55	7.78	6.99
Sector 18	12.82	7.30	5.44	14.55	70.33	28.16	14.48	5.06
Sector 19	16.38	8.97	3.90	17.57	106.91	9.18	24.45	4.00
Sector 20	8.57	5.43	3.75	8.83	44.11	23.46	7.13	3.37
Sector 21	7.10	3.28	3.99	6.34	31.62	17.19	4.10	4.35
Sector 22	14.94	7.47	4.70	12.65	75.21	6.66	13.62	5.53
Sector 23	9.18	5.36	4.97	11.44	86.07	10.46	7.13	4.65
Sector 24	41.55	19.31	2.01	25.25	76.66	1.69	8.53	4.82
Sector 25	16.15	11.25	7.16	19.74	64.61	1.69	11.52	4.65
Sector 26	57.98	131.69	11.31	41.77	102.52	131.22	118.38	12.31
177	178	179	180	181	182	183	184	
Sector 1	511.52	8.17	19.73	31.95	8.26	15.58	42.35	19.71
Sector 2	657.55	9.09	29.09	27.92	41.29	7.90	25.30	72.19
Sector 3	52,322.00	147.06	2304.40	8894.90	58.59	33.09	677.50	17.36
Sector 4	524.67	7.84	16.68	55.72	37.01	20.58	53.70	20.56

Sector 5	790.13	7.72	13.82	48.57	88.06	25.53	39.82	41.75
Sector 6	509.81	5.18	14.39	174.54	53.34	16.92	36.94	22.94
Sector 7	2921.40	20.52	104.99	325.53	57.37	30.35	85.46	50.98
Sector 8	1169.10	8.98	22.03	1321.70	64.22	20.62	42.13	27.62
Sector 9	304.59	6.20	16.96	185.35	46.64	26.23	33.90	20.34
Sector 10	342.59	8.50	16.83	290.45	60.09	17.67	33.74	29.15
Sector 11	576.93	7.82	16.85	206.96	74.44	20.54	42.63	37.69
Sector 12	13,309.00	11.38	16.85	244.38	115.60	20.54	24.07	72.52
Sector 13	4518.40	37.48	13.79	757.69	49.02	13.87	30.87	14.15
Sector 14	882.09	8.28	54.96	154.70	40.05	17.42	53.15	14.47
Sector 15	261.82	6.14	9.70	67.38	56.05	10.26	18.16	53.26
Sector 16	152.80	3.80	13.09	67.37	19.16	11.93	17.96	7.48
Sector 17	246.34	7.25	8.13	67.38	25.39	9.28	20.63	10.18
Sector 18	397.56	6.64	13.73	112.73	26.38	22.05	24.84	13.01
Sector 19	606.41	5.51	11.89	116.72	24.15	15.01	34.71	12.72
Sector 20	145.12	3.60	6.25	63.93	24.14	6.12	15.66	10.15
Sector 21	104.43	4.27	7.92	92.30	17.41	11.60	26.91	3.86
Sector 22	381.58	9.42	12.45	58.60	30.70	10.95	12.50	10.19
Sector 23	368.22	8.46	9.87	70.06	27.03	10.82	19.47	8.69
Sector 24	351.78	8.67	2.36	89.09	67.08	4.34	32.97	77.99
Sector 25	248.55	7.90	2.36	89.09	151.07	14.63	32.97	42.94
Sector 26	360.87	26.91	12.93	120.12	72.02	83.65	153.37	211.47
Sector				Economy				
				185	186			
Sector 1				121.87				45.51
Sector 2				280.09				104.54
Sector 3				9773.90				5180.80
Sector 4				112.63				42.59
Sector 5				411.60				76.31
Sector 6				113.77				44.28
Sector 7				626.37				144.68
Sector 8				662.82				235.69
Sector 9				83.76				30.95
Sector 10				101.82				40.31
Sector 11				145.63				55.02
Sector 12				4749.90				702.13
Sector 13				559.65				209.66
Sector 14				134.04				57.86
Sector 15				91.76				58.31
Sector 16				31.55				10.37
Sector 17				33.22				22.00
Sector 18				70.77				19.69
Sector 19				145.53				26.42
Sector 20				44.26				11.69
Sector 21				33.26				8.61
Sector 22				57.11				21.43
Sector 23				66.90				23.55
Sector 24				117.06				83.12
Sector 25				109.00				40.73
Sector 26				131.43				218.83

Table A5

Detailed emission information for 186 economies.

Code	Direct emissions (t)	EEI (t)	EEE (t)	EEB (t)	Embodied emissions (tonnes)	Direct emission intensity (g/million USD)	Embodied emissions intensity (g/million USD)	Direct emissions per capita (g/person)	Embodied emissions per capita (g/person)
1	0.00	0.52	0.03	0.49	0.49	0.00	44.20	0.00	1.56
2	0.00	0.25	0.03	0.22	0.22	0.00	18.97	0.00	6.86
3	0.43	1.16	0.65	0.51	0.94	2.60	5.67	1.21	2.64
4	0.00	0.08	0.01	0.07	0.07	0.00	19.26	0.00	82.23
5	0.00	1.63	0.43	1.20	1.20	0.00	16.76	0.00	6.29
6	0.00	0.06	0.02	0.04	0.04	0.00	32.76	0.00	47.91
7	6.47	2.00	4.52	−2.52	3.95	20.16	12.32	16.01	9.79
8	0.59	0.14	0.47	−0.33	0.26	59.12	26.24	19.05	8.46
9	0.00	0.11	0.04	0.07	0.07	0.00	28.43	0.00	69.64
10	13.17	3.84	9.63	−5.79	7.38	11.60	6.50	59.13	33.14
11	0.53	2.09	1.43	0.65	1.19	1.39	3.10	6.35	14.14
12	0.52	0.25	0.58	−0.32	0.20	10.57	4.01	5.70	2.17
13	0.00	0.10	0.02	0.08	0.08	0.00	9.97	0.00	23.90
14	0.00	0.53	0.15	0.39	0.39	0.00	24.41	0.00	30.71
15	0.00	0.65	0.07	0.58	0.58	0.00	5.71	0.00	0.39
16	0.00	0.09	0.02	0.08	0.08	0.00	15.85	0.00	28.29

Table A5 (continued)

Code	Direct emissions (t)	EEL (t)	EEE (t)	EEB (t)	Embodied emissions (tonnes)	Direct emission intensity (g/million USD)	Embodied emissions intensity (g/million USD)	Direct emissions per capita (g/person)	Embodied emissions per capita (g/person)
17	0.00	0.08	0.08	0.00	0.00	0.00	11.15	0.00	0.02
18	2.78	5.22	7.57	−2.34	0.43	5.49	0.85	25.91	4.03
19	0.00	0.09	0.03	0.06	0.06	0.00	40.79	0.00	19.95
20	0.01	0.12	0.01	0.11	0.11	0.71	14.22	0.06	1.25
21	0.00	0.32	0.03	0.30	0.30	0.00	54.75	0.00	459.60
22	0.00	0.11	0.03	0.08	0.08	0.00	46.51	0.00	10.49
23	1.76	0.39	1.80	−1.40	0.36	91.90	18.69	17.76	3.61
24	0.00	0.15	0.02	0.13	0.13	0.00	6.19	0.00	3.33
25	0.98	0.47	0.14	0.32	1.30	81.94	108.92	48.83	64.91
26	25.71	9.34	10.03	−0.70	25.01	12.91	12.57	13.19	12.83
27	0.00	0.06	0.02	0.04	0.04	0.00	44.49	0.00	166.64
28	0.00	0.17	0.06	0.11	0.11	0.00	9.20	0.00	27.74
29	3.25	0.89	1.63	−0.74	2.51	57.50	44.44	43.33	33.49
30	26.89	0.20	7.53	−7.33	19.57	4099.01	2982.48	163.30	118.82
31	0.21	0.16	0.08	0.08	0.28	82.15	111.96	2.47	3.36
32	3.75	0.28	0.91	−0.63	3.12	372.21	309.76	26.52	22.07
33	0.44	0.29	0.30	−0.01	0.43	16.25	15.95	2.25	2.21
34	9.51	16.68	6.71	9.96	19.47	5.73	11.74	27.95	57.24
35	0.00	0.06	0.01	0.05	0.05	0.00	31.45	0.00	10.31
36	0.00	0.09	0.02	0.07	0.07	0.00	27.87	0.00	127.03
37	0.02	0.08	0.02	0.05	0.07	9.35	39.82	0.38	1.60
38	0.03	0.11	0.03	0.08	0.11	4.61	18.40	0.25	0.98
39	11.44	3.68	7.72	−4.05	7.40	63.73	41.18	66.87	43.21
40	239.95	60.77	70.97	−10.20	229.75	52.07	49.85	18.20	17.43
41	60.00	1.47	29.65	−28.18	31.82	231.02	122.53	129.60	68.74
42	11.99	0.28	11.74	−11.46	0.53	1433.14	63.68	296.64	13.18
43	0.06	0.90	0.25	0.66	0.71	1.43	18.49	1.18	15.27
44	0.00	0.73	0.15	0.58	0.58	0.00	9.66	0.00	13.15
45	0.00	0.40	0.02	0.38	0.38	0.00	5.62	0.00	3.34
46	0.00	0.28	0.03	0.25	0.25	0.00	9.43	0.00	30.61
47	0.09	1.17	0.88	0.30	0.39	0.42	1.79	0.86	3.70
48	1.60	0.73	0.74	−0.02	1.58	71.11	70.33	7.59	7.51
49	0.63	0.16	0.58	−0.41	0.21	69.63	23.72	2.57	0.88
50	0.00	2.13	0.12	2.01	2.01	0.00	109.89	0.00	3.04
51	0.33	3.39	1.56	1.83	2.16	1.05	6.84	5.96	38.90
52	0.00	0.09	0.02	0.07	0.07	0.00	47.53	0.00	7.32
53	0.14	0.76	0.10	0.66	0.80	2.32	13.48	1.39	8.05
54	17.55	1.20	6.40	−5.20	12.35	300.90	211.70	121.34	85.37
55	0.71	2.85	0.30	2.55	3.26	2.20	10.05	0.88	4.02
56	0.00	0.70	0.12	0.58	0.58	0.00	24.08	0.00	9.36
57	0.01	0.06	0.01	0.05	0.06	3.45	25.62	0.16	1.17
58	0.03	0.18	0.12	0.06	0.09	1.63	4.63	2.24	6.35
59	3.31	0.19	0.37	−0.18	3.13	145.36	137.49	3.99	3.77
60	0.51	0.10	0.15	−0.05	0.46	132.93	118.83	59.47	53.16
61	4.88	1.44	4.25	−2.80	2.07	18.97	8.06	90.88	38.61
62	1.82	10.64	6.52	4.12	5.93	0.70	2.29	2.81	9.17
63	0.00	0.10	0.01	0.09	0.09	0.00	12.99	0.00	32.82
64	0.22	0.16	0.24	−0.08	0.14	13.41	8.31	14.61	9.05
65	0.22	0.02	0.03	−0.01	0.21	251.62	238.70	12.73	12.07
66	0.55	0.13	0.37	−0.23	0.32	40.84	23.49	12.67	7.29
67	5.33	50.31	27.04	23.27	28.60	1.46	7.86	6.47	34.75
68	52.61	0.72	23.37	−22.66	29.95	1754.48	998.93	215.69	122.81
69	0.15	1.35	0.28	1.07	1.22	0.52	4.19	1.32	10.73
70	0.00	0.04	0.01	0.03	0.03	0.00	12.95	0.00	54.42
71	2.48	0.61	0.99	−0.38	2.10	52.78	44.61	17.25	14.58
72	4.20	0.09	3.94	−3.85	0.35	671.12	56.13	42.04	3.52
73	12.65	0.93	1.13	−0.20	12.44	36.35	35.76	1676.00	1649.11
74	0.00	0.17	0.02	0.15	0.15	0.00	21.87	0.00	1.54
75	0.61	0.45	0.32	0.13	0.73	35.07	42.41	7.98	9.65
76	0.00	7.73	1.15	6.58	6.58	0.00	38.89	0.00	93.35
77	0.00	1.01	0.65	0.36	0.36	0.00	2.68	0.00	3.59
78	0.00	0.17	0.04	0.13	0.13	0.00	8.21	0.00	40.53
79	10.13	5.87	6.35	−0.48	9.65	6.17	5.88	0.83	0.79
80	59.77	5.32	28.53	−23.21	36.56	91.55	55.99	24.92	15.24
81	2.19	1.50	1.43	0.07	2.26	5.80	5.97	2.96	3.05
82	0.00	2.85	0.04	2.81	2.81	0.00	8.29	0.00	8.87
83	0.06	1.55	1.15	0.40	0.46	0.30	2.31	1.34	10.27
84	0.08	1.64	0.91	0.73	0.81	0.34	3.64	1.01	10.87
85	1.27	9.19	5.39	3.80	5.07	0.60	2.37	2.10	8.37
86	0.00	0.19	0.02	0.16	0.16	0.00	10.64	0.00	5.98
87	6.86	81.90	18.20	63.70	70.56	1.17	12.03	5.42	55.76
88	0.00	0.59	0.11	0.48	0.48	0.00	16.64	0.00	7.72

(continued on next page)

Table A5 (continued)

Code	Direct emissions (t)	EEI (t)	EEE (t)	EEB (t)	Embodied emissions (tonnes)	Direct emission intensity (g/million USD)	Embodied emissions intensity (g/million USD)	Direct emissions per capita (g/person)	Embodied emissions per capita (g/person)
89	13.25	2.11	9.18	−7.07	6.18	96.32	44.92	82.69	38.56
90	5.63	0.22	5.81	−5.58	0.05	180.86	1.57	13.90	0.12
91	0.00	0.88	0.13	0.75	0.75	0.00	8.06	0.00	27.37
92	5.05	0.35	3.01	−2.66	2.39	1087.95	514.41	94.60	44.73
93	1.40	0.12	0.51	−0.39	1.00	248.78	179.07	22.51	16.20
94	0.00	0.18	0.07	0.11	0.11	0.00	4.55	0.00	4.93
95	0.00	0.56	0.09	0.47	0.47	0.00	13.97	0.00	11.08
96	0.00	0.24	0.04	0.20	0.20	0.00	82.77	0.00	9.30
97	0.22	0.13	0.23	−0.10	0.12	159.68	86.18	5.52	2.98
98	0.00	0.31	0.08	0.24	0.24	0.00	3.49	0.00	3.72
99	0.00	0.12	0.03	0.09	0.09	0.00	16.46	0.00	249.06
100	0.00	0.35	0.16	0.19	0.19	0.00	6.57	0.00	5.86
101	0.00	2.63	1.41	1.22	1.22	0.00	33.54	0.00	240.41
102	0.00	0.32	0.09	0.24	0.24	0.00	11.21	0.00	43.76
103	0.02	0.12	0.03	0.09	0.11	1.84	10.49	0.09	0.53
104	0.00	0.44	0.06	0.38	0.38	0.00	74.12	0.00	2.57
105	1.01	7.09	3.48	3.62	4.63	3.63	16.60	3.57	16.30
106	0.00	0.10	0.02	0.08	0.08	0.00	46.77	0.00	24.40
107	15.20	0.24	1.65	−1.41	13.79	1495.55	1356.86	98.91	89.74
108	0.00	0.07	0.02	0.05	0.05	0.00	6.53	0.00	12.35
109	2.76	0.14	2.05	−1.91	0.85	813.06	249.82	79.70	24.49
110	0.00	0.15	0.03	0.12	0.12	0.00	12.03	0.00	9.36
111	10.32	4.83	7.05	−2.23	8.09	9.31	7.30	9.10	7.13
112	0.00	0.13	0.03	0.09	0.09	0.00	16.93	0.00	264.88
113	5.66	0.22	5.54	−5.33	0.34	1090.50	65.18	205.54	12.28
114	0.00	0.42	0.05	0.37	0.37	0.00	78.63	0.00	58.94
115	0.49	1.14	0.47	0.66	1.16	5.21	12.22	1.54	3.62
116	3.14	0.25	0.80	−0.55	2.59	277.81	229.11	13.44	11.08
117	0.10	0.02	0.00	0.02	0.12	0.00	#DIV/0!	#DIV/0!	0.00
118	1.90	1.00	1.58	−0.58	1.32	168.35	116.64	83.19	57.64
119	0.00	0.24	0.02	0.21	0.21	0.00	12.33	0.00	0.71
120	1.90	6.10	6.37	−0.27	1.63	2.20	1.88	11.43	9.79
121	0.00	0.11	0.02	0.09	0.09	0.00	19.87	0.00	43.16
122	0.00	0.21	0.04	0.17	0.17	0.00	18.14	0.00	66.19
123	3.61	0.85	1.65	−0.80	2.81	26.65	20.76	82.68	64.41
124	0.00	0.26	0.03	0.24	0.24	0.00	22.99	0.00	4.12
125	0.47	1.07	0.59	0.48	0.95	79.06	160.77	3.02	6.15
126	14.18	1.91	6.19	−4.28	9.90	85.08	59.42	8.95	6.25
127	1.04	1.42	1.59	−0.17	0.87	2.99	2.51	21.34	17.89
128	0.00	0.33	0.02	0.31	0.31	0.00	29.69	0.00	7.98
129	0.07	0.68	0.29	0.39	0.46	1.21	7.98	2.52	16.60
130	0.09	1.55	0.24	1.31	1.40	0.46	6.92	0.05	0.81
131	0.36	1.01	0.31	0.70	1.06	13.88	41.03	10.19	30.13
132	18.70	0.44	16.38	−15.94	2.75	1921.24	282.90	272.60	40.14
133	0.00	0.29	0.04	0.25	0.25	0.00	9.47	0.00	3.93
134	31.89	1.24	17.55	−16.31	15.58	206.98	101.10	109.67	53.57
135	37.45	2.21	19.26	−17.05	20.40	154.11	83.95	40.16	21.88
136	4.23	3.16	2.50	0.65	4.88	9.17	10.58	11.05	12.75
137	0.01	2.06	0.61	1.46	1.47	0.05	8.35	0.08	13.74
138	0.00	0.34	0.05	0.30	0.30	0.00	2.21	0.00	16.85
139	0.00	47.50	19.59	27.91	27.91	0.00	26.16	0.00	57.93
140	0.00	0.01	0.01	0.00	0.00	0.00	258.24	0.00	0.06
141	0.14	0.95	0.46	0.49	0.63	0.89	3.92	0.67	2.93
142	16.86	8.39	17.76	−9.38	7.48	13.23	5.87	11.79	5.23
143	0.01	0.26	0.03	0.23	0.23	1.06	44.27	0.05	2.17
144	0.00	0.07	0.02	0.04	0.04	0.00	62.91	0.00	23.30
145	0.00	0.06	0.02	0.04	0.04	0.00	24.91	0.00	125.23
146	0.00	0.05	0.01	0.04	0.04	0.00	195.98	0.00	24.35
147	1.35	8.47	3.26	5.21	6.56	2.41	11.65	4.94	23.90
148	1.35	0.62	0.31	0.30	1.65	47.09	57.75	10.82	13.27
149	0.38	1.73	0.08	1.65	2.03	10.42	55.34	5.19	27.56
150	0.00	0.08	0.02	0.07	0.07	0.00	39.49	0.00	76.15
151	0.04	0.10	0.03	0.08	0.12	17.56	49.67	0.70	1.99
152	0.00	2.88	1.39	1.48	1.48	0.00	4.08	0.00	29.15
153	0.33	0.74	0.54	0.20	0.52	3.40	5.45	5.97	9.59
154	0.04	0.37	0.20	0.17	0.21	0.74	3.69	2.07	10.30
155	0.00	0.05	0.01	0.04	0.04	0.00	33.51	0.00	0.43
156	13.22	1.43	9.45	−8.02	5.20	32.15	12.65	26.37	10.38
157	6.12	8.26	7.55	0.72	6.84	4.56	5.10	13.29	14.84
158	0.00	0.48	0.11	0.37	0.37	0.00	6.73	0.00	1.78
159	3.39	0.14	1.04	−0.89	2.49	1115.70	821.05	645.76	475.21
160	0.00	0.24	0.06	0.18	0.18	0.00	44.22	0.00	15.18
161	2.46	1.98	2.88	−0.90	1.56	5.14	3.26	26.19	16.59

Table A5 (continued)

Code	Direct emissions (t)	EEL (t)	EEE (t)	EEB (t)	Embodied emissions (tonnes)	Direct emission intensity (g/million USD)	Embodied emissions intensity (g/million USD)	Direct emissions per capita (g/person)	Embodied emissions per capita (g/person)
162	0.02	3.49	1.48	2.01	2.03	0.04	3.54	0.31	26.53
163	0.00	0.91	0.13	0.78	0.78	0.00	13.69	0.00	3.83
164	0.11	7.13	3.70	3.43	3.53	0.37	12.47	0.45	15.27
165	3.07	0.38	1.87	−1.48	1.59	784.69	405.17	44.63	23.05
166	2.29	7.04	3.09	3.95	6.24	6.65	18.14	3.31	9.02
167	0.00	0.11	0.04	0.08	0.08	0.00	6.44	0.00	3.73
168	0.00	0.58	0.11	0.48	0.48	0.00	123.52	0.00	7.89
169	0.00	0.52	0.22	0.30	0.30	0.00	11.48	0.00	22.65
170	0.00	0.70	0.12	0.58	0.58	0.00	11.60	0.00	5.52
171	4.86	2.32	2.71	−0.39	4.47	7.17	6.60	6.67	6.14
172	0.00	0.48	0.09	0.38	0.38	0.00	23.83	0.00	7.64
173	0.44	2.09	0.16	1.93	2.37	20.66	110.95	1.32	7.09
174	0.02	3.41	1.27	2.14	2.16	0.14	14.67	0.05	4.76
175	0.01	8.93	3.01	5.92	5.93	0.02	21.22	0.08	78.89
176	0.93	14.39	5.34	9.05	9.98	0.41	4.41	1.50	16.09
177	11.58	0.65	6.54	−5.89	5.69	686.41	337.43	26.57	13.06
178	25.20	132.58	29.20	103.38	128.57	1.32	6.73	8.12	41.42
179	0.55	0.34	0.29	0.05	0.60	11.89	12.96	16.37	17.85
180	5.56	0.72	2.59	−1.87	3.69	150.65	99.90	20.25	13.43
181	0.00	0.05	0.02	0.03	0.03	0.00	39.92	0.00	13.87
182	4.40	3.49	3.13	0.36	4.76	8.46	9.15	15.18	16.42
183	3.79	2.20	3.53	−1.33	2.46	116.72	75.78	4.31	2.80
184	0.00	0.65	0.07	0.58	0.58	0.00	18.75	0.00	2.39
185	3.39	0.81	2.70	−1.89	1.50	218.24	96.85	25.90	11.50
186	4.48	0.51	4.02	−3.52	0.96	153.98	33.11	35.65	7.67

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