

1 Supplementary Information for

2 **Interprovincial supply chains reshape the pattern of**
3 **nitrogen deposition in China**

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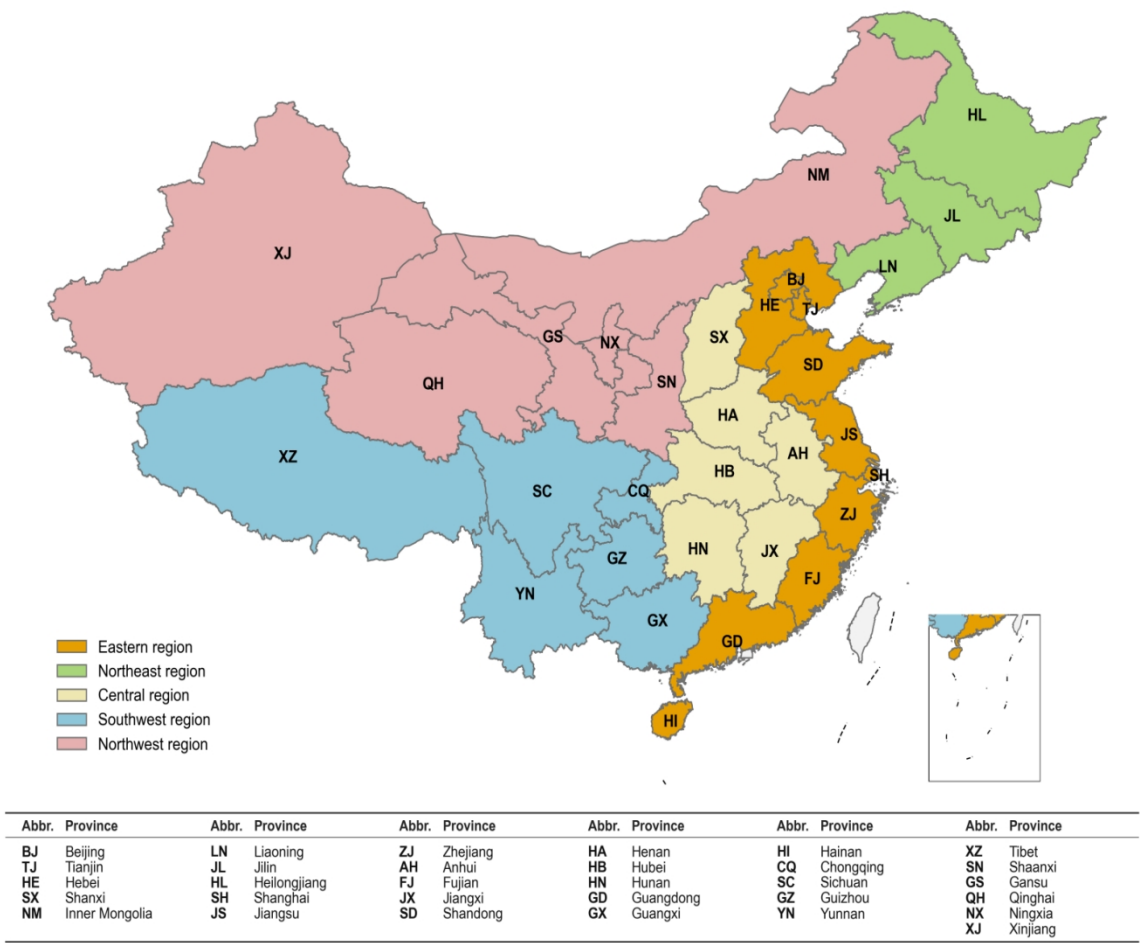
Supplementary Text

Text S1. A Merged Emission Inventory

A merged Chinese provincial emission inventory for 2017 was constructed based on the Multi-resolution Emission Inventory for China (MEIC, <http://meicmodel.org.cn>) (Li et al., 2017; Zheng et al., 2018) and the Greenhouse Gas-Air Pollution Interactions and Synergies inventory (GAINS, <https://gains.iiasa.ac.at>) (Amann et al., 2011). The pollutants considered in this study include ammonia (NH_3) and nitrogen oxides (NO_x), which are the main precursors of reduced nitrogen (NH_x) and oxidized nitrogen (NO_y) deposition, respectively. Sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic compounds (VOCs), black carbon (BC), and organic carbon (OC) were also included because these species can influence atmospheric processes relevant to nitrogen deposition, including oxidant chemistry, secondary inorganic aerosol formation, gas-particle partitioning, and atmospheric removal (Paulot et al., 2013; Wang et al., 2013). MEIC has been widely used in studies of atmospheric pollution in China and provides province-level emissions for 22 source sectors (Table S1) (Li et al., 2017; Zheng et al., 2018). However, its sectoral classification cannot be directly aligned with the sectoral structure used in the MRIO analysis. Therefore, for each province and pollutant, the provincial emission totals from MEIC were disaggregated across 56 detailed GAINS source sectors (Table S2) using the corresponding sectoral shares from GAINS. This procedure retained the provincial emission totals from MEIC while improving the sectoral resolution of the inventory. Further details on the inventory construction are available in our previous studies (Wang et al., 2024; Wang et al., 2025).

To facilitate the MRIO analysis, the 56 source sectors in the resulting inventory were mapped to the 42 sectors of the MRIO table (Table S3). In particular, agricultural NH_3 emissions in China mainly originate from livestock manure management and synthetic fertilizer application and exhibit pronounced heterogeneity among agricultural activities. To represent this heterogeneity more explicitly, we further refined agricultural NH_3 emissions using the agricultural NH_3 emission inventory developed by Chen et al. (Chen et al., 2021). This inventory resolves livestock categories, crop-specific fertilizer application, management practices, and region-specific emission factors based on China-specific agricultural statistics. This refinement improved the sectoral representation of agricultural NH_3 emissions in the consumption-based emissions

49 accounting framework, thereby supporting a robust assessment of consumption-driven NH_3
50 emissions and subsequent NH_x deposition.



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53 **Figure S1. Regional classification of mainland China in this study.**

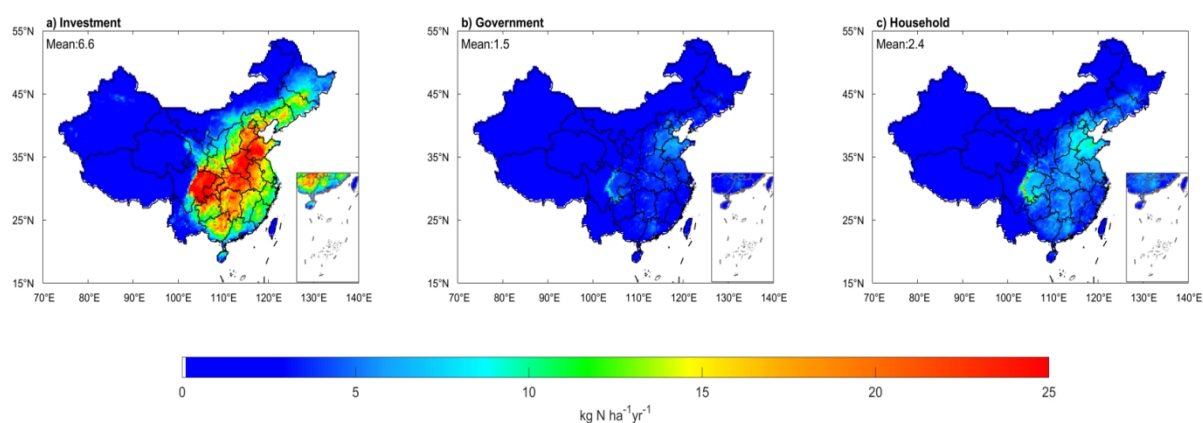


Figure S2. Spatial distribution of nitrogen deposition in China driven by different domestic consumption types in 2017.

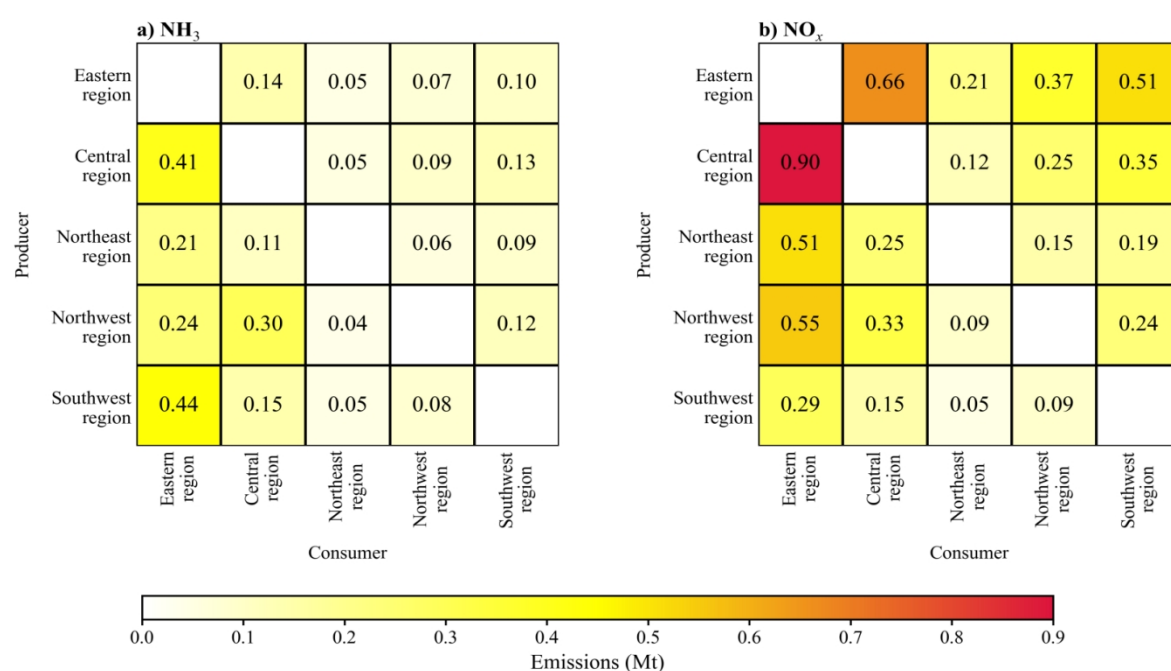


Figure S3. Emission flows of domestic consumption-driven NH₃ and NO_x emissions across Chinese regions in 2017.

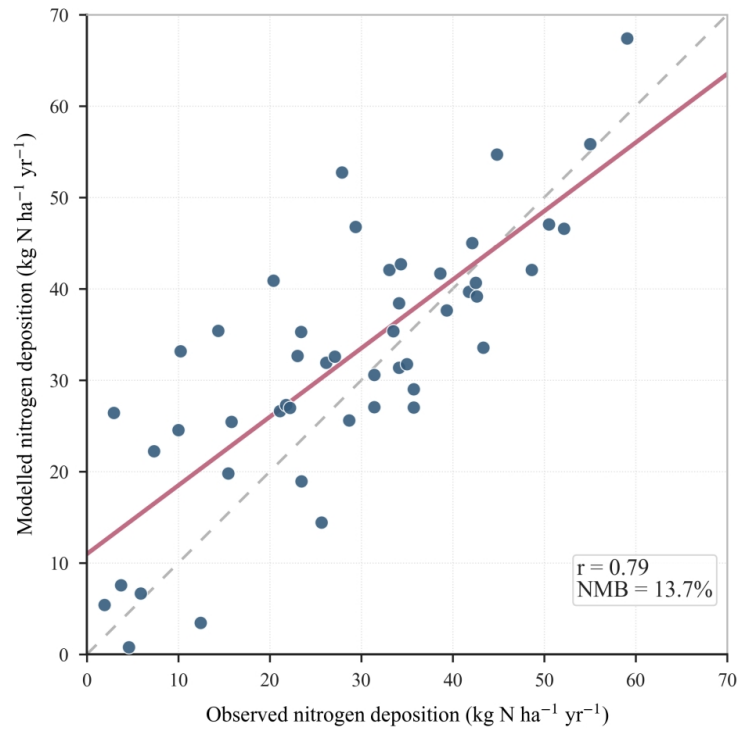


Figure S4. Evaluation of simulated total nitrogen deposition against observations in China.

Here, the observation nitrogen deposition is obtained from the Nationwide Nitrogen Deposition Monitoring Network (NNDMN). The dashed gray line represents the 1:1 line, and the solid line represents the linear regression fit.

65 **Supplementary Tables**

66 **Table S1. Sectors of MEIC emission inventory.**

NO.	MEIC	NO.	MEIC
1	Electricity	12	Other industrial sectors
2	Heating	13	Civilian coal
3	Industrial boilers	14	Civilian biomass burning
4	Cement	15	Use of chemicals for civil use
5	Coking	16	Other civilian sources
6	Steel	17	Gasoline cars
7	Petrochemical industry	18	Diesel vehicles
8	Oil and gas storage and transportation	19	Motorcycle
9	Industrial coating	20	Non-road mobile sources
10	Printing and dyeing	21	Fertilizer application
11	Architectural coatings	22	Animal husbandry

67 **Table S2. Sectors of the GAINS inventory.**

NO.	GAINS
1	Public electricity and heat production
2	Petroleum refining
3	Manufacture of solid fuels and other energy industries
4	Industrial stationary combustion: iron and steel
5	Industrial stationary combustion: non-ferrous metals
6	Industrial stationary combustion: chemical industry
7	Industrial stationary combustion: pulp, paper and printing
8	Industrial stationary combustion: food, beverages, tobacco and others
9	Industrial stationary combustion: non-metallic mineral products
10	Industrial mobile combustion
11	Civil aviation
12	Road transport: passenger cars
13	Road transport: light-duty vehicles
14	Road transport: heavy-duty vehicles and buses
15	Road transport: mopeds and motorcycles
16	Road transport: tire and brake wear

NO.	GAINS
17	Road transport: road abrasion
18	Rail transport
19	Domestic navigation, inland waterways and fisheries
20	Commercial and institutional stationary combustion
21	Residential stationary combustion
22	Agricultural, forestry, animal husbandry and fishery stationary sources
23	Agricultural, forestry, animal husbandry and fishery non-road machinery and other equipment
24	Other mobile sources, including military, land-based and recreational vessels
25	Solid fuel transformation
26	Petroleum refining, storage and transportation
27	Fugitive emissions from natural gas
28	Chemical industry: other processes
29	Nitric acid production
30	Iron and steel production
31	Aluminum production
32	Other metal production
33	Manure management: non-dairy cattle
34	Manure management: dairy cattle
35	Other solvent use
36	Paper industry
37	Open burning of crop residues
38	Open burning of waste
39	Manure management: sheep
40	Manure management: swine
41	Manure management: horses
42	Manure management: laying hens
43	Manure management: buffalo
44	Manure management: other poultry
45	Manure management: other animals
46	Nitrogen fertilizer application
47	Coal mining and handling
48	Non-coal mineral extraction and processing

NO.	GAINS
49	Construction and demolition
50	Storage, handling and transport of mineral products
51	Storage, handling and transport of chemical products
52	Storage, handling and transport of agricultural products
53	Wood processing
54	Venting and flaring
55	Household and garden mobile sources
56	Other sources included in national totals

68 **Table S3. Sectors of the MRIO table.**

NO.	MRIO
1	Agriculture, Forestry, Animal Husbandry & Fishery
2	Mining & Washing of Coal
3	Extraction of Petroleum & Natural Gas
4	Mining & Processing of Metal Ores
5	Mining & Processing of Nonmetal & other Ores
6	Food & Tobacco Processing
7	Textile Industry
8	Manufacture of Leather, Fur, Feather & Related Products
9	Processing of Timber and Furniture
10	Manufacture of Paper, Printing & Articles for Culture, Education & Sport Activity
11	Processing of Petroleum, Coking & Nuclear fuel
12	Chemical Products
13	Non-metallic Mineral Products
14	Smelting & Processing of Metals
15	Metal Products
16	General Purpose Machinery
17	Special Purpose Machinery
18	Transport Equipment
19	Electrical Machinery & Equipment
20	Communication Equipment, Computers & other Electronic Equipment
21	Manufacture of Measuring Instruments
22	Other Manufacturing & Waste Resources

23	Repair of Metal Products, Machinery & Equipment
24	Production & Supply of Electricity & Heat
25	Production & Supply of Gas
26	Production & Supply of Tap Water
27	Construction
28	Wholesale & Retail Trades
29	Transport, Storage & Postal Services
30	Accommodation & Catering
31	Information Transfer, Software & Information Technology Services
32	Finance
33	Real Estate
34	Leasing & Commercial Services
35	Research & Experimental Development
36	Comprehensive Technical Service Industry
37	Administration of Water, Environment, & Public Facilities
38	Resident, Repair & other Services
39	Education
40	Health Care & Social Work
41	Culture, Sports & Entertainment
42	Public Administration, Social Insurance & Social Organizations

69 **Table S4. Simulation Settings**

Simulation	Setting of emissions
Control	Including all emissions
X_DOM	Excluding all domestic consumption-driven emissions
X_INV	Excluding investment-driven emissions
X_GOV	Excluding government consumption-driven emissions
X_HH	Excluding household consumption-driven emissions

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