

# **Affluence and emission trade-offs: evidence from Indonesian households' carbon footprint**

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## **Online Appendix**

Table A1. *Estimate of private consumption: SUSENAS vs. national account (Rp)*

<b>Year</b>	<b>SUSENAS</b>	<b>National Accounts</b>	<b>Percentage of SUSENAS to National Accounts</b>
1996	210,507	460,297	45.73
1999	499,435	1,051,483	47.50
2002	760,003	1,557,099	48.81
2005	983,032	2,167,979	45.34
2009	1,695,220	4,031,541	42.05

*Source:* Author's computation based on the monthly household expenditure (SUSENAS, BPS) and the monthly private (household) consumption (WDI, World Bank), various series.

Table A2. *CO<sub>2</sub> intensity of economic sectors: top 10 and bottom 10*

<b>Number on list</b>	<b>Sectors</b>	<b>gram CO<sub>2</sub>/Rp</b>
<b><i>Top 10</i></b>		
1	Electricity and gas	1.04962
2	Cement	0.44619
3	Other items of non-metallic materials	0.39552
4	Glass and glass products	0.38542
5	Ceramics and building materials from clay	0.37331
6	Ceramics and items made of clay	0.36825
7	Air transport services	0.20421
8	Railway services	0.17156
9	Marine transportation services	0.16338
10	River and lake transport services	0.16153
<b><i>Bottom 10</i></b>		
10	Other nuts	0.00380
9	Other animal products	0.00374
8	Soybean	0.00287
7	Cassava	0.00280
6	Vegetables	0.00266
5	Beans	0.00218
4	Fruits	0.00185
3	Sweet potato	0.00102
2	Grains and other foodstuffs	0.00078
1	Fiber crops	0.00031

*Source:* Author's computation based on IO 2005 and GTAP-E 2005.

Table A3. *Expenditure elasticities of emission*

Share of CO <sub>2</sub> emission	Overall observation		Rural		Urban	
	2005	2009	2005	2009	2005	2009
Cereal	-0.0169	-0.0095	-0.0185	-0.0076	-0.0080	-0.0052
Vegetable and fruit	-0.0088	-0.0066	-0.0084	-0.0060	-0.0095	-0.0074
Oil and fat	-0.0044	-0.0029	-0.0054	-0.0032	-0.0033	-0.0024
Beverage	0.0045	-0.0006	0.0070	0.0023	0.0021	-0.0048
Egg, fish, meat, dairy	0.0033	0.0143	0.0074	0.0159	-0.0011	0.0122
Tobacco	0.0023	0.0046	0.0048	0.0089	-0.0005	-0.0011
Fuel and light	-0.0686	-0.0916	-0.0740	-0.1045	-0.0639	-0.0741
Telecommunication	0.0065	0.0068	0.0041	0.0064	0.0091	0.0073
Transportation	0.0277	0.0334	0.0304	0.0379	0.0250	0.0272
Health	0.0022	0.0021	0.0023	0.0019	0.0021	0.0024
Education	-0.0011	0.0047	-0.0004	0.0045	-0.0019	0.0048
Toiletry	-0.0012	-0.0007	-0.0014	-0.0008	-0.0009	-0.0007
Clothes	0.0000	0.0024	0.0003	0.0031	-0.0003	0.0013
House and durable goods	0.0349	0.0263	0.0391	0.0282	0.0306	0.0240
Services and rent	0.0087	0.0077	0.0045	0.0056	0.0136	0.0105
Taxes	0.0007	0.0010	0.0005	0.0008	0.0009	0.0012
Recreation, ceremony	0.0071	0.0057	0.0079	0.0066	0.0062	0.0047

*Note:* All estimated coefficients are significant at the one per cent level.

*Source:* Author's estimation ( $sCO2_{ij} = \beta_0 + \beta_{1ij} \ln EXP_i + \beta_{2ij} X_i + \varepsilon_{ij}$ ).

Table A4. *Quantile regression*

	OLS		Q(0.1)		Q(0.25)		Q(0.50)		Q(0.75)		Q(0.90)	
	Coef.	se	Coef.	se	Coef.	se	Coef.	se	Coef.	se	Coef.	se
lnexp_cap	1.899	0.019	2.564	0.036	2.285	0.027	1.888	0.023	1.603	0.024	1.300	0.030
lnexp_capsq	-0.028	0.001	-0.048	0.001	-0.039	0.001	-0.027	0.001	-0.019	0.001	-0.009	0.001
HH-head age	0.022	0.001	0.029	0.002	0.026	0.001	0.023	0.001	0.020	0.001	0.015	0.001
HH-head agesq	-3.25E-04	1.82E-05	-4.49E-04	3.41E-05	-3.93E-04	2.56E-05	-3.36E-04	2.21E-05	-2.86E-04	2.26E-05	-2.04E-04	2.85E-05
HH-head agecub	1.61E-06	1.16E-07	2.33E-06	2.17E-07	2.02E-06	1.63E-07	1.68E-06	1.41E-07	1.37E-06	1.44E-07	9.36E-07	1.82E-07
HH size	-0.006	0.000	0.007	0.001	-0.001	0.001	-0.009	0.000	-0.013	0.000	-0.013	0.001
Urbanity	0.167	0.001	0.225	0.002	0.210	0.002	0.173	0.001	0.134	0.002	0.102	0.002
Married HH-head	0.062	0.002	0.083	0.004	0.070	0.003	0.060	0.003	0.045	0.003	0.036	0.004
Female HH-head	0.050	0.003	0.062	0.005	0.054	0.004	0.049	0.003	0.042	0.003	0.040	0.004
Elementary school	0.043	0.002	0.054	0.003	0.050	0.002	0.046	0.002	0.034	0.002	0.030	0.003
Secondary school	0.047	0.002	0.060	0.004	0.055	0.003	0.046	0.002	0.038	0.003	0.029	0.003
High school	0.075	0.002	0.093	0.004	0.086	0.003	0.076	0.002	0.064	0.002	0.054	0.003
At least college	0.096	0.003	0.117	0.005	0.107	0.004	0.099	0.003	0.085	0.003	0.074	0.004
Survey year 2009	-0.025	0.001	-0.026	0.002	-0.031	0.002	-0.032	0.002	-0.029	0.002	-0.028	0.002
_cons	-17.203	0.146	-23.311	0.274	-20.660	0.206	-17.054	0.178	-14.379	0.181	-11.666	0.229
#Obs	549659		549659		549659		549659		549659		549659	
(pseudo) R-sq	0.8194		0.5341		0.5553		0.5783		0.5996		0.6165	

Source: Author's estimation.

Table A5. *Emission share to total emission vs. expenditure share to total expenditure, by quintile*

	Overall household				I				II			
	s CO2		s EXP		s CO2		s EXP		s CO2		s EXP	
	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009
Cereal	0.025	0.023	0.162	0.155	0.044	0.032	0.261	0.210	0.030	0.027	0.198	0.181
Vegetable and fruit	0.050	0.049	0.092	0.089	0.059	0.054	0.101	0.102	0.054	0.052	0.100	0.095
Oil and fat	0.011	0.010	0.031	0.028	0.016	0.013	0.040	0.037	0.013	0.011	0.036	0.031
Beverage	0.065	0.068	0.150	0.145	0.058	0.062	0.134	0.144	0.062	0.065	0.147	0.144
Egg, fish, meat, dairy	0.076	0.073	0.132	0.124	0.076	0.065	0.116	0.112	0.077	0.072	0.130	0.122
Tobacco	0.032	0.031	0.083	0.077	0.034	0.027	0.078	0.069	0.036	0.033	0.090	0.083
Fuel and light	0.573	0.559	0.066	0.061	0.586	0.613	0.063	0.070	0.591	0.576	0.067	0.063
Telecommunication	0.006	0.009	0.015	0.021	0.001	0.004	0.001	0.009	0.002	0.007	0.004	0.015
Transportation	0.050	0.070	0.035	0.045	0.028	0.043	0.017	0.028	0.038	0.061	0.026	0.039
Health	0.005	0.006	0.017	0.021	0.004	0.005	0.013	0.018	0.004	0.005	0.015	0.018
Education	0.007	0.009	0.026	0.028	0.008	0.006	0.026	0.018	0.007	0.008	0.023	0.025
Toiletry	0.008	0.007	0.029	0.025	0.009	0.007	0.030	0.028	0.008	0.007	0.030	0.026
Clothes	0.019	0.018	0.034	0.032	0.021	0.017	0.034	0.030	0.020	0.019	0.035	0.032
House and durable	0.028	0.027	0.021	0.020	0.017	0.016	0.011	0.011	0.020	0.019	0.014	0.014
Services and rent	0.028	0.029	0.113	0.111	0.024	0.025	0.087	0.102	0.024	0.026	0.093	0.099
Taxes	0.001	0.001	0.007	0.008	0.001	0.001	0.004	0.005	0.001	0.001	0.005	0.007
Recreation, entert.	0.016	0.012	0.012	0.009	0.016	0.011	0.011	0.008	0.015	0.011	0.011	0.008

	III				IV				V			
	s CO2		s EXP		s CO2		s EXP		s CO2		s EXP	
	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009
Cereal	0.023	0.023	0.159	0.155	0.017	0.019	0.122	0.131	0.010	0.015	0.072	0.098
Vegetable and fruit	0.051	0.049	0.097	0.090	0.046	0.046	0.090	0.084	0.037	0.040	0.072	0.074
Oil and fat	0.011	0.010	0.032	0.028	0.009	0.009	0.028	0.025	0.006	0.007	0.019	0.019
Beverage	0.064	0.068	0.152	0.146	0.066	0.070	0.154	0.146	0.077	0.075	0.162	0.148
Egg, fish, meat, dairy	0.079	0.075	0.140	0.127	0.079	0.077	0.145	0.131	0.069	0.076	0.129	0.127
Tobacco	0.035	0.033	0.092	0.084	0.033	0.032	0.088	0.081	0.025	0.027	0.068	0.070
Fuel and light	0.584	0.558	0.068	0.060	0.573	0.539	0.068	0.058	0.532	0.511	0.065	0.055
Telecommunication	0.003	0.009	0.009	0.020	0.007	0.011	0.018	0.026	0.016	0.015	0.043	0.035
Transportation	0.048	0.072	0.033	0.047	0.059	0.082	0.042	0.053	0.078	0.093	0.056	0.060
Health	0.004	0.005	0.016	0.020	0.005	0.006	0.018	0.022	0.006	0.008	0.023	0.026
Education	0.006	0.009	0.024	0.028	0.006	0.010	0.025	0.032	0.008	0.012	0.031	0.039
Toiletry	0.007	0.007	0.030	0.024	0.007	0.006	0.029	0.024	0.007	0.006	0.028	0.023
Clothes	0.019	0.019	0.035	0.032	0.018	0.019	0.034	0.033	0.017	0.018	0.032	0.032
House and durable	0.024	0.024	0.017	0.018	0.030	0.030	0.023	0.023	0.052	0.045	0.043	0.035
Services and rent	0.025	0.027	0.103	0.104	0.029	0.029	0.120	0.113	0.040	0.037	0.161	0.135
Taxes	0.001	0.001	0.006	0.008	0.001	0.001	0.008	0.009	0.002	0.002	0.012	0.013
Recreation, entert.	0.015	0.011	0.012	0.009	0.016	0.013	0.013	0.010	0.018	0.015	0.016	0.012

Source: Author's computation, based on GTAP-E, Indonesian Input Output and SUSENAS 2005 and 2009.

Table A6. *Expenditure category: description*

	<b>Notes</b>
Cereal	Rice, grains, and cereals
Vegetable and fruit	Vegetable and fruit
Oil and fat	Oil and fat ingredients
Beverage	Drink material, season, noodles, chips, alcohol drink
Egg, fish, meat, and dairy	Egg, fish, meat, dairy products
Tobacco	Tobacco
Fuel and light	Electricity bill, fuel
Telecommunication	Telephone bill, other telecommunication
Transportation	Transportation cost
Health	Health costs, health insurance
Education	Education costs
Toiletry	Soap, cosmetic, etc.
Clothes	Clothes
House and durable goods	House and durable goods
Services and rent	Services
Taxes	Taxes, retribution, other taxes
Recreation, entertainment, ceremony	Recreation, entertainment, ceremony

Table A7. *Expenditure: share to total expenditure (%)*

	2005			2009		
	National	Rural	Urban	National	Rural	Urban
Cereal	16.24	19.68	10.49	15.51	18.67	9.72
Vegetable and fruit	9.20	9.72	8.34	8.89	9.37	8.01
Oil and fat	3.08	3.51	2.35	2.81	3.21	2.09
Beverage	14.99	14.32	16.12	14.54	13.62	16.23
Egg, fish, meat, dairy	13.21	13.44	12.83	12.38	12.60	11.98
Tobacco	8.30	9.08	6.99	7.72	8.42	6.42
Fuel and light	6.62	6.08	7.54	6.12	5.87	6.58
Telecommunication	1.50	0.55	3.09	2.11	1.53	3.18
Transportation	3.49	2.64	4.91	4.50	3.86	5.68
Health	1.71	1.61	1.89	2.06	1.89	2.36
Education	2.58	1.93	3.65	2.84	2.41	3.62
Toiletry	2.94	2.84	3.11	2.49	2.46	2.54
Clothes	3.38	3.42	3.31	3.17	3.21	3.10
House and durable goods	2.15	2.13	2.17	2.02	2.02	2.02
Services and rent	11.26	9.11	14.86	11.07	9.17	14.53
Taxes	0.68	0.53	0.93	0.84	0.67	1.16
Recreation, entertainment, ceremony	1.25	1.34	1.09	0.93	1.01	0.78



Table A8. *Elasticities to CO2 emission sources by quintiles, pooled estimation*

	Q1	Q2	Q3	Q4	Q5	Overall
Cereal	-0.010	-0.011	-0.010	-0.008	-0.005	-0.009
Vegetable and fruit	-0.004	-0.006	-0.007	-0.009	-0.009	-0.007
Oil and fat	-0.003	-0.004	-0.004	-0.004	-0.003	-0.003
Beverage	0.003	0.004	0.001	0.003	-0.009	0.001
Egg, fish, meat, dairy	0.016	0.025	0.020	0.013	-0.006	0.011
Tobacco	0.016	0.010	0.006	-0.001	-0.006	0.004
Fuel and light	-0.061	-0.083	-0.084	-0.090	-0.076	-0.082
Telecommunication	0.004	0.005	0.007	0.009	0.006	0.007
Transportation	0.029	0.034	0.032	0.033	0.017	0.031
Health	0.000	0.001	0.002	0.003	0.005	0.002
Education	0.003	0.002	0.002	0.002	0.001	0.003
Toiletry	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Clothes	0.004	0.002	0.001	0.001	-0.001	0.002
House and durable goods	0.008	0.015	0.022	0.034	0.051	0.029
Services and rent	-0.004	0.002	0.005	0.008	0.021	0.007
Taxes	0.000	0.001	0.001	0.001	0.001	0.001
Recreation, ceremony	0.001	0.004	0.007	0.006	0.010	0.006
No of observations						549,659

$$sCO2_{ij} = \beta_0 + \beta_{1ij} \ln EXP_i + \beta_{2ij} X_i + \varepsilon_{ij}$$

Table A9. *Expenditure elasticities to CO2 emission shares, 2005 and 2009 estimation*

Share of CO2 emission	I		II		III		IV		V	
	2005	2009	2005	2009	2005	2009	2005	2009	2005	2009
Cereal	-0.0298	-0.0036	-0.0113	-0.0114	-0.0089	-0.0138	-0.0090	-0.0135	-0.0046	-0.0084
Vegetable and fruit	-0.0086	-0.0030	-0.0073	-0.0049	-0.0079	-0.0072	-0.0064	-0.0088	-0.0079	-0.0094
Oil and fat	-0.0065	-0.0017	-0.0043	-0.0030	-0.0047	-0.0038	-0.0041	-0.0041	-0.0025	-0.0028
Beverage	0.0099	-0.0007	-0.0014	0.0057	-0.0075	0.0056	-0.0130	0.0000	-0.0102	-0.0079
Egg, fish, meat, dairy	0.0087	0.0184	0.0096	0.0221	0.0128	0.0146	0.0075	0.0073	-0.0145	-0.0017
Tobacco	0.0088	0.0202	0.0138	0.0144	0.0116	0.0080	0.0068	0.0005	-0.0052	-0.0072
Fuel and light	-0.0026	-0.0911	-0.0459	-0.1007	-0.0548	-0.0956	-0.0565	-0.0857	-0.0690	-0.0776
Telecommunication	0.0006	0.0050	0.0010	0.0070	0.0024	0.0076	0.0051	0.0083	0.0062	0.0059
Transportation	0.0198	0.0349	0.0270	0.0445	0.0301	0.0467	0.0314	0.0375	0.0144	0.0195
Health	0.0001	-0.0002	-0.0006	0.0002	0.0000	0.0008	0.0010	0.0021	0.0043	0.0047
Education	-0.0011	0.0061	0.0039	0.0056	0.0034	0.0061	0.0011	0.0055	-0.0024	0.0037
Toiletry	-0.0018	-0.0006	-0.0008	-0.0011	-0.0006	-0.0012	-0.0009	-0.0012	-0.0010	-0.0006
Clothes	0.0021	0.0057	0.0036	0.0054	0.0027	0.0024	0.0016	0.0022	-0.0010	-0.0008
House and durable goods	0.0076	0.0078	0.0140	0.0104	0.0156	0.0184	0.0285	0.0320	0.0565	0.0487
Services and rent	-0.0083	-0.0019	-0.0046	-0.0005	-0.0040	0.0019	-0.0009	0.0064	0.0215	0.0216
Taxes	-0.0002	0.0003	0.0004	0.0005	0.0003	0.0007	0.0004	0.0010	0.0014	0.0016
Recreation, ceremony	-0.0009	0.0028	0.0011	0.0029	0.0074	0.0057	0.0055	0.0072	0.0129	0.0083

$$sCO2_{ij} = \beta_0 + \beta_{1ij} \ln EXP_i + \beta_{2ij} X_i + \varepsilon_{ij}$$

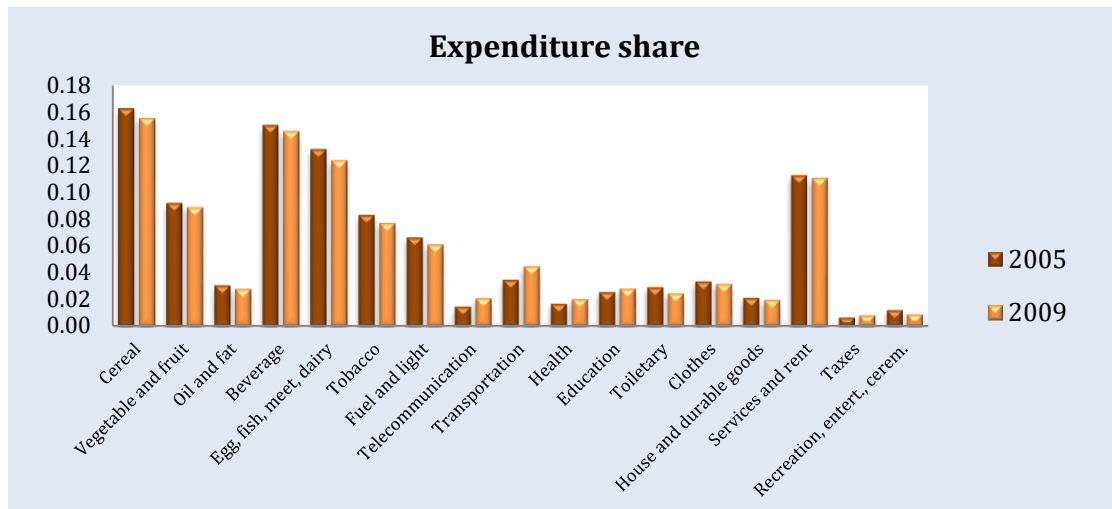


Figure A1. *Expenditure share per consumption category*  
 Source: Author's computation based on SUSENAS (2005, 2009)

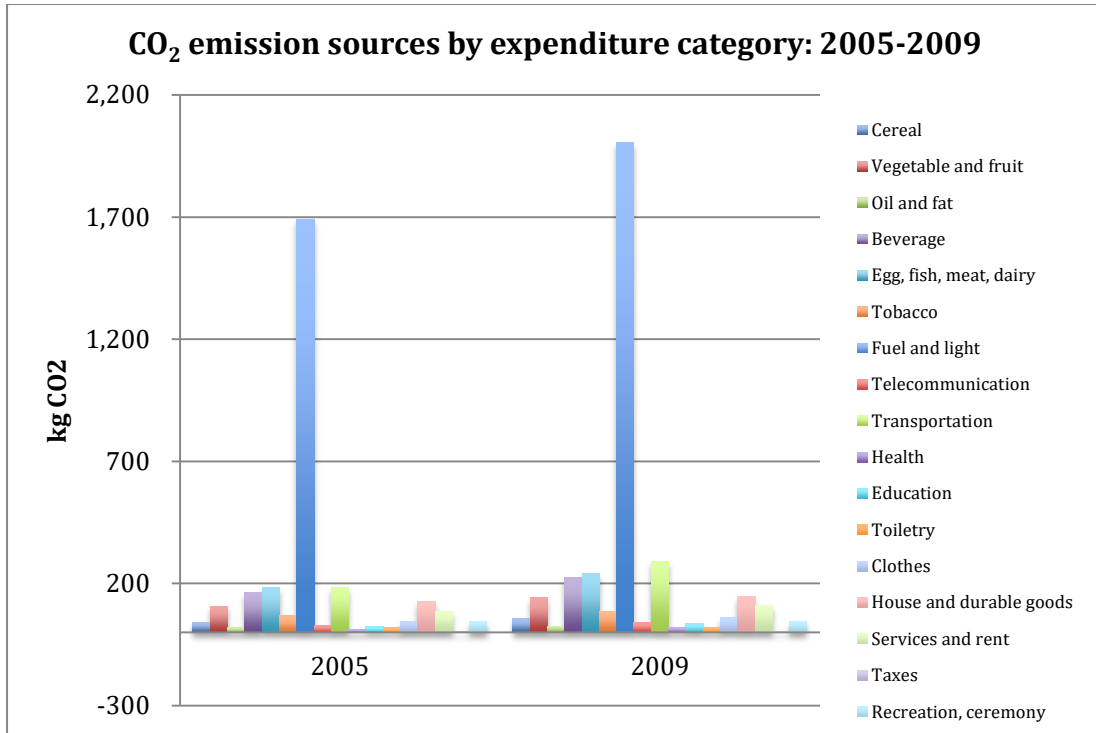


Figure A2. Emissions in expenditure subgroup (2005 and 2009)

Source: Author's computation based on SUSENAS 2005-2009, IO 2005, GTAP-E 2005

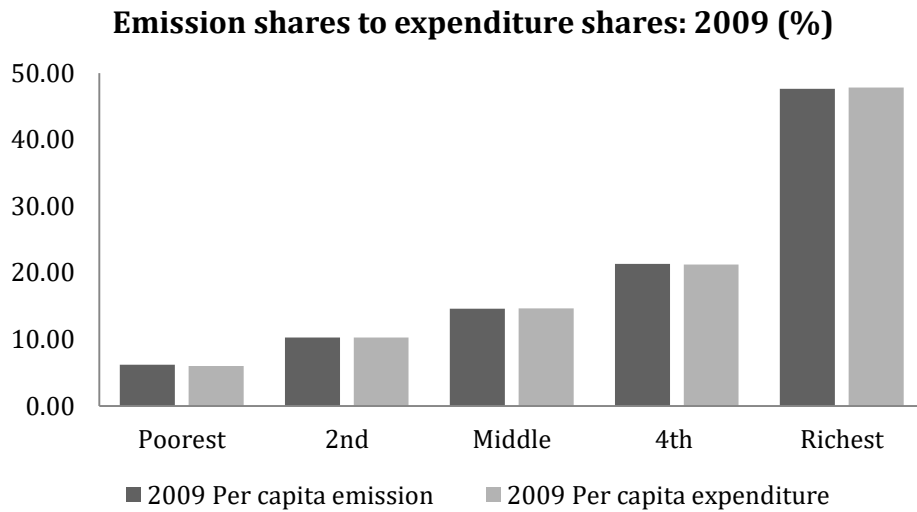
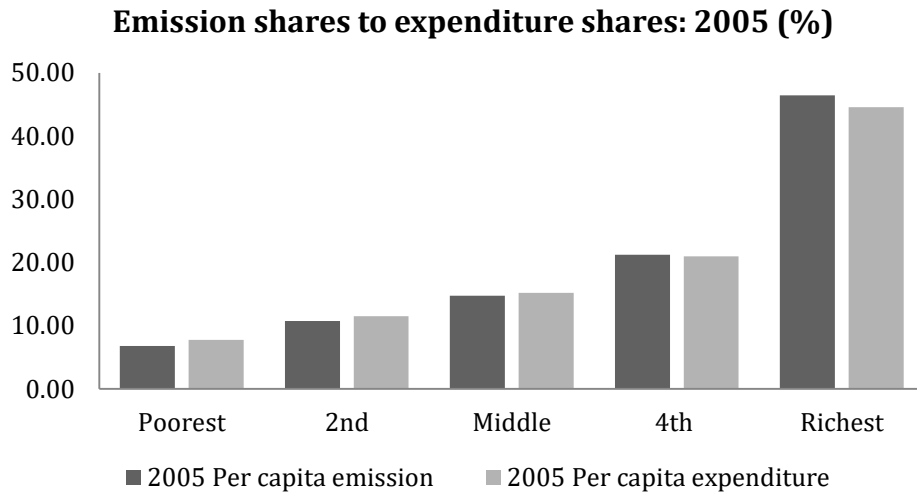


Figure A3. *Emission shares to expenditure shares by quintile (2005 and 2009)*  
 Source: Author's computation based on SUSENAS 2005-2009, IO 2005, GTAP-E 2005