Composition and sensitivity of residential energy consumption

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ONLINE APPENDIX

Table A1. Information Criteria for different income polynomials

	Residential			
	TFC	Modern fuels	Electricity	Gas
Model 1				
ln(income)	0.029***	0.091***	0.098***	0.123***
	(0.006)	(0.009)	(0.008)	(0.014)
N	4368	4368	4256	4206
r2_a	0.915	0.965	0.973	0.924
rmse	0.088	0.111	0.084	0.171
bic	-8527.288	-6439.092	-8677.200	-2565.647
aic	-8916.593	-6828.398	-9064.921	-2952.647
F	787.226	2028.834	2594.300	853.981
Model 2				
ln(income)	0.069	0.498***	0.364***	0.401***
	(0.043)	(0.057)	(0.043)	(0.088)
ln(income)2	-0.002	-0.022***	-0.015***	-0.016**
	(0.002)	(0.003)	(0.002)	(0.005)
N	4368	4368	4256	4206
r2_a	0.915	0.966	0.974	0.924
rmse	0.088	0.111	0.083	0.171
bic	-8519.808	-6485.172	-8708.894	-2567.845
aic	-8915.496	-6880.860	-9102.971	-2961.190
F	774.311	2020.996	2575.901	842.047
Model 3				
ln(income)	-0.868***	-0.975**	-0.826***	-2.752***
	(0.241)	(0.310)	(0.237)	(0.499)
ln(income)2	0.108***	0.153***	0.126***	0.359***
	(0.028)	(0.036)	(0.028)	(0.058)
ln(income)3	-0.004***	-0.007***	-0.005***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.002)
N	4368	4368	4256	4206
r2_a	0.915	0.966	0.974	0.925
rmse	0.087	0.110	0.083	0.170
bic	-8527.670	-6500.946	-8727.562	-2602.284
aic	-8929.740	-6903.016	-9127.995	-3001.973
F	764.731	1999.326	2550.295	837.395
Model 4				
ln(income)	2.875*	-4.046*	-1.542	-6.881*
	(1.428)	(1.795)	(1.384)	(2.957)
ln(income)2	-0.559*	0.699*	0.254	1.096*
	(0.252)	(0.317)	(0.245)	(0.524)
ln(income)3	0.048*	-0.049*	-0.015	-0.072
	(0.020)	(0.024)	(0.019)	(0.041)
ln(income)4	-0.001**	0.001	0.000	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
N	4368	4368	4256	4206
r2_a	0.916	0.966	0.974	0.925
rmse	0.087	0.110	0.083	0.170
bic	-8526.642	-6495.700	-8719.493	-2596.030
aic	-8935.093	-6904.152	-9126.282	-3002.063
F	753.793	1968.583	2509.374	824.340

Table A2. Modern fuels regressions by income group

Variable	High income			Middle income			Low income		
	FE	MG	CEE	FE	MG	CEE	FE	MG	CEE
Lagged dependent	0.91	0.73	0.53	0.93	0.68	0.53	0.94	0.67	0.54
	0.01	0.03	0.04	0.01	0.04	0.04	0.01	0.03	0.04
Ln(GDP ppp pe capita)	0.05	0.11	0.09	0.07	0.26	0.36	0.11	0.19	0.35
	0.02	0.07	0.07	0.02	0.06	0.09	0.02	0.07	0.07
Ln(oil price)	-0.01	-0.02		-0.01	-0.02		0.00	0.00	
	0.01	0.01		0.01	0.01		0.01	0.01	
ln_shydro	-0.12	0.17	-0.30	0.01	-1.17	0.65	0.28	1.30	1.30
	0.16	0.22	0.18	0.02	1.28	0.91	0.19	0.83	0.59
ln_xnf	0.00	0.00		0.00	0.00		0.00	0.00	
	0.00	0.00		0.00	0.00		0.00	0.00	
Trend		0.00	0.00		0.00	-0.01		0.01	0.00
		0.00	0.00		0.00	0.00		0.00	0.01
Average dependent			0.68			0.45			0.77
			0.10			0.14			0.18
Lagged ave. dependent			-0.33			-0.13			-0.34
			0.09			0.11			0.18
Average Ln(GDP ppp pe capita)			-0.06			-0.17			-0.08
			0.10			0.09			0.16
Average ln_shydro			-2.02			-0.78			-1.93
			1.05			1.17			1.63
Constant	0.11	0.50	0.68	-0.26	-0.83	-1.72	-0.67	-1.03	-1.54
	0.17	0.62	0.97	0.13	0.53	0.68	0.14	0.47	0.97
Income long run elasticity	0.51	0.40	0.20	1.02	0.81	0.77	1.79	0.57	0.75
	0.20	0.25	0.14	0.23	0.21	0.21	0.19	0.21	0.16
Observations	1,848	1,848	1,848	1,134	1,134	1,134	1,386	1,386	1,386
Countries	44	44	44	27	27	27	33	33	33

Notes: GDP: gross domestic product; PPP: purchasing power parity. Long-run elasticities are estimated through a dynamic version of equation (2), and their variances are estimated by the delta method.

Table A3. Robustness check

Dependent var.:	Share			Modern fuels		
Estimator:	FE	MG	CCE	FE	MG	CCE
Static model						
ln(GDP per capita)	0.144	0.018	0.038	1.093	0.374	0.380
	(0.044)	(0.020)	(0.019)	(0.227)	(0.116)	(0.084)
ln(electricity price)	0.031	-0.002	0.003	0.059	-0.053	-0.025
	(0.015)	(0.004)	(0.003)	(0.070)	(0.022)	(0.020)
ln(share of hydro)	0.406	0.047	0.152	1.632	0.328	-0.140
	(0.088)	(0.125)	(0.080)	(0.289)	(0.808)	(0.486)
ln(net exports of fossil fuels)	0.000	0.000	-0.000	0.011	0.004	0.001
	(0.002)	(0.000)	(0.000)	(0.007)	(0.002)	(0.001)
Dynamic model						
ln(GDP per capita)	0.005	0.013	0.030	0.057	0.178	0.369
	(0.002)	(0.008)	(0.012)	(0.015)	(0.043)	(0.068)
ln(electricity price)	0.000	-0.001	-0.000	-0.012	-0.024	-0.015
	(0.001)	(0.002)	(0.002)	(0.005)	(0.011)	(0.012)
ln(share of hydro)	0.014	0.087	0.043	0.042	-0.204	-0.555
	(0.005)	(0.041)	(0.044)	(0.021)	(0.318)	(0.285)
ln(net exports of fossil fuels)	-0.000	-0.000	-0.000	-0.001	0.000	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
lagged dependent	0.944	0.688	0.475	0.933	0.675	0.438
	(0.010)	(0.028)	(0.038)	(0.008)	(0.034)	(0.040)
Long-run elasticities						
GDP per capita	0.116	0.059	0.08	0.842	0.548	0.657
	(0.04)	(0.035)	(0.033)	(0.167)	(0.144)	(0.129)
Electricity price	0.004	-0.003	-0.001	-0.179	-0.074	-0.026
	(0.025)	(0.007)	(0.005)	(0.081)	(0.034)	(0.022)

Note: This table presents the results of specification in table 2 with electricity prices instead of international oil prices. FE: fixed effect; MG: mean group; CCE: common correlated effects; TFC: total final consumption. Robust standard errors in parentheses. The static model, equation (1), shows the short-run elasticities. Long-run elasticities are derived from the dynamic model, equation (2), and their corresponding standard errors are estimated using the delta method. In the case of share of modern energy, the elasticity is calculated at the fuel sample average of s; 0.72. MG and CCE include country-specific trends. CCE corrects for cross-sectional correlation.

Table A4. KRLS pointwise derivatives

	Avg.	SE	t	p-value	P25	P50	P75
Modern fuels							
ln(gdp per capita)	1.245	0.019	65.773	0.000	0.960	1.310	1.600
ln(electricity prices)	-0.087	0.017	-5.277	0.000	-0.263	-0.093	0.084
ln(Share hydro)	0.112	0.226	0.497	0.619	-2.254	-0.423	1.509
ln(XN fuels)	0.072	0.014	5.102	0.000	-0.042	0.042	0.163
R2=0.86 ; Eff. Df=59.46							
Transitional fuels							
ln(gdp per capita)	0.997	0.052	19.008	0.000	0.357	0.920	1.453
ln(electricity prices)	-0.562	0.046	-12.322	0.000	-1.039	-0.453	-0.049
ln(Share hydro)	-9.392	0.631	-14.882	0.000	-15.333	-9.250	-2.631
ln(XN fuels)	-0.623	0.039	-15.829	0.000	-1.121	-0.597	-0.148
R2=0.40 ; Eff. Df=63.39							
Traditional fuels							
ln(gdp per capita)	-0.635	0.063	-10.103	0.000	-1.558	-0.585	0.289
ln(electricity prices)	0.421	0.055	7.690	0.000	0.010	0.495	0.828
ln(Share hydro)	15.702	0.755	20.804	0.000	2.942	16.320	27.258
ln(XN fuels)	0.247	0.047	5.244	0.000	-0.036	0.209	0.631
R2=0.49 ; Eff. Df=63.39							

*Note:* Avg.: average coefficient; SE: standard error; XN: net exports.

Table A5. Robustness check – Arellano Bond and Kiviet estimators

|		Share		Modern fuels		Transitional fuels		Traditional fuels		TFC, residential	
		AB	KV	AB	KV	AB	KV	AB	KV	AB	KV
lagged dependent	Coef.	0.91	0.962	0.892	0.942	0.858	0.964	0.855	0.96	0.883	0.936
	SE	0.010	0.005	0.011	0.004	0.039	0.006	0.034	0.006	0.017	0.005
	t	88.9	193	79.7	215	22.3	151	25.3	148	51.2	178
ln(GDP per capita)	Coef.	0.015	0.003	0.142	0.050	-0.186	-0.023	-0.005	0.027	0.050	0.013
	SE	0.004	0.001	0.027	0.007	0.062	0.015	0.028	0.016	0.018	0.005
	t	3.74	2.78	5.27	6.97	-2.99	-1.61	-0.177	1.71	2.81	2.89
ln(oil price)	Coef.	-0.00123	-0.00022	-0.0157	-0.00553	-0.0136	-0.0163	0.0104	-0.00233	-0.0076	-0.00377
	SE	0.001	0.001	0.004	0.004	0.010	0.008	0.007	0.009	0.003	0.003
	t	-2.09	-0.364	-4	-1.5	-1.33	-1.96	1.45	-0.266	-2.26	-1.3
ln(share of hydro)	Coef.	0.081	0.007	0.329	0.011	-2.030	0.104	-0.612	-0.086	-0.513	-0.068
	SE	0.039	0.009	0.234	0.053	0.884	0.138	0.344	0.146	0.257	0.045
	t	2.09	0.802	1.41	0.211	-2.29	0.751	-1.78	-0.584	-2	-1.52
ln(net exports of fossil fuels)	Coef.	0.000	0.000	0.000	0.001	-0.001	-0.002	-0.008	-0.001	0.001	-0.001
	SE	0.000	0.000	0.002	0.001	0.005	0.003	0.004	0.003	0.001	0.001
	t	-0.12	1.09	-0.06	1.20	-0.26	-0.80	-1.97	-0.23	0.54	-0.60
Long run elasticities											
GDP per capita		0.167	0.090	1.315	0.860	-1.310	-0.650	-0.034	0.675	0.430	0.205
Oil price		-0.014	-0.006	-0.145	-0.095	-0.096	-0.453	0.072	-0.058	-0.065	-0.059

Note: AB: Arellano-Bond; KV: Kiviet.

a. Modern fuels
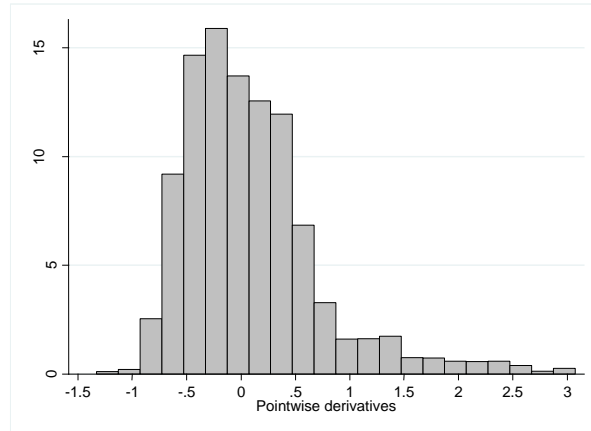
b. Transitional fuels
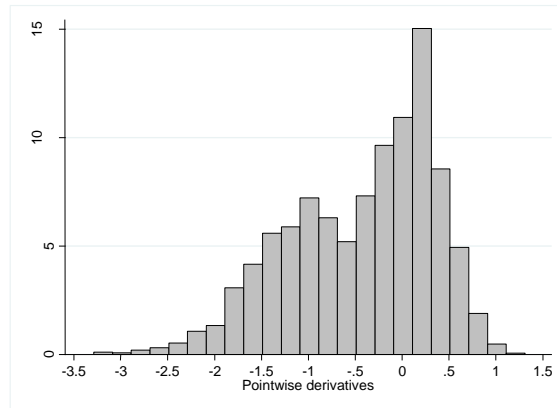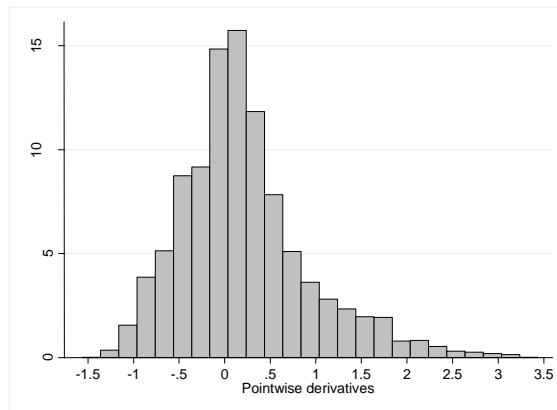

c. Traditional fuels

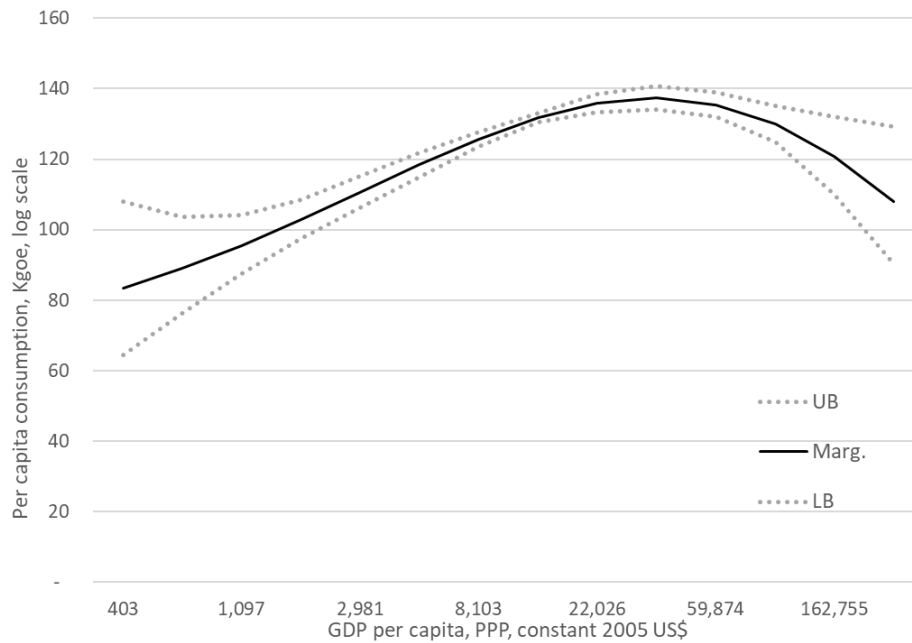**Figure A1.** Histograms of price pointwise derivatives.

Figure A2. Long-run estimated income effects of modern energy consumption.

Note: GDP: gross domestic product; Kgoe: kilograms of oil equivalent. Scales are in logs. The estimation is based on 104 countries. In-sample predictions. The predicted margins are based on a polynomial of degree 3 for GDP per capita. The model was selected on the basis of adjusted R^2, RMSE, BIC and AIC where RMSE = root mean square error; BIC = Bayesian information criterion; and AIC = Akaike information criterion.
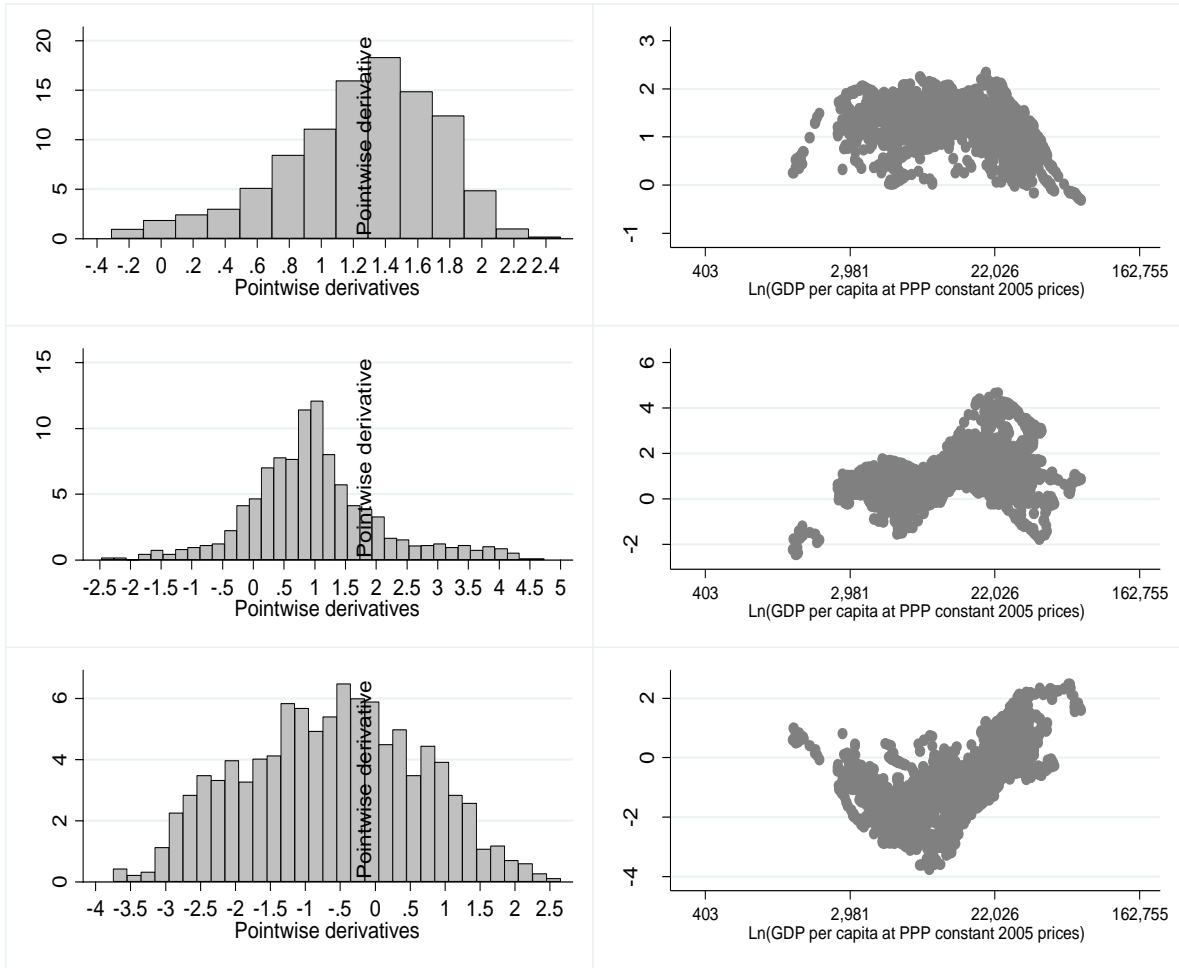
Figure A3. Estimated income pointwise derivatives along the income distribution.

Note: In the distribution graphs, the *x*-axes are in log scales.