

A spatial equilibrium analysis of using agricultural resources to produce biofuel

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Electronic supplementary material

Supplementary Tables S1–2

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Table S1. Simulation results of ethanol production under market operations (by source)

Term	Unit	Scenarios				
		A	B	C	D	E
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	1	1	1	1	1
Ethanol (energy crop)	t	581 785	581 991	591 438	610 529	612 188
Ethanol (energy crop residual)	t	373 080	373 225	376 860	394 641	395 802
Ethanol (general crop residual)	t	125 160	125 160	125 178	124 958	125 276
Total Production	t	1 080 025	1 080 377	1 093 477	1 130 128	1 133 266
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	2	2	2	2	2
Ethanol (energy crop)	t	581 889	591 438	602 096	612 188	616 854
Ethanol (energy crop residual)	t	373 153	376 860	388 738	395 802	399 069
Ethanol (general crop residual)	t	125 160	125 178	125 277	125 276	124 778
Total Production	t	1 080 202	1 093 477	1 116 112	1 133 266	1 140 701
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	3	3	3	3	3
Ethanol (energy crop)	t	581 991	593 351	608 266	612 189	631 160
Ethanol (energy crop residual)	t	373 225	378 234	393 057	395 803	425 101
Ethanol (general crop residual)	t	125 160	125 178	124 834	125 276	124 778
Total Production	t	1 080 377	1 096 763	1 126 156	1 133 268	1 181 039
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	4	4	4	4	4
Ethanol (energy crop)	t	591 336	602 096	606 553	630 850	644 242
Ethanol (energy crop residual)	t	376 788	388 738	391 858	424 884	450 970
Ethanol (general crop residual)	t	125 178	125 277	116 950	124 778	124 778
Total Production	t	1 093 302	1 116 111	1 115 360	1 180 512	1 219 990
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	5	5	5	5	5
Ethanol (energy crop)	t	591 438	608 265	612 188	644 242	644 136
Ethanol (energy crop residual)	t	376 860	393 057	395 802	450 970	450 895
Ethanol (general crop residual)	t	125 178	124 834	125 276	124 778	124 778
Total Production	t	1 093 477	1 126 156	1 133 266	1 219 990	1 219 809
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	6	6	6	6	6
Ethanol (energy crop)	t	602 087	608 266	630 850	644 089	644 141
Ethanol (energy crop residual)	t	388 732	393 057	424 884	450 863	450 899
Ethanol (general crop residual)	t	125 277	124 834	124 778	124 778	124 778
Total Production	t	1 116 096	1 126 157	1 180 512	1 219 730	1 219 818
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	7	7	7	7	7
Ethanol (energy crop)	t	608 265	618 339	631 160	644 136	644 141
Ethanol (energy crop residual)	t	393 057	400 109	425 101	450 895	450 899
Ethanol (general crop residual)	t	124 834	124 753	124 778	124 778	124 778
Total Production	t	1 126 156	1 143 201	1 181 039	1 219 809	1 219 818

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Continuation Table S1.

Term	Unit	Scenarios				
		A	B	C	D	E
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	8	8	8	8	8
Ethanol (energy crop)	t	608 266	618 345	644 242	644 141	644 998
Ethanol (energy crop residual)	t	393 057	400 112	450 970	450 899	451 499
Ethanol (general crop residual)	t	124 834	124 753	124 778	124 778	124 783
Total Production	t	1 126 157	1 143 210	1 219 990	1 219 818	1 221 280
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	9	9	9	9	9
Ethanol (energy crop)	t	618 339	632 341	644 136	644 997	646 160
Ethanol (energy crop residual)	t	400 109	425 927	450 895	451 498	452 312
Ethanol (general crop residual)	t	124 753	124 753	124 778	124 783	124 835
Total Production	t	1 143 201	1 183 021	1 219 809	1 221 277	1 223 307
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	10	10	10	10	10
Ethanol (energy crop)	t	618 345	645 435	644 141	646 160	646 160
Ethanol (energy crop residual)	t	400 112	451 804	450 899	452 312	452 312
Ethanol (general crop residual)	t	124 753	124 753	124 778	124 835	124 835
Total Production	t	1 143 210	1 221 992	1 219 818	1 223 307	1 223 307

Source: Authors' calculation

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Table S2. Simulation results of emission reduction under market operations (by source)

Term	Unit	Scenarios				
		A	B	C	D	E
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	1	1	1	1	1
Emission offset (energy crop)	t	64 917	64 940	65 977	68 147	68 332
Emission offset (energy crop residual)	t	41 785	41 801	42 208	44 200	44 330
Emission offset (general crop residual)	t	14 018	14 018	14 020	13 995	14 031
Total offset	t	120 720	120 759	122 205	126 342	126 693
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	2	2	2	2	2
Emission offset (energy crop)	t	64 929	65 977	67 202	68 332	68 855
Emission offset (energy crop residual)	t	41 793	42 208	43 539	44 330	44 696
Emission offset (general crop residual)	t	14 018	14 020	14 031	14 031	13 975
Total offset	t	120 740	122 205	124 772	126 693	127 526
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	3	3	3	3	3
Emission offset (energy crop)	t	64 940	66 191	67 893	68 332	70 571
Emission offset (energy crop residual)	t	41 801	42 362	44 022	44 330	47 611
Emission offset (general crop residual)	t	14 018	14 020	13 981	14 031	13 975
Total offset	t	120 759	122 574	125 897	126 693	132 158
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	4	4	4	4	4
Emission offset (energy crop)	t	65 966	67 202	67 701	70 536	72 155
Emission offset (energy crop residual)	t	42 200	43 539	43 888	47 587	50 509
Emission offset (general crop residual)	t	14 020	14 031	13 098	13 975	13 975
Total offset	t	122 186	124 772	124 688	132 099	136 639
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	5	5	5	5	5
Emission offset (energy crop)	t	65 977	67 893	68 332	72 155	72 143
Emission offset (energy crop residual)	t	42 208	44 022	44 330	50 509	50 500
Emission offset (general crop residual)	t	14 020	13 981	14 031	13 975	13 975
Total offset	t	122 205	125 897	126 693	136 639	136 619
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	6	6	6	6	6
Emission offset (energy crop)	t	67 201	67 893	70 536	72 138	72 144
Emission offset (energy crop residual)	Ton	43 538	44 022	47 587	50 497	50 501
Emission offset (general crop residual)	t	14 031	13 981	13 975	13 975	13 975
Total offset	t	124 770	125 897	132 099	136 610	136 620
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	7	7	7	7	7
Emission offset (energy crop)	t	67 893	69 021	70 571	72 143	72 144
Emission offset (energy crop residual)	t	44 022	44 812	47 611	50 500	50 501
Emission offset (general crop residual)	t	13 981	13 972	13 975	13 975	13 975
Total offset	t	125 897	127 806	132 158	136 619	136 620

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Continuation Table S2.

Term	Unit	Scenarios				
		A	B	C	D	E
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	8	8	8	8	8
Emission offset (energy crop)	t	67 893	69 022	72 155	72 144	72 240
Emission offset (energy crop residual)	t	44 022	44 813	50 509	50 501	50 568
Emission offset (general crop residual)	t	13 981	13 972	13 975	13 975	13 976
Total offset	t	125 897	127 807	136 639	136 620	136 783
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/ton	9	9	9	9	9
Emission offset (energy crop)	t	69 021	70 703	72 143	72 240	72 370
Emission offset (energy crop residual)	t	44 812	47 704	50 500	50 568	50 659
Emission offset (general crop residual)	t	13 972	13 972	13 975	13 976	13 981
Total offset	t	127 806	132 380	136 619	136 783	137 010
Gasoline price	USD/L	0.75	0.85	0.94	1.04	1.13
Emission price	USD/t	10	10	10	10	10
Emission offset (energy crop)	t	69 022	72 289	72 144	72 370	72 370
Emission offset (energy crop residual)	t	44 813	50 602	50 501	50 659	50 659
Emission offset (general crop residual)	t	13 972	13 972	13 975	13 981	13 981
Total offset	t	127 807	136 863	136 620	137 010	137 010

Source: Authors' calculation