Competition between two products

Unbalanced competition and regime change diachronic model

$$
\begin{aligned}
z_1'(t) &= m\Bigg\{ \left[p_{1a} + q_{1a}\frac{z(t)}{m}\right](1 - I_{t>c_2}) \\
&\quad + \left[p_{1c} + (q_{1c} + \delta)\frac{z_1(t)}{m} + q_{1c}\frac{z_2(t)}{m}\right] I_{t>c_2} \Bigg\} \left[1 - \frac{z(t)}{m}\right], \\
z_2'(t) &= m\left[p_2 + (q_2 - \gamma)\frac{z_1(t)}{m} + q_2\frac{z_2(t)}{m}\right]\left[1 - \frac{z(t)}{m}\right] I_{t>c_2},
\end{aligned}
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within imitation

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\end{aligned}
$$

within imitation

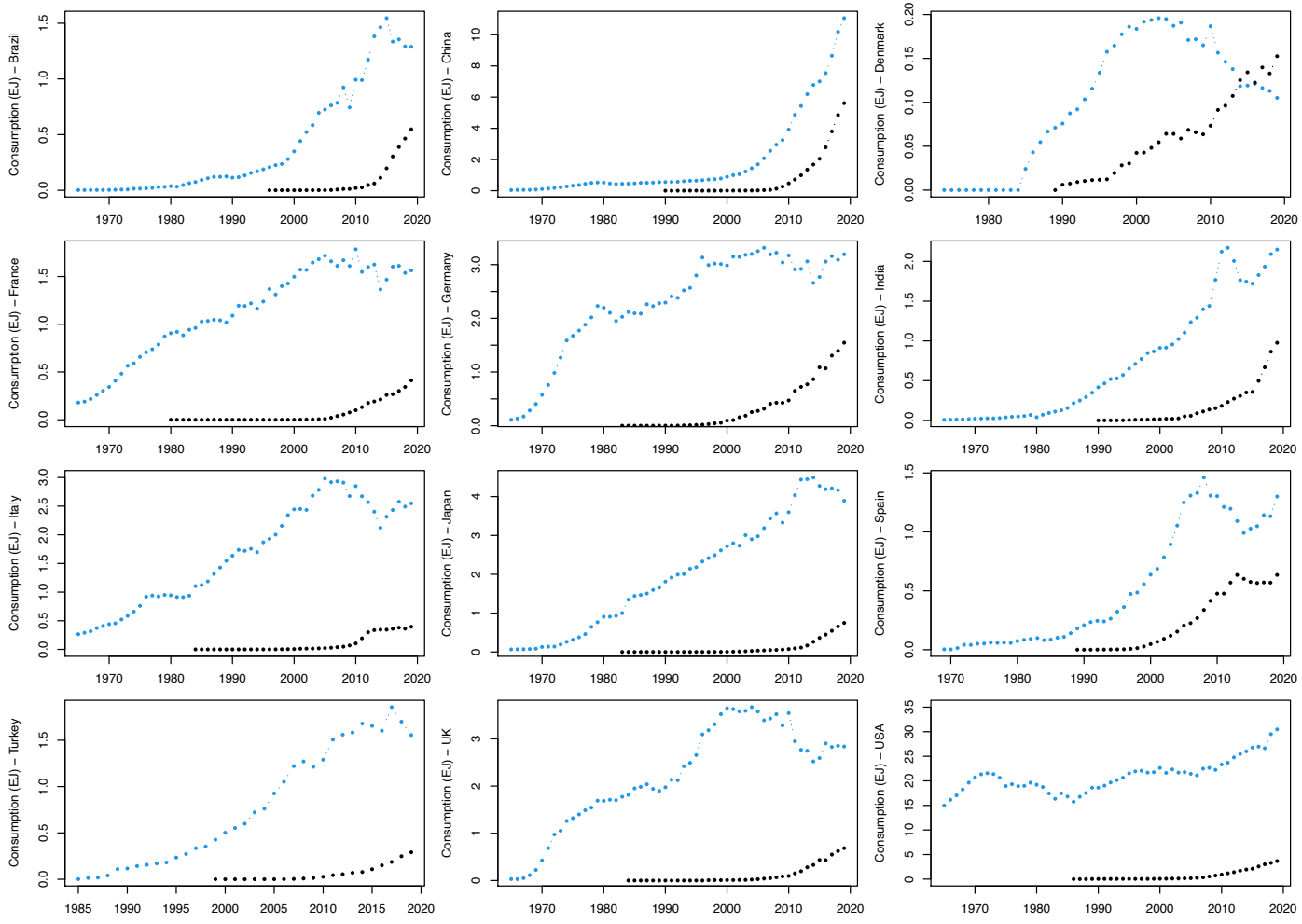
cross imitation

Model

Sign of cross-imitation coefficients: competition-collaboration

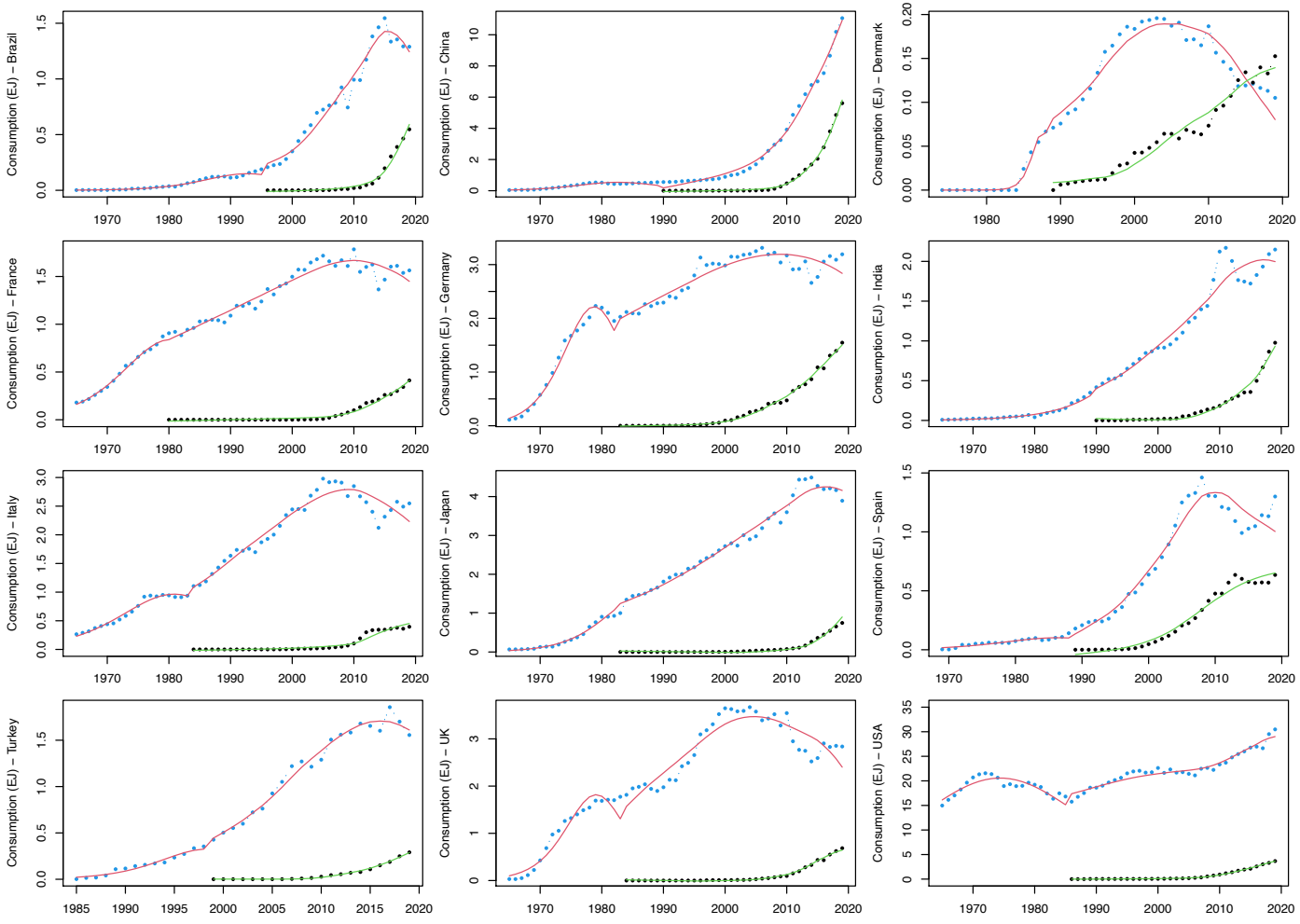
q_{1c}	$q_2 - \gamma$	interpretation
negative	negative	full competition
negative	positive	2 competes with 1, 1 collaborates with 2
positive	negative	2 collaborates with 1, 1 competes with 2
positive	positive	full collaboration

Example: energy technologies in competition



Is there a significant interplay?

Example: energy technologies in competition



UCRCD fit: there is a significant interplay...what kind?

Example: energy technologies in competition

Country	m_c	p_{1c}	$(q_{1c}+\delta)$	q_{1c}	q_2	$(q_2-\gamma)$	δ	γ
Brazil	61	0.003	0.12	-0.29	0.41	0.002	0.41	
China	2429	0.000	0.13	-0.05	0.2	0.010	0.19	
Denmark	10	0.007	0.11	-0.19	0.22	-0.010	0.30	0.23
France	139	0.006	0.04	-0.20	0.24	0.001	0.24	
Germany	409	0.004	0.03	-0.10	0.14	0.003	0.13	
India	158	0.002	0.08	-0.16	0.24	-0.001	0.24	
Italy	132	0.008	0.07	-0.18	0.33	0.001	0.25	0.33
Japan	532	0.002	0.04	-0.27	0.32	-0.001	0.32	
Spain	48	0.002	0.14	-0.09	0.24	0.004	0.23	
Turkey	52	0.007	0.13	-0.32	0.45	-0.0002	0.45	
UK	153	0.009	0.07	-0.33	0.40	0.001	0.40	
USA	1257	0.013	0.04	1.35	0.39	-0.0002	-1.3	0.40

Dynamic relationship between natural gas and renewables for the 12 countries selected