

Supporting Information

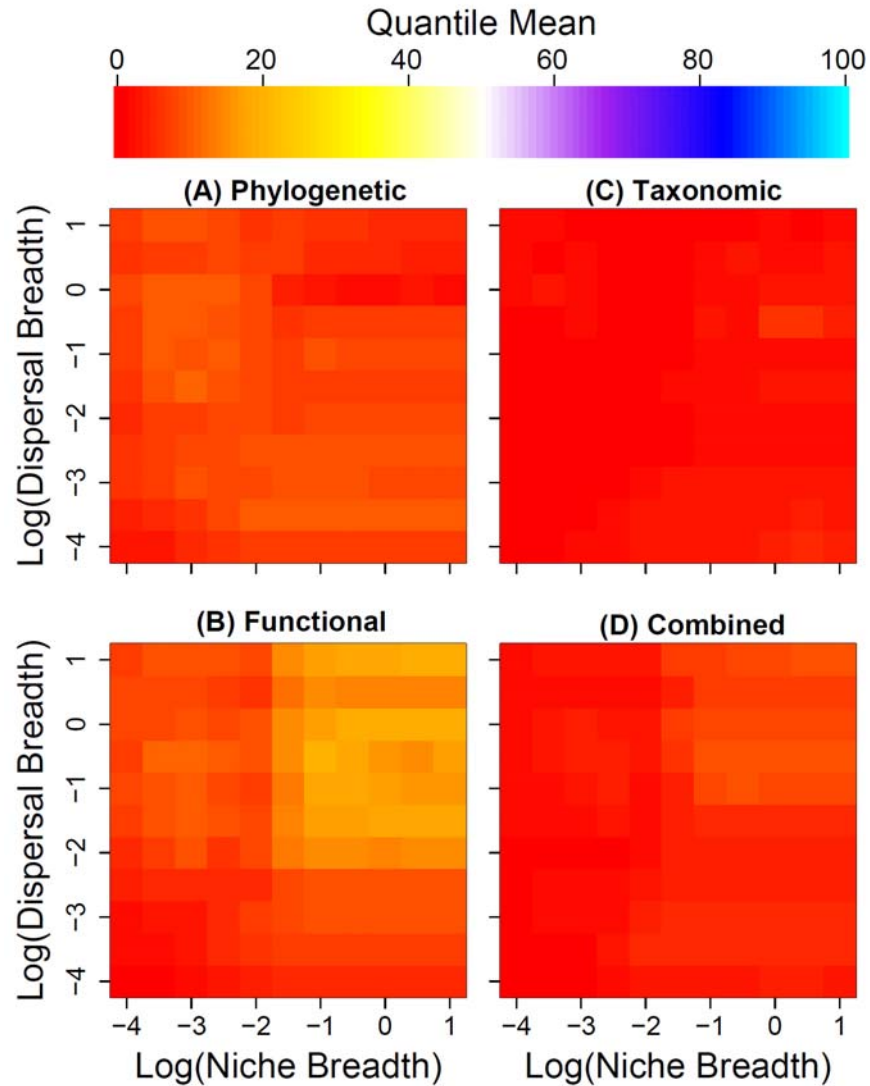


Figure S1. Mean quantiles of negative log-likelihoods across all 100 replicates at each combination of dispersal and niche breadths. The quantile at any given combination of dispersal and niche breadths is the fraction of other parameter combinations that generated similar beta-diversity patterns. A quantile near zero thus indicates that the beta-diversity patterns generated at that parameter combination were clearly unique and distinguishable from the patterns at all other parameter combinations. Likewise, large quantiles would indicate, but were not observed, that a given parameter combination produced beta-diversity patterns similar to the patterns generated under different parameter combinations.

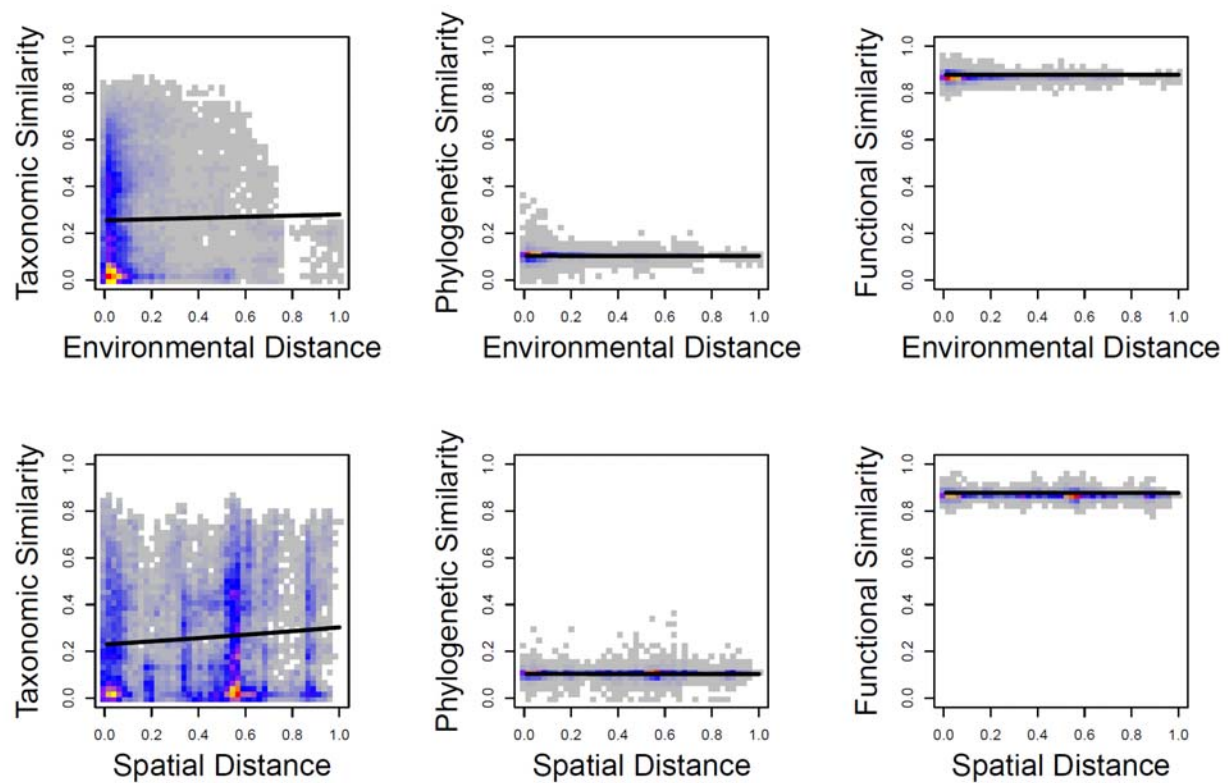


Figure S2. Simulated distance decay patterns under weak dispersal limitation ($d = 10$) and weak environmental filtering ($n = 10$). Warmer colors indicate higher densities of points. Solid black lines describe the best-fit exponential decay function. Note that all relationships are flat, as expected when both processes are very weak.

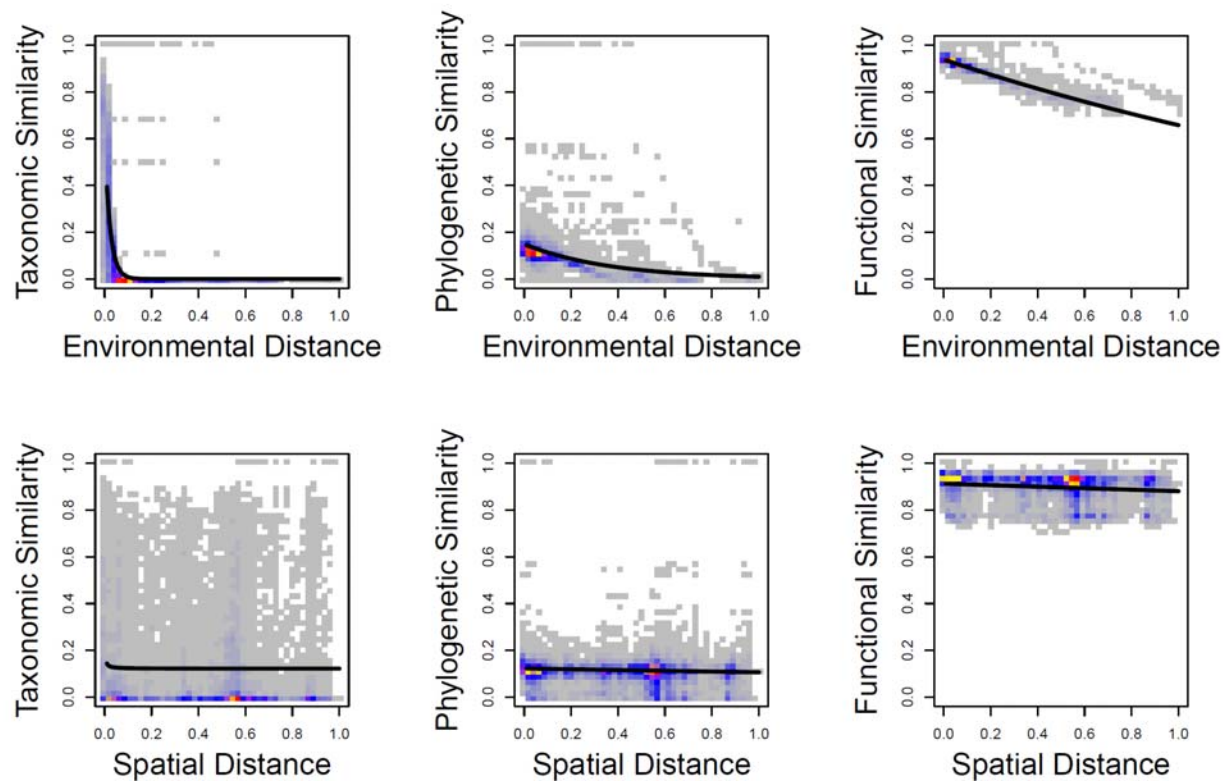


Figure S3. Simulated distance decay patterns under weak dispersal limitation ($d = 10$) and strong environmental filtering ($n = 10^{-4}$). Warmer colors indicate higher densities of points. Solid black lines describe the best-fit exponential decay function. Note that similarities decay with environmental distance and not spatial distance, as expected when only environmental filtering influences community assembly.

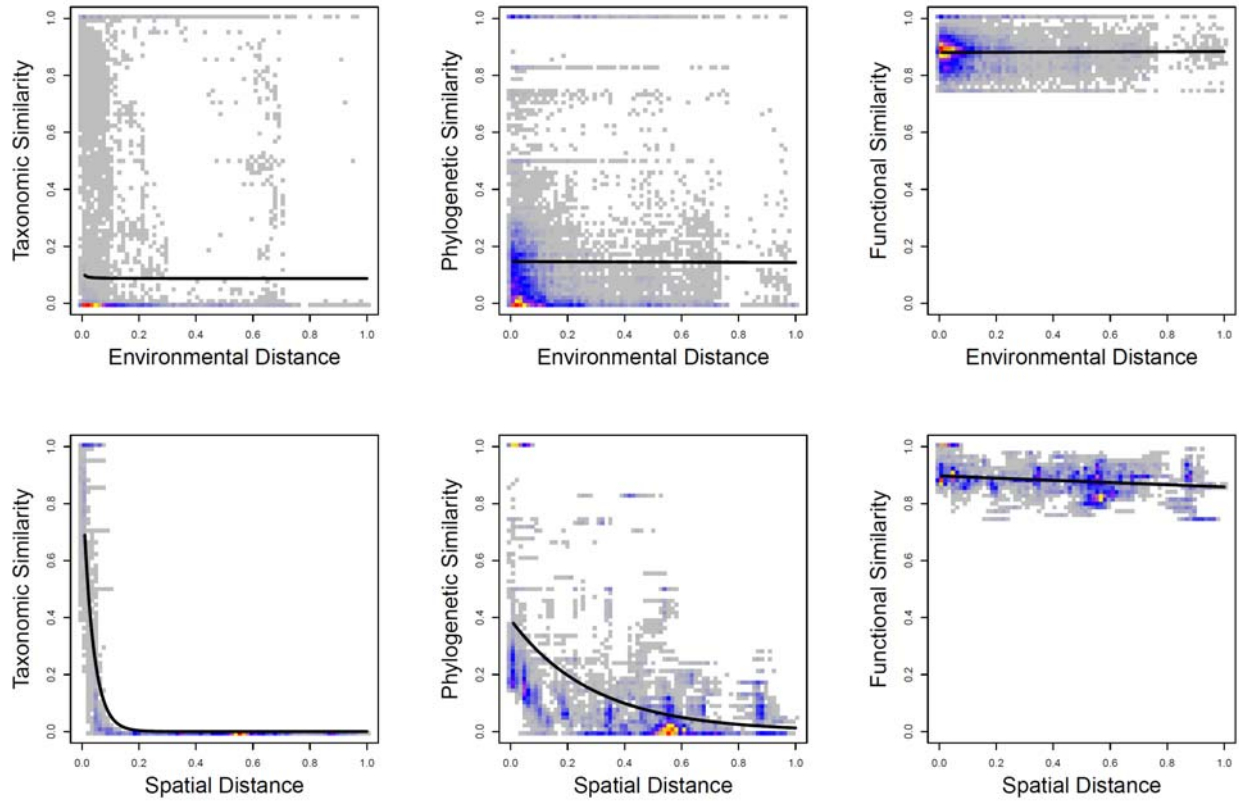


Figure S4. Simulated distance decay patterns under strong dispersal limitation ($d = 10^{-4}$) and weak environmental filtering ($n = 10^1$). Warmer colors indicate higher densities of points. Solid black lines describe the best-fit exponential decay function. Note that similarities decay with spatial distance and not environmental distance, as expected when only dispersal limitation influences community assembly.

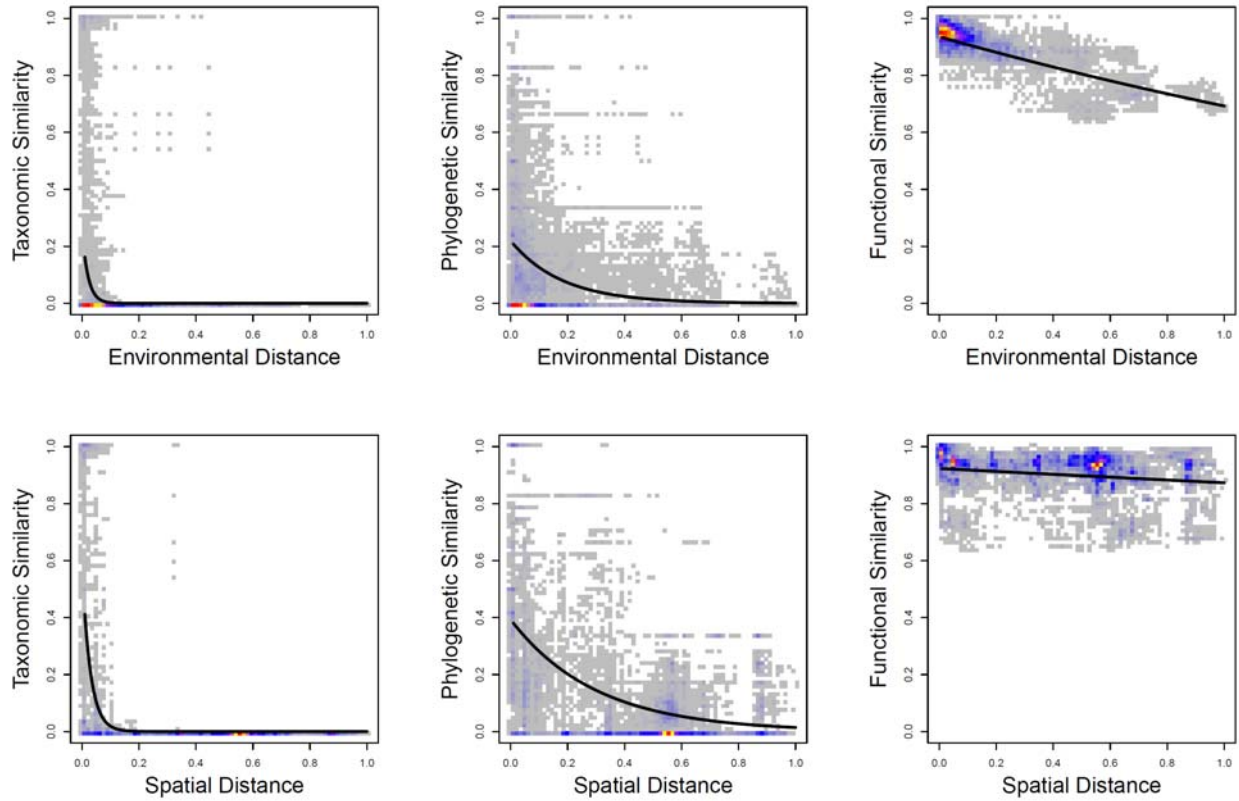


Figure S5. Simulated distance decay patterns under strong dispersal limitation ($d = 10^{-4}$) and strong environmental filtering ($n = 10^{-4}$). Warmer colors indicate higher densities of points. Solid black lines describe the best-fit exponential decay function. Note that similarities decay with spatial distance and with environmental distance, as expected when both dispersal limitation and environmental filtering influence community assembly.

Table S1: Decay fits of functional, phylogenetic, and Bray-Curtis empirical data. Variance is given for the full model and for that accounted for spatial and environmental distances individually. Slopes of the exponential fits are also given.

Flux								
	Model.Form	Model.Var.	Env.Var.	Spat.Var.	Env.Spat.Var.	Env.Slope	Spat.Slope	Neg.Log.Like
Functional	exp	0.285	0.271	0.001	0.013	-0.227	-0.011	-45380.904
Phylogenetic	exp	0.078	0.076	0.000	0.003	-1.136	-0.026	-25397.723
Bray-Curtis	exp	0.178	0.114	0.075	-0.011	-16.505	-2.069	-25414.339
Functional	dbRDA	0.100	0.090	0.012	-0.002	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.040	0.028	0.011	0.001	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.060	0.019	0.041	0.001	-999.000	-999.000	-999.000
Depth								
Functional	exp	0.063	0.049	0.011	0.003	-0.080	-0.030	-41373.393
Phylogenetic	exp	0.024	0.021	0.002	0.001	-0.432	-0.100	-24543.805
Bray-Curtis	exp	0.235	0.170	0.099	-0.035	-4.875	-2.130	-26466.178
Functional	dbRDA	0.031	0.021	0.010	0.000	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.042	0.030	0.011	0.001	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.092	0.050	0.039	0.002	-999.000	-999.000	-999.000
Temperature								
Functional	exp	0.251	0.236	0.008	0.006	-0.216	-0.025	-44683.348
Phylogenetic	exp	0.072	0.069	0.002	0.001	-1.098	-0.098	-25296.798
Bray-Curtis	exp	0.213	0.149	0.089	-0.025	-16.546	-2.067	-26060.325
Functional	dbRDA	0.052	0.042	0.009	0.000	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.040	0.028	0.014	-0.002	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.061	0.020	0.043	-0.001	-999.000	-999.000	-999.000
Ox.Util								

Functional	exp	0.052	0.038	0.002	0.013	-0.129	-0.012	-41200.296
Phylogenetic	exp	0.020	0.017	0.000	0.003	-0.777	-0.005	-24489.019
Bray-Curtis	exp	0.111	0.047	0.078	-0.013	-8.407	-2.609	-24249.652
Functional	dbRDA	0.012	0.002	0.008	0.001	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.018	0.006	0.011	0.001	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.054	0.013	0.043	-0.001	-999.000	-999.000	-999.000

Phosphate

Functional	exp	0.045	0.030	0.001	0.013	-0.107	-0.010	-41088.898
Phylogenetic	exp	0.012	0.009	0.000	0.003	-0.490	-0.027	-24364.836
Bray-Curtis	exp	0.134	0.069	0.090	-0.025	-8.505	-2.887	-24634.954
Functional	dbRDA	0.014	0.004	0.007	0.002	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.019	0.007	0.015	-0.003	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.059	0.018	0.048	-0.006	-999.000	-999.000	-999.000

Salinity

Functional	exp	0.067	0.053	0.008	0.007	-0.123	-0.025	-41436.184
Phylogenetic	exp	0.059	0.056	0.001	0.002	-1.197	-0.059	-25084.980
Bray-Curtis	exp	0.143	0.079	0.047	0.017	-7.888	-3.365	-24720.198
Functional	dbRDA	0.002	0.008	0.005	0.005	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.028	0.016	0.018	-0.006	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.058	0.017	0.046	-0.004	-999.000	-999.000	-999.000

Diss.Ox

Functional	exp	0.040	0.025	0.005	0.010	-0.089	-0.020	-41007.804
Phylogenetic	exp	0.029	0.026	0.000	0.003	-0.858	-0.004	-24626.306
Bray-Curtis	exp	0.091	0.026	0.055	0.009	-5.749	-2.045	-23917.302
Functional	dbRDA	0.014	0.004	0.009	0.001	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.027	0.015	0.009	0.003	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.051	0.009	0.039	0.002	-999.000	-999.000	-999.000

Ox.Sat

Functional	exp	0.039	0.025	0.004	0.011	-0.107	-0.018	-41001.396
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Phylogenetic	exp	0.026	0.023	0.000	0.003	-0.970	0.002	-24576.530
Bray-Curtis	exp	0.111	0.046	0.073	-0.009	-7.674	-2.086	-24244.693
Functional	dbRDA	0.012	0.002	0.009	0.001	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.019	0.007	0.010	0.002	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.052	0.010	0.041	0.000	-999.000	-999.000	-999.000

Silicate

Functional	exp	0.016	0.001	0.010	0.004	-0.019	-0.030	-40645.181
Phylogenetic	exp	0.004	0.001	0.003	-0.001	0.181	-0.154	-24245.536
Bray-Curtis	exp	0.161	0.097	0.094	-0.030	-10.483	-2.819	-25103.984
Functional	dbRDA	0.020	0.010	0.011	-0.001	-999.000	-999.000	-999.000
Phylogenetic	dbRDA	0.029	0.017	0.019	-0.007	-999.000	-999.000	-999.000
Bray-Curtis	dbRDA	0.070	0.028	0.049	-0.007	-999.000	-999.000	-999.000

Table 2: Decay fits of functional, phylogenetic, and Bray-Curtis empirical data. Individual models test the relative contributions of flux, temperature, and depth in explaining variance. Slopes of the exponential fits are also given.

	Model.Form	Model.Var.	Flux.Var.	Temp.Var.	Flux.Temp.Var.	Flux.Slope	Spat.Slope	Temp.Slope	Neg.Log.Like
Flux.Temperature									
Functional	exp	0.330	0.080	0.045	0.205	-0.156	-0.013	-0.119	-46349.698
Phylogenetic	exp	0.094	0.022	0.016	0.056	-0.793	-0.030	-0.654	-25660.183
Bray-Curtis	exp	0.223	0.010	0.045	0.169	-4.925	-1.832	-12.865	-26243.658
Flux.Depth									
Functional	exp	0.285	0.222	0.000	0.063	-0.228	-0.011	0.002	-45381.604
Phylogenetic	exp	0.079	0.056	0.001	0.023	-1.079	-0.026	-0.100	-25411.667
Bray-Curtis	exp	0.257	0.022	0.078	0.156	-4.934	-1.874	-4.081	-26899.980
Temperature.Depth									
Functional	exp	0.255	0.191	0.004	0.059	-0.234	-0.026	0.027	-44761.327
Phylogenetic	exp	0.072	0.048	0.000	0.024	-1.129	-0.099	0.038	-25298.459
Bray-Curtis	exp	0.259	0.025	0.046	0.189	-6.316	-2.010	-3.422	-26949.174