Figure S4. Power differentials (a) between MLC and MinP-M, and (b) between MLC and PC80, each plotted against power differentials between MLC and SSBw. The latter is on the x axis. Each point corresponds to one gene with power estimated in 1000 replicated datasets (nominal alpha=0.05). Data were generated under simulation models 1-5, as defined in Table 2, and were analysed with (typed) and without (untyped) the causal variant(s) in the regression model.

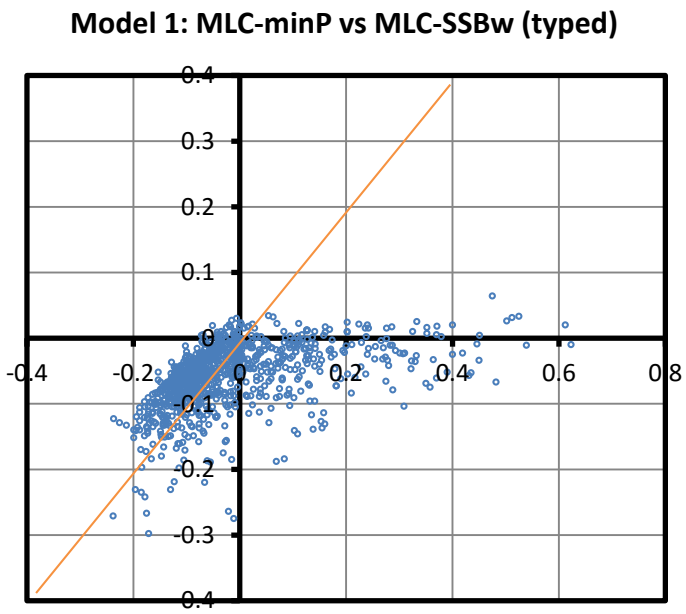
In the upper panels: MLC power is greater than MinP-M power for genes above the x axis, MLC power is greater than SSBw power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both MinP-M and SSBw. Genes close to the diagonal line have MinP-M power ≈ SSBw power, while those below the line have MinP-M power > SSBw power.

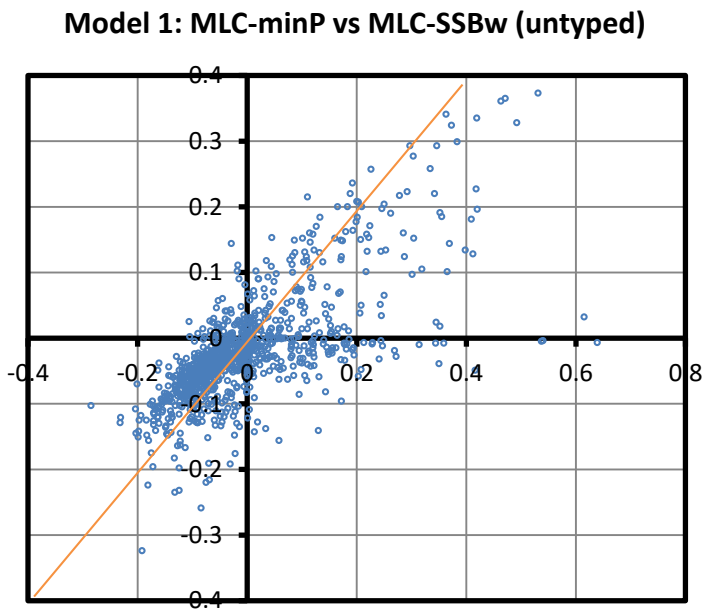
In the lower panels: MLC power is greater than PC80 power for genes above the x axis, MLC power is greater than SSBw power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both PC80 and SSBw. Genes close to the diagonal line have PC80 power ≈ SSBw power, while those below the line have PC80 power > SSBw power.

The table summarizes the number of genes according to power inequalities among the methods.

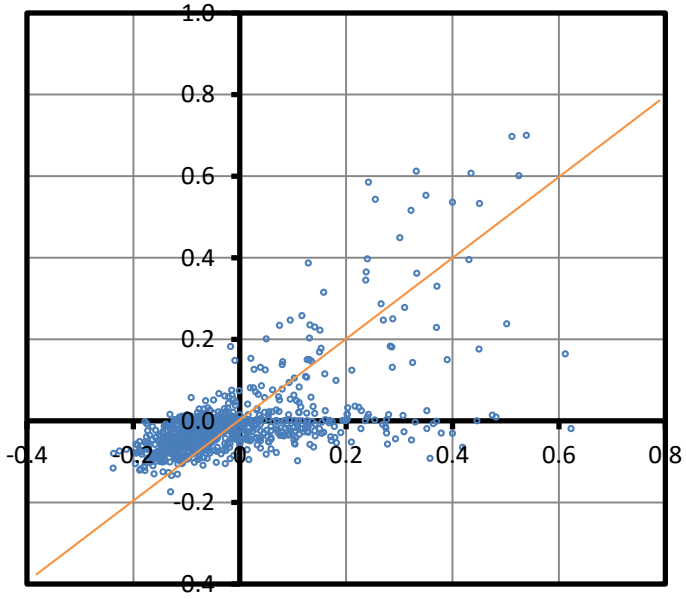
			Power Differential				
Model	# of genes	Analysis	MLC>MinPM	MLC>SSBw	MLC>PC80	MLC>Min,SSB	MLC>all 3
1	1000	Typed	80	369	260	53	32
		Untyped	258	348	349	193	132
2	993	Typed	62	51	142	27	9
		Untyped	223	279	249	170	97
3	935	Typed	372	295	278	220	136
		Untyped	312	275	296	199	109
4	993	Typed	119	167	269	89	54
		Untyped	286	354	344	236	157
5	935	Typed	359	315	244	234	130
		Untyped	313	302	267	220	108

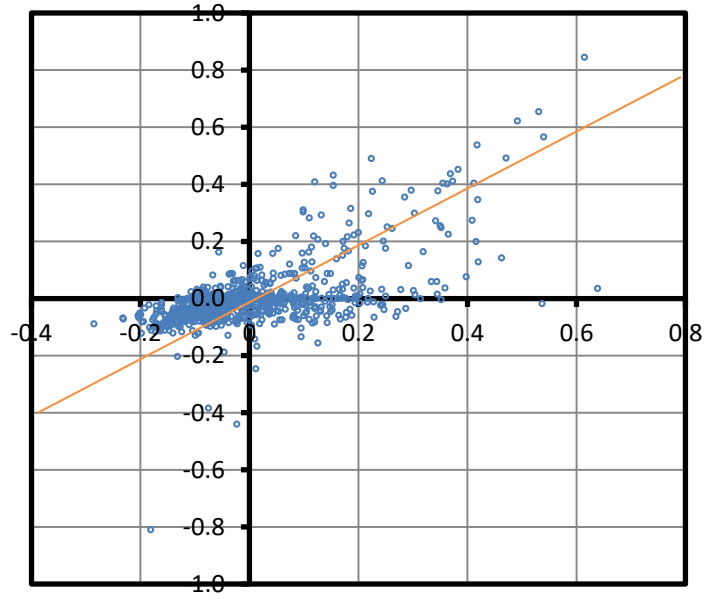
(a)


Model 1: MLC-minP vs MLC-SSBw (typed)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

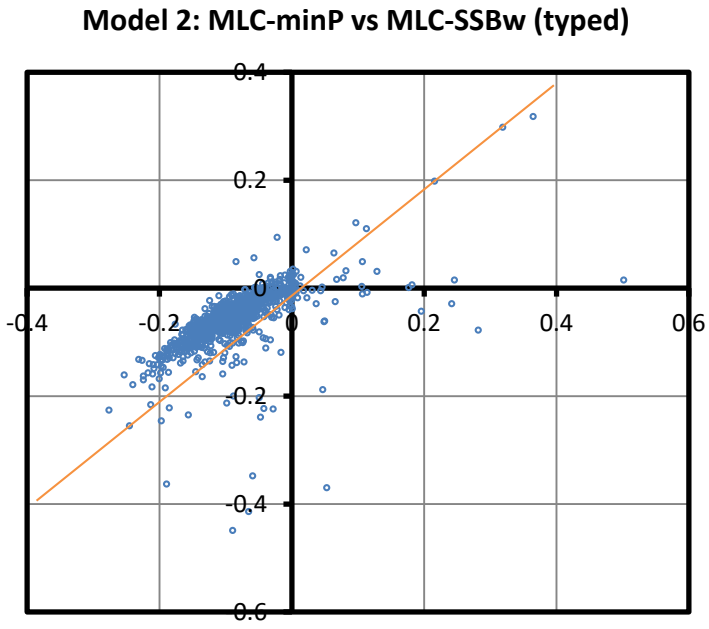

Model 1: MLC-minP vs MLC-SSBw (untyped)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

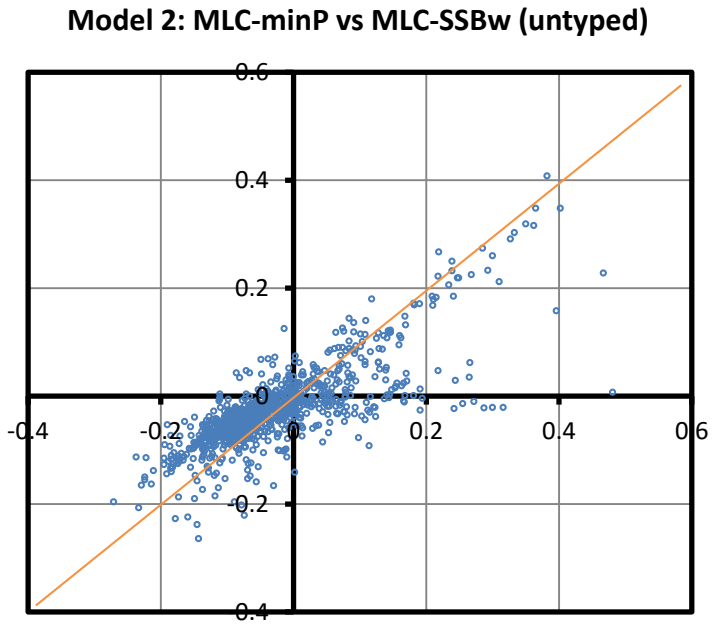
(b)


Model 1: MLC-PC80 vs MLC-SSBw (typed)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

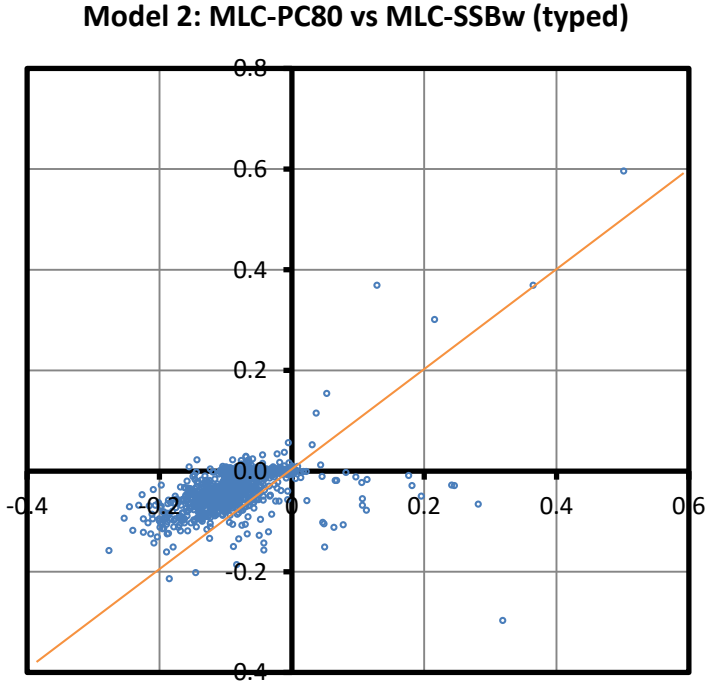

Model 1: MLC-PC80 vs MLC-SSBw (untyped)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-0.4
-0.2
0
0.2
0.4
0.6
0.8

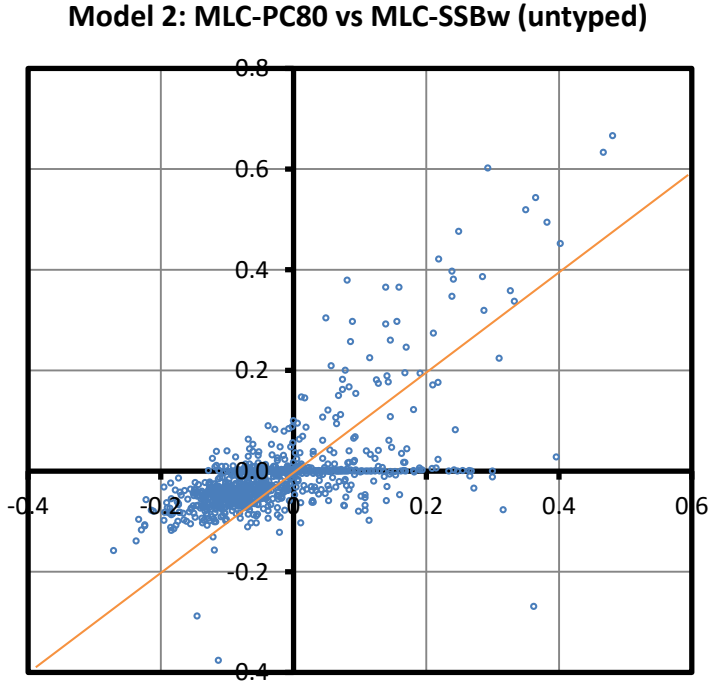
(a)


Model 2: MLC-minP vs MLC-SSBw (typed)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

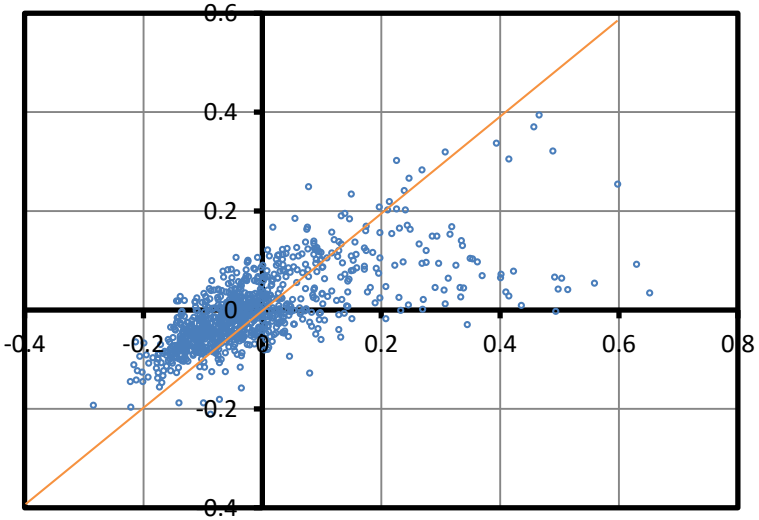

Model 2: MLC-minP vs MLC-SSBw (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6

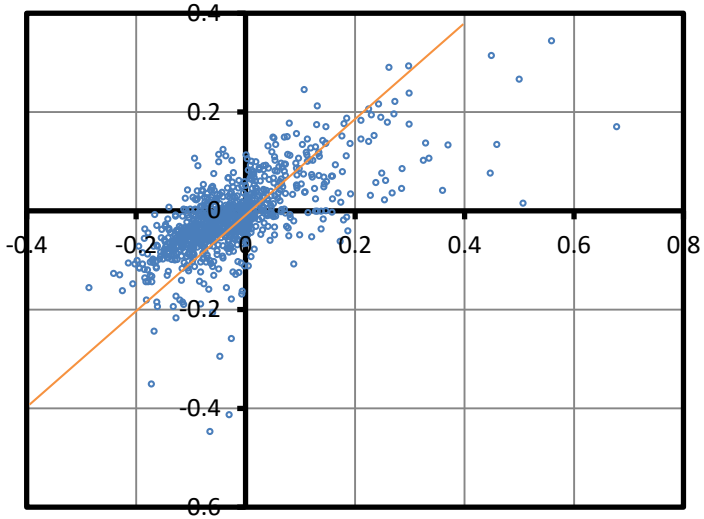
(b)


Model 2: MLC-PC80 vs MLC-SSBw (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6

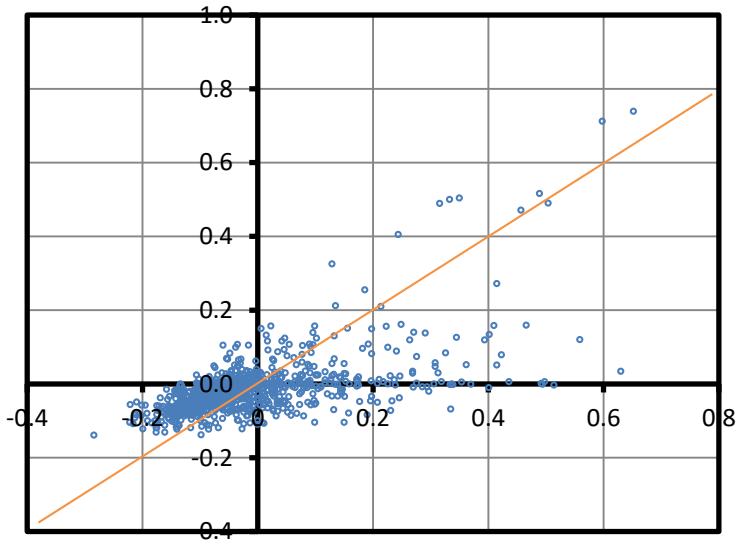

Model 2: MLC-PC80 vs MLC-SSBw (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6

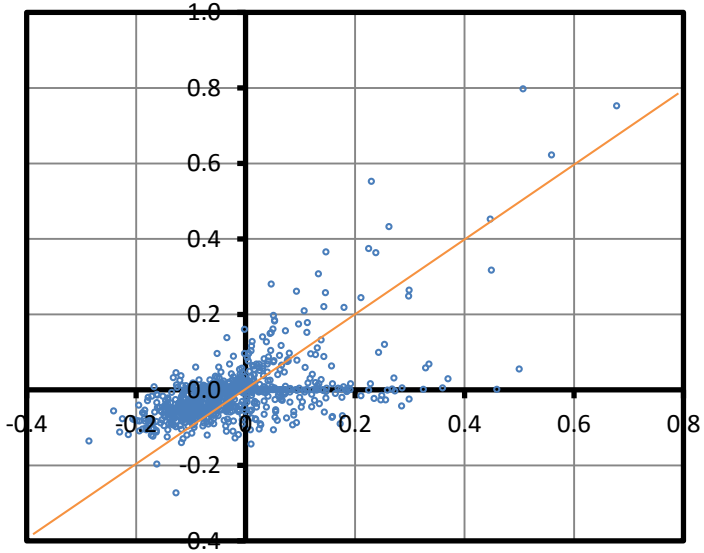
(a)


Model 3: MLC-minP vs MLC-SSBw (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

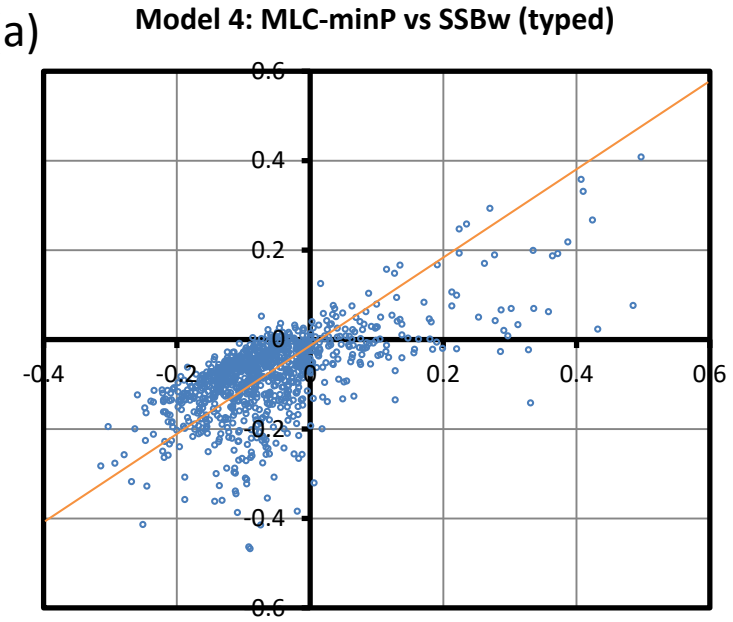

Model 3: MLC-minP vs MLC-SSBw (untyped)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

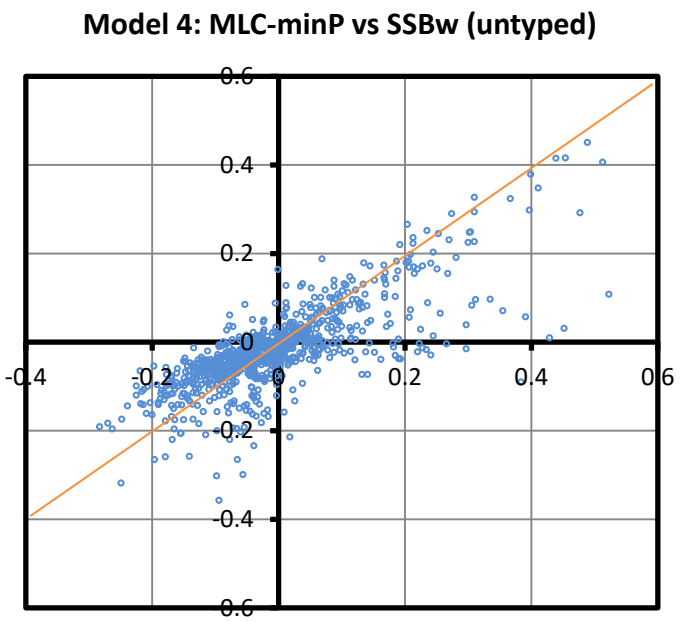
(b)


Model 3: MLC-PC80 vs MLC-SSBw (typed)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

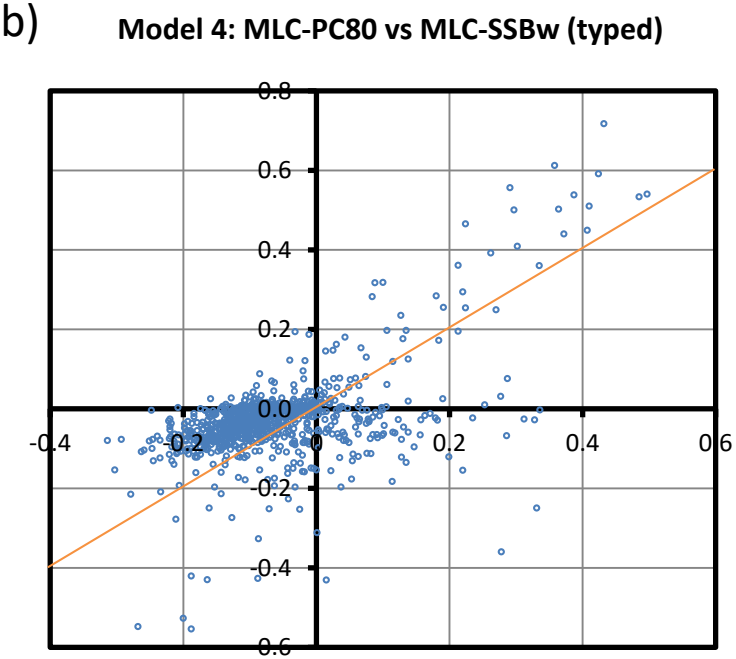

Model 3: MLC-PC80 vs MLC-SSBw (untyped)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

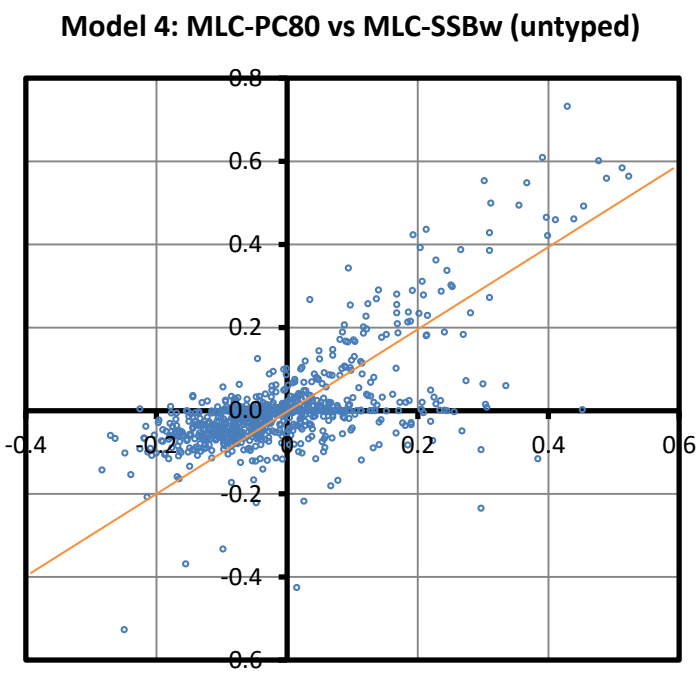
(a)


Model 4: MLC-minP vs SSBw (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

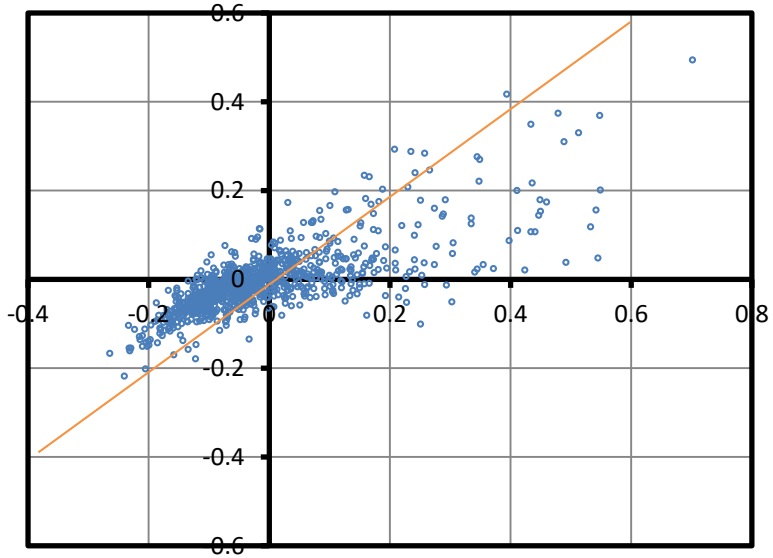

Model 4: MLC-minP vs SSBw (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

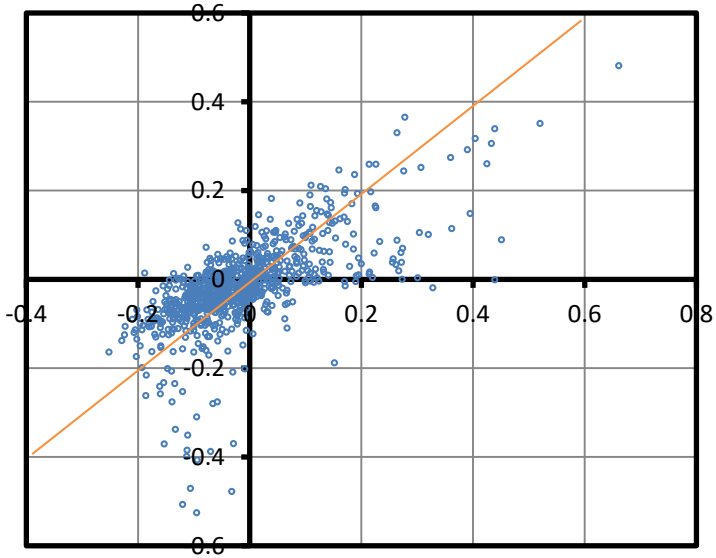
(b)


Model 4: MLC-PC80 vs MLC-SSBw (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

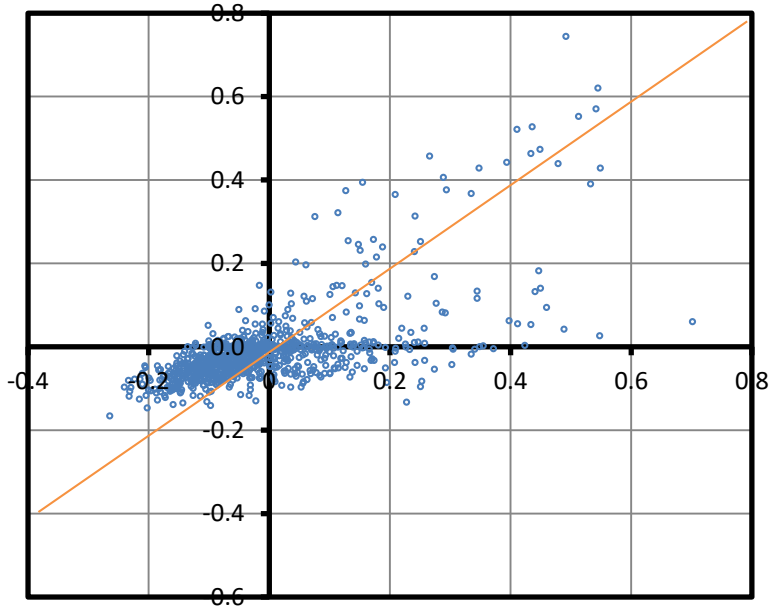

Model 4: MLC-PC80 vs MLC-SSBw (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

(a)


Model 5: MLC-minP vs MLC-SSBw (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


Model 5: MLC-minP vs SSBw (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

(b)


Model 5: MLC-PC80 vs MLC-SSBw (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

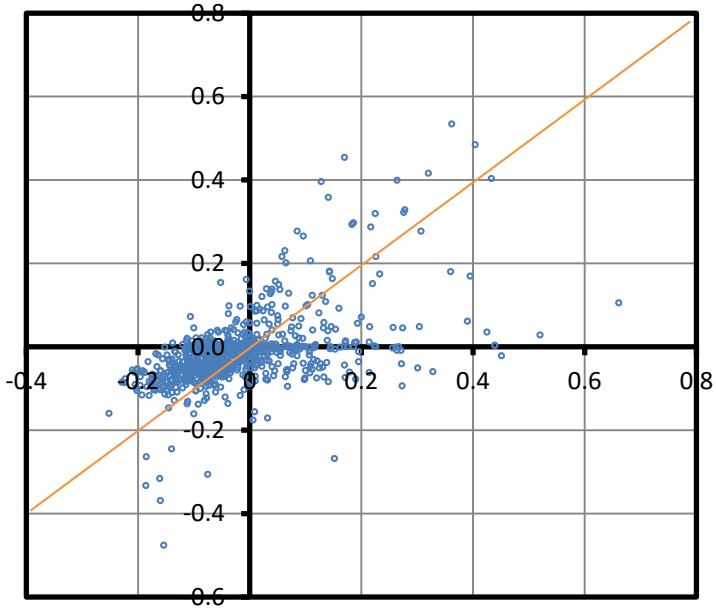

Model 5: MLC-PC80 vs MLC-SSBw (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

Figure S5. Power differentials (a) between MLC and MinP-M, and (b) between MLC and SKAT, each plotted against power differentials between MLC and SKATO. The latter is on the x axis. Each point corresponds to one gene with power estimated in 1000 replicated datasets (nominal alpha=0.05). Data were generated under simulation models 1-5, as defined in Table 2, and were analysed with (typed) and without (untyped) the causal variant(s) in the regression model.

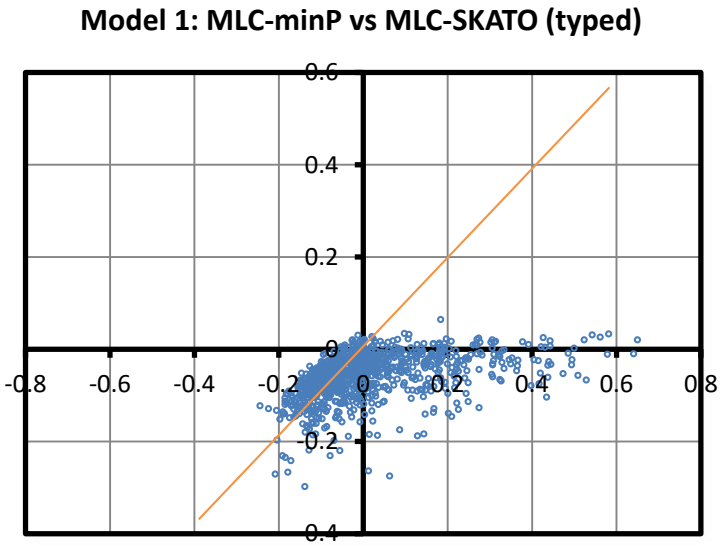
In the upper panels: MLC power is greater than MinP-M power for genes above the x axis, MLC power is greater than SKATO power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both MinP-M and SKATO. Genes close to the diagonal line have MinP-M power ≈ SKATO power, while those below the line have MinP-M power > SKATO power.

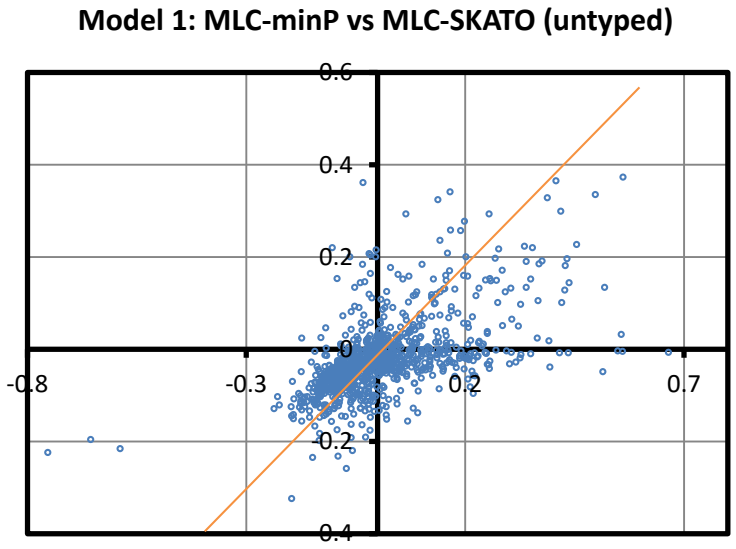
In the lower panels: MLC power is greater than SKAT power for genes above the x axis, MLC power is greater than SKATO power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both SKAT and SKAT). Genes close to the diagonal line have SKAT power ≈ SKATO power, while those below the line have SKAT power > SKATO power..

The table summarizes the number of genes according to power inequalities among the methods.

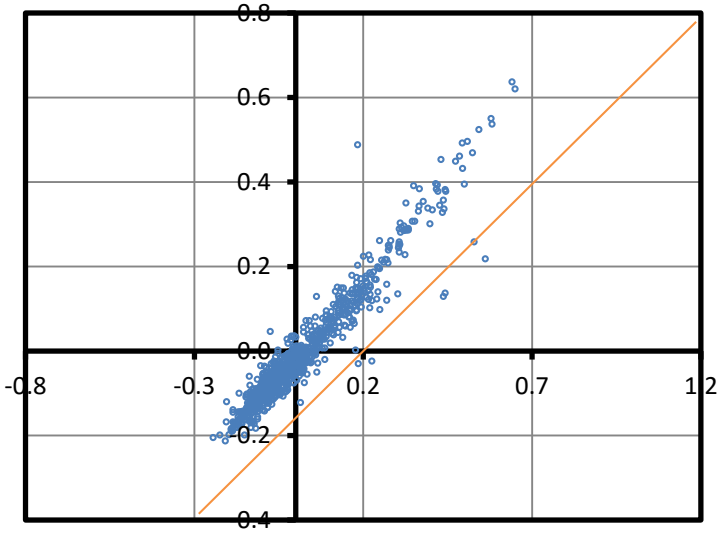
			Power Differential				
Model	# of genes	Analysis	MLC>MinPM	MLC>SKATO	MLC>SKAT	MLC>Min,SKATO	MLC>all 3
1	1000	Typed	80	380	296	62	53
		Untyped	258	438	390	195	173
2	993	Typed	62	106	67	37	25
		Untyped	223	371	314	142	125
3	935	Typed	372	284	326	193	178
		Untyped	312	370	317	198	165
4	993	Typed	119	238	179	98	88
		Untyped	286	452	395	221	203
5	935	Typed	359	458	334	294	238
		Untyped	313	416	351	230	202

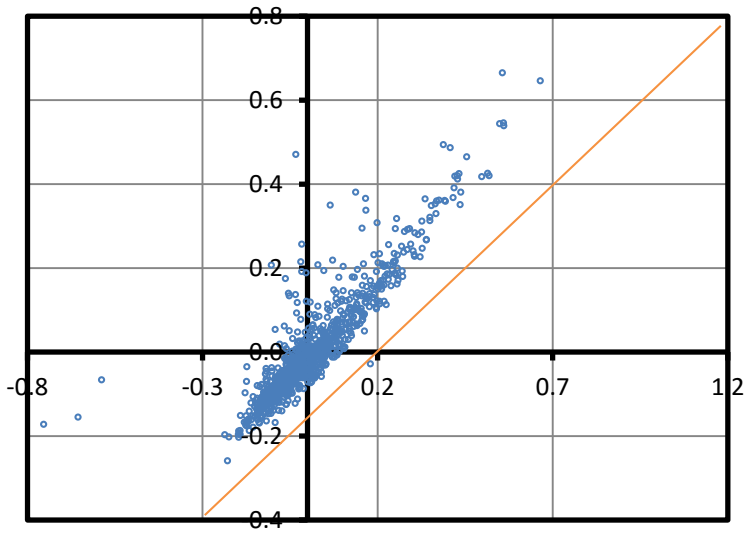
(a)


Model 1: MLC-minP vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

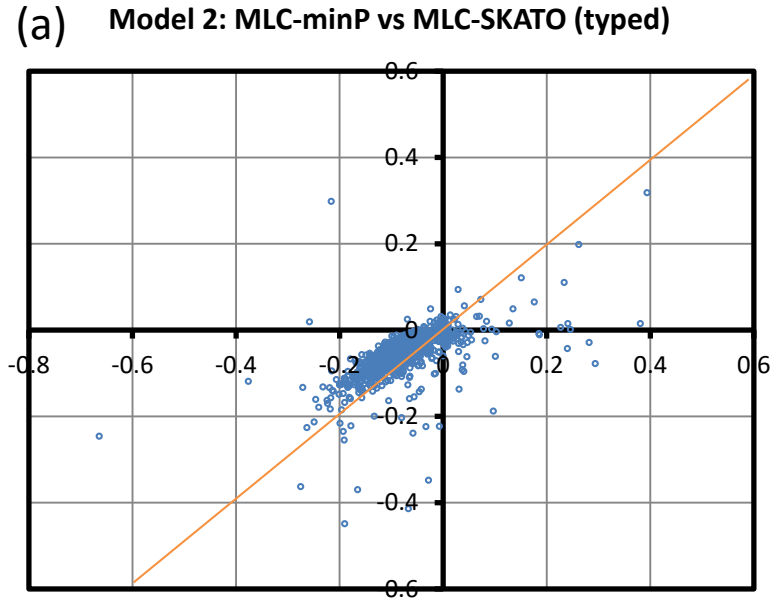

Model 1: MLC-minP vs MLC-SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.8
-0.3
0.2
0.7

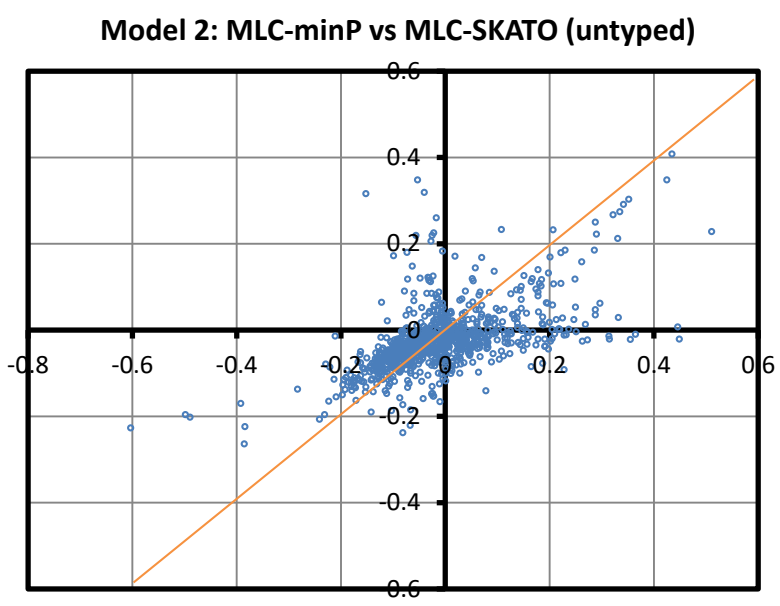
(b)


Model 1: MLC-SKAT vs MLC-SKATO (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.8
-0.3
0.2
0.7
1.2

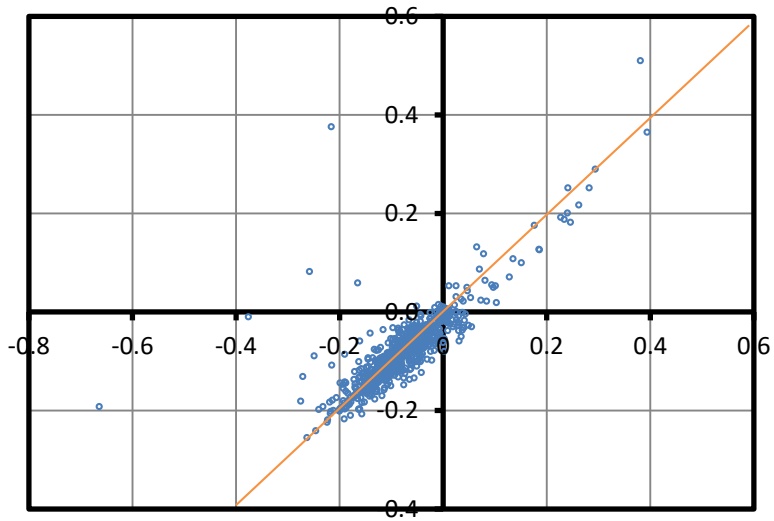

Model 1: MLC-SKAT vs MLC-SKATO (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.8
-0.3
0.2
0.7
1.2

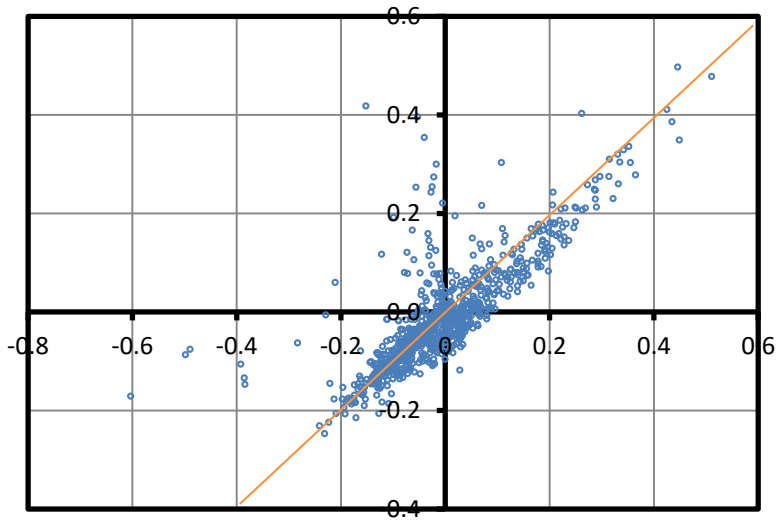
(a)


Model 2: MLC-minP vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

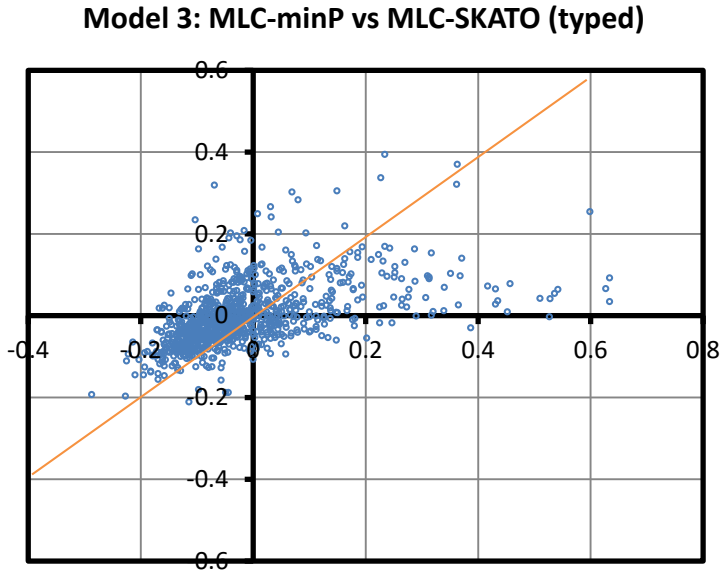

Model 2: MLC-minP vs MLC-SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

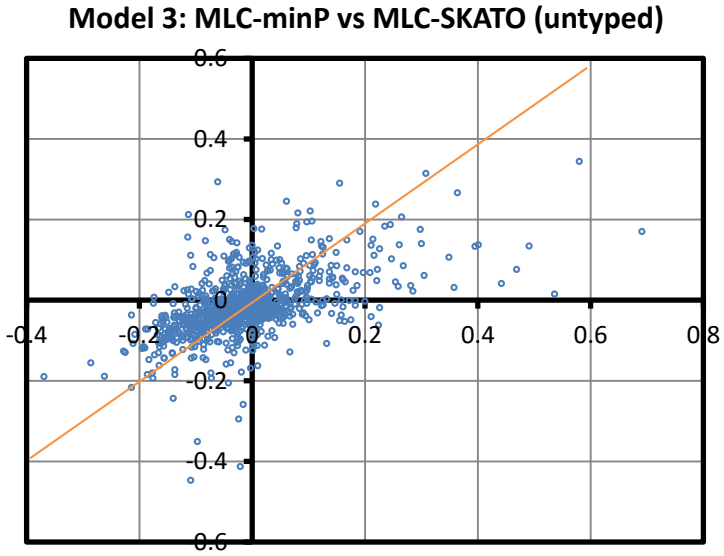
(b)


Model 2: MLC-SKAT vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

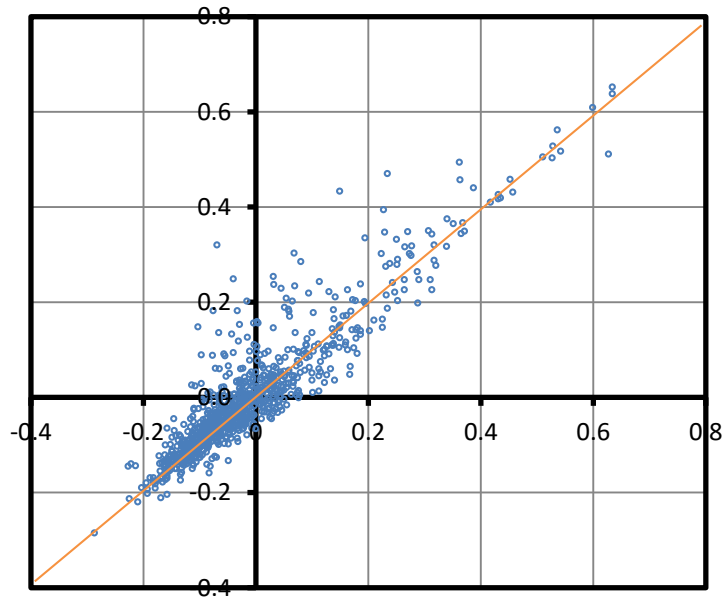

Model 2: MLC-SKAT vs MLC-SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

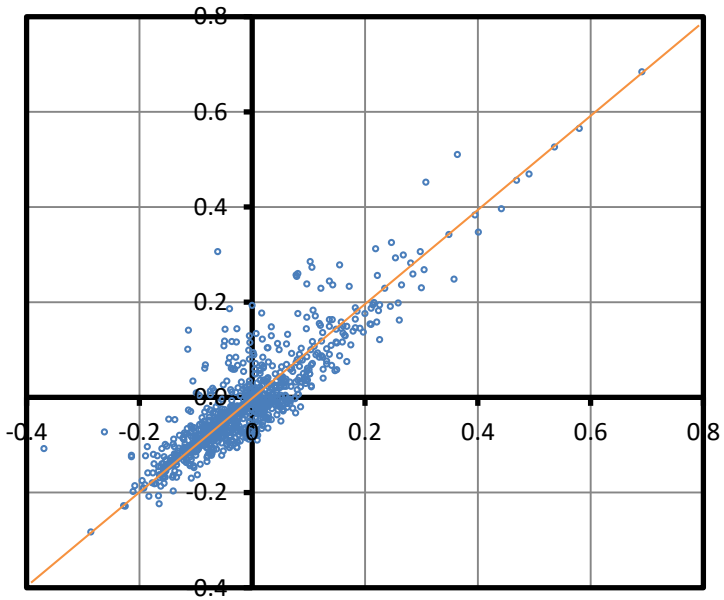
(a)


Model 3: MLC-minP vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

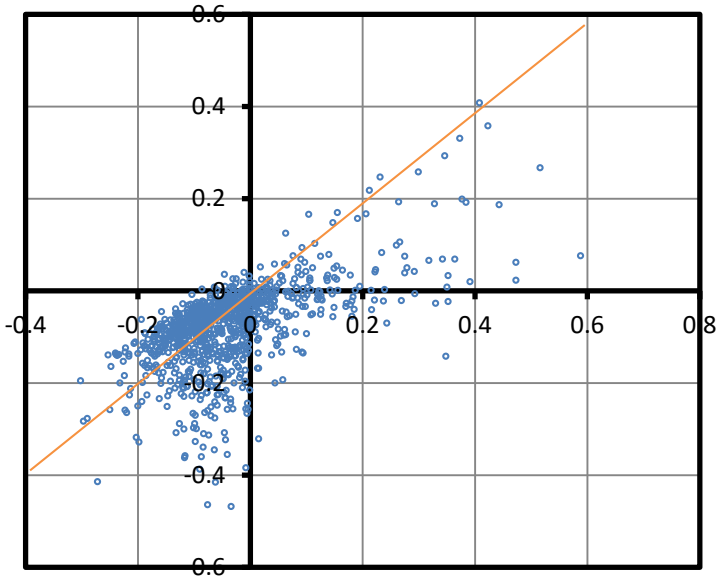

Model 3: MLC-minP vs MLC-SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

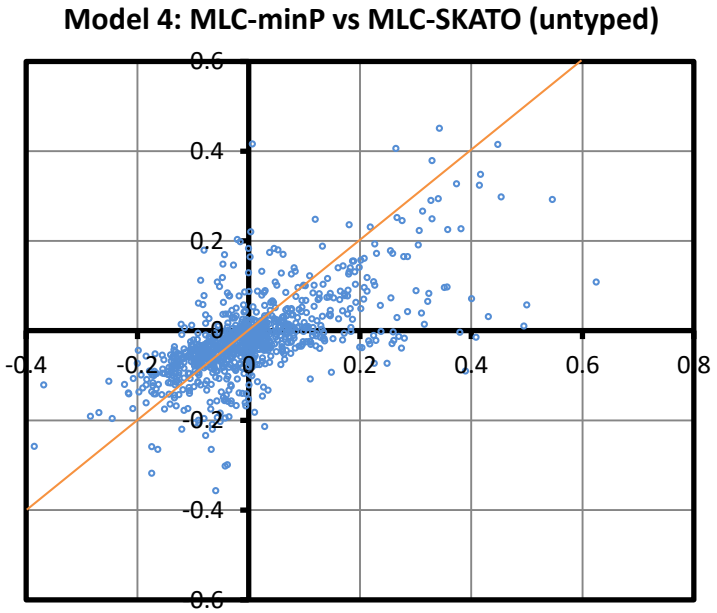
(b)


Model 3: MLC-SKAT vs MLC-SKATO (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

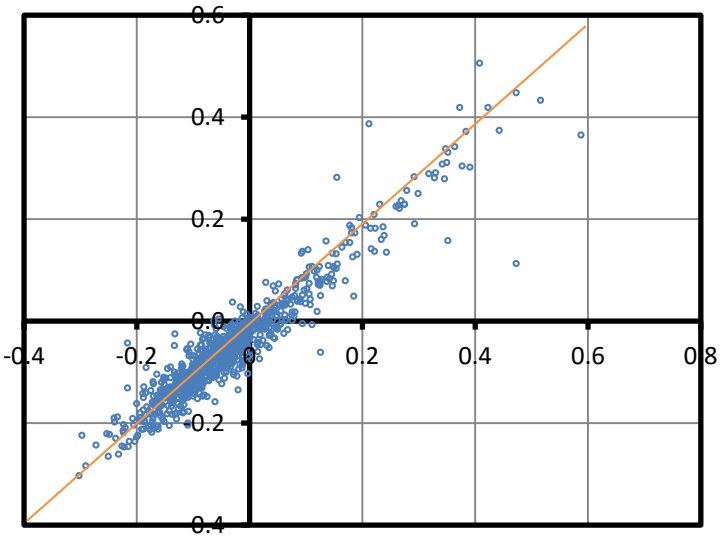

Model 3: MLC-SKAT vs MLC-SKATO (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

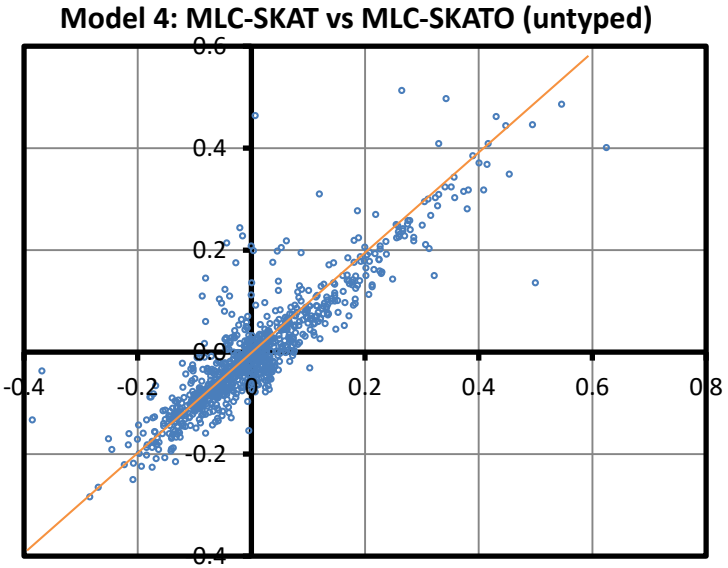
(a)


Model 4: MLC-minP vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

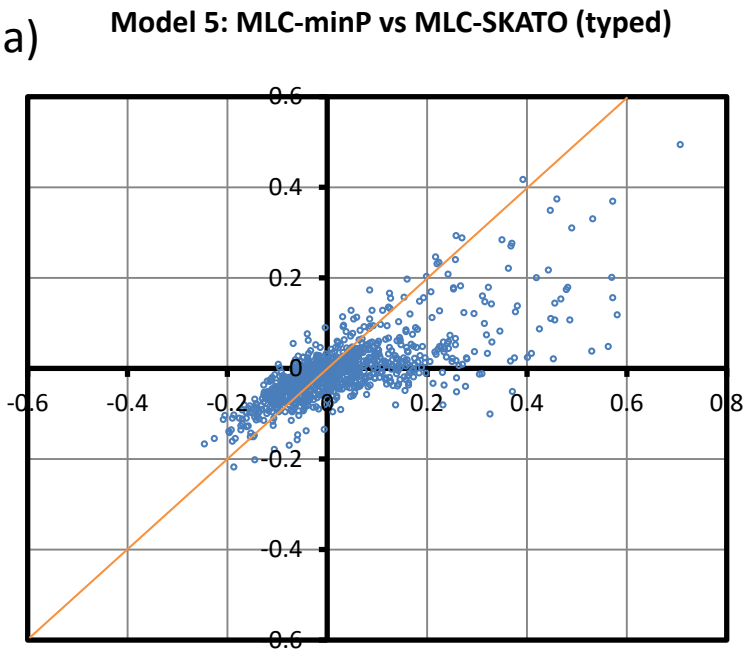

Model 4: MLC-minP vs MLC-SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

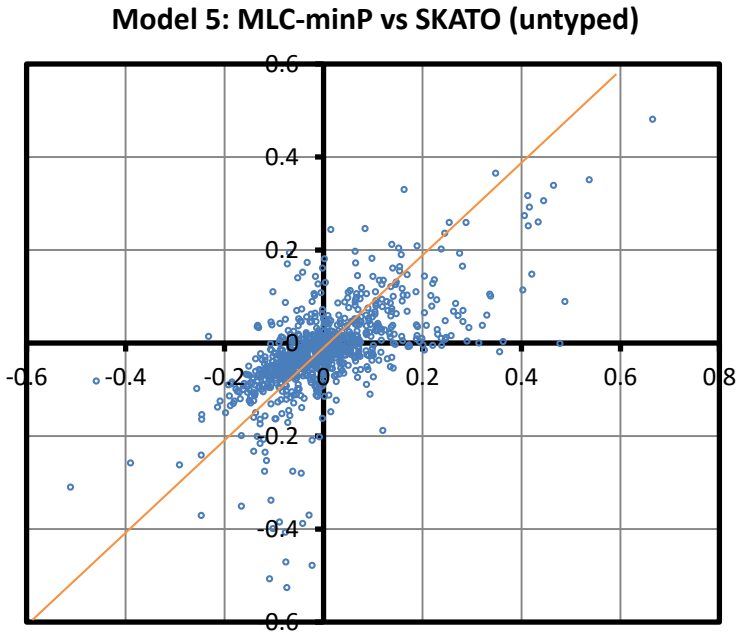
(b)


Model 4: MLC-SKAT vs MLC-SKATO (typed)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

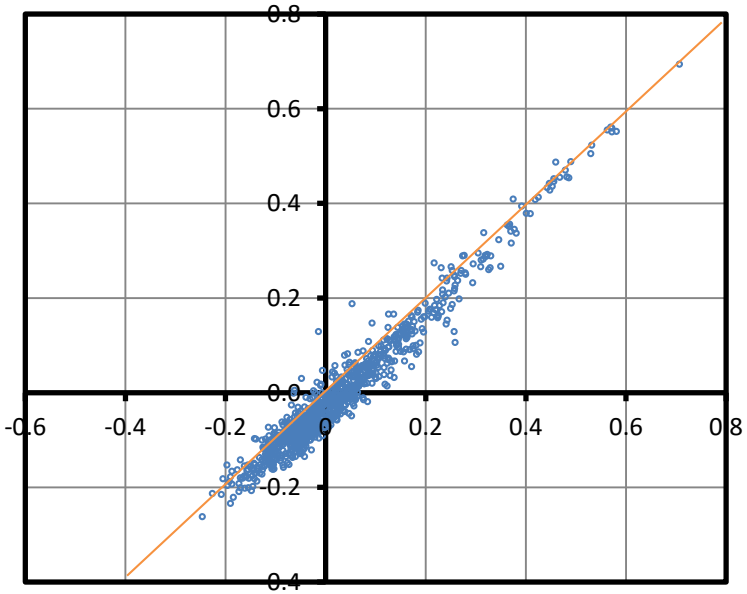

Model 4: MLC-SKAT vs MLC-SKATO (untyped)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8

(a)


Model 5: MLC-minP vs MLC-SKATO (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


Model 5: MLC-minP vs SKATO (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

(b)


Model 5: MLC-SKAT vs MLC-SKATO (typed)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

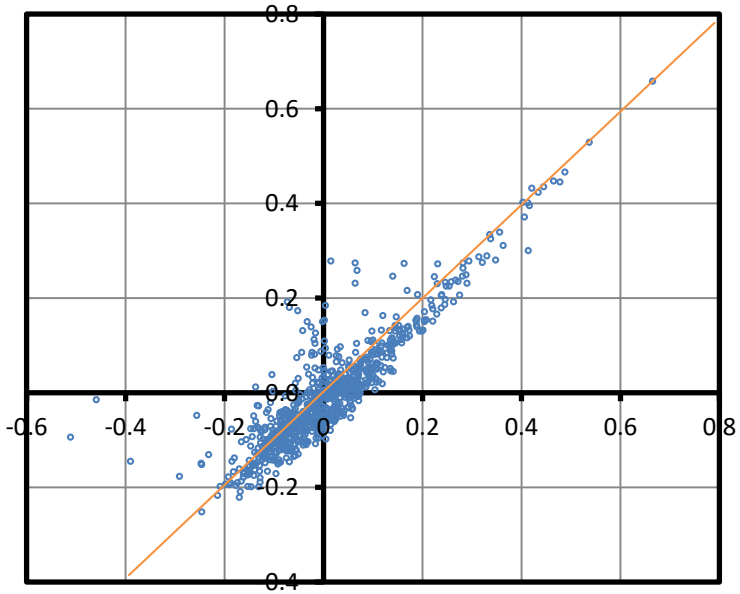

Model 5: MLC-SKAT vs MLC-SKATO (untyped)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

Figure S6. Power differentials (a) between MLC and MinP-M, and (b) between MLC and Wald, each plotted against power differentials between MLC and LC. The latter is on the x axis. Each point corresponds to one gene with power estimated in 1000 replicated datasets (nominal alpha=0.05). Data were generated under simulation models 1-5, as defined in Table 2, and were analysed with (typed) and without (untyped) the causal variant(s) in the regression model.

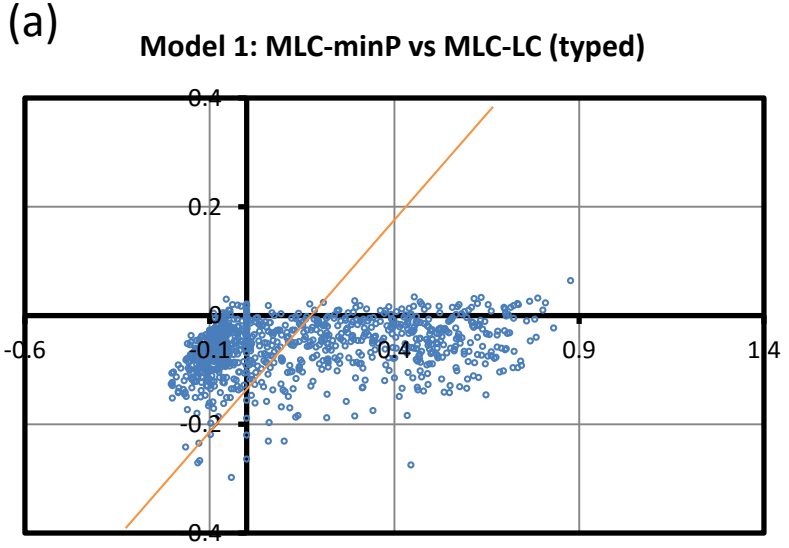
In the upper panels: MLC power is greater than MinP-M power for genes above the x axis, MLC power is greater than LC power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both MinP-M and LC. Genes close to the diagonal line have MinP-M power ≈ LC power, while those below the line have MinP-M power > LC power.

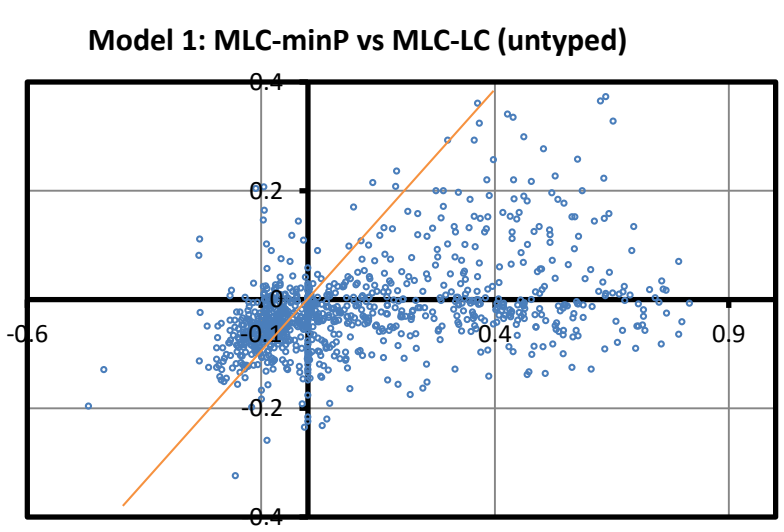
In the lower panels: MLC power is greater than Wald power for genes above the x axis, MLC power is greater than LC power for genes on the right of the y axis, and the upper right quadrant includes all genes for which MLC is more powerful than both Wald and LC). Genes close to the diagonal line have Wald power ≈ LC power, while those below the line have Wald power > LC power.

The table summarizes the number of genes according to power inequalities among the methods.

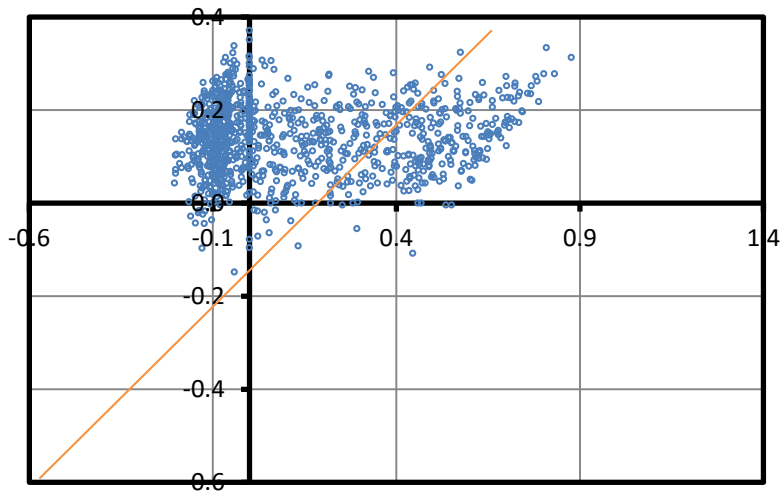
			Power Differential				
Model	# of genes	Analysis	MLC>MinPM	MLC>LC	MLC>Wald	MLC>Min,LC	MLC>all 3
1	1000	Typed	80	502	964	60	60
		Untyped	258	489	866	199	171
2	993	Typed	62	267	947	31	29
		Untyped	223	397	792	146	107
3	935	Typed	372	510	893	298	283
		Untyped	312	388	764	221	182
4	993	Typed	119	427	516	100	64
		Untyped	286	490	603	218	141
5	935	Typed	359	585	905	319	310
		Untyped	313	498	741	264	218

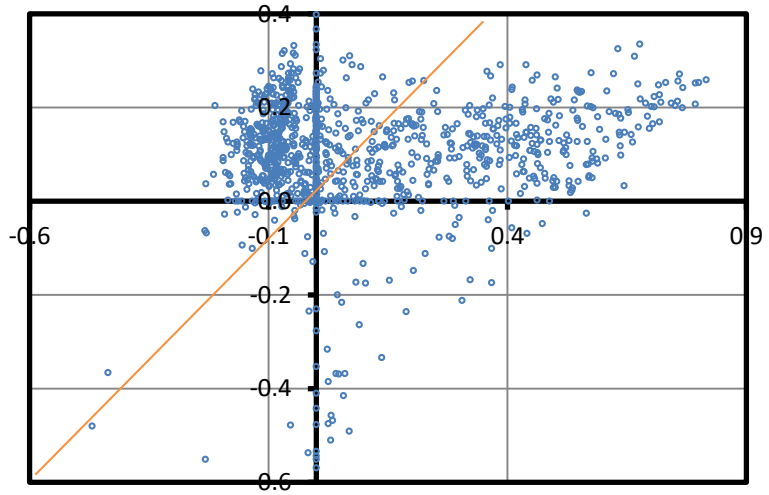
(a)


Model 1: MLC-minP vs MLC-LC (typed)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.1
0.4
0.9
1.4

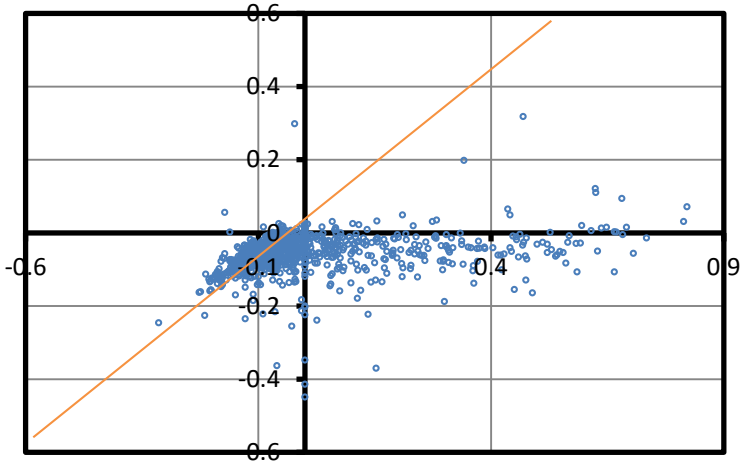

Model 1: MLC-minP vs MLC-LC (untyped)
0.4
0.2
0
-0.2
-0.4
-0.6
-0.1
0.4
0.9

(b)

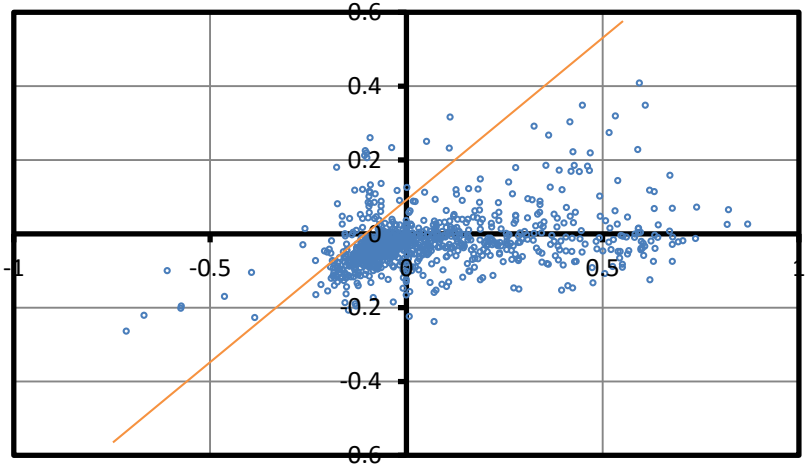

Model 1: MLC-Wald vs MLC-LC (typed)
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.6
-0.1
0.4
0.9
1.4


Model 1: MLC-Wald vs MLC-LC (untyped)
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.6
-0.1
0.4
0.9

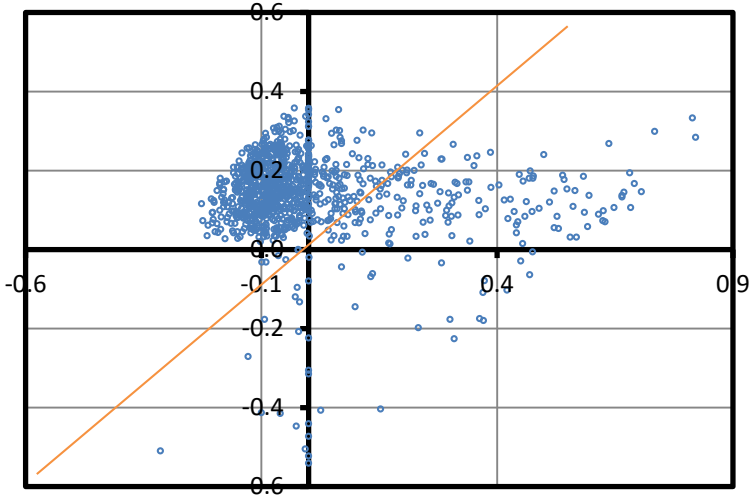
(a) **Model 2: MLC-minP vs MLC-LC (typed)**



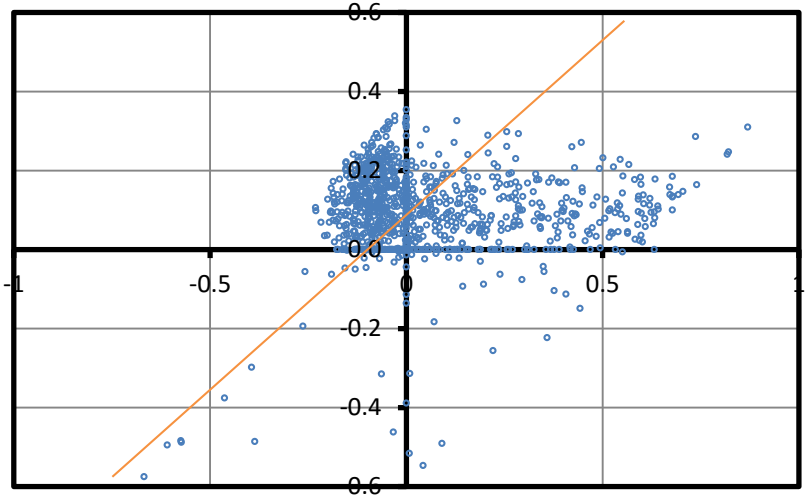
Model 2: MLC-minP vs MLC-LC (untyped)



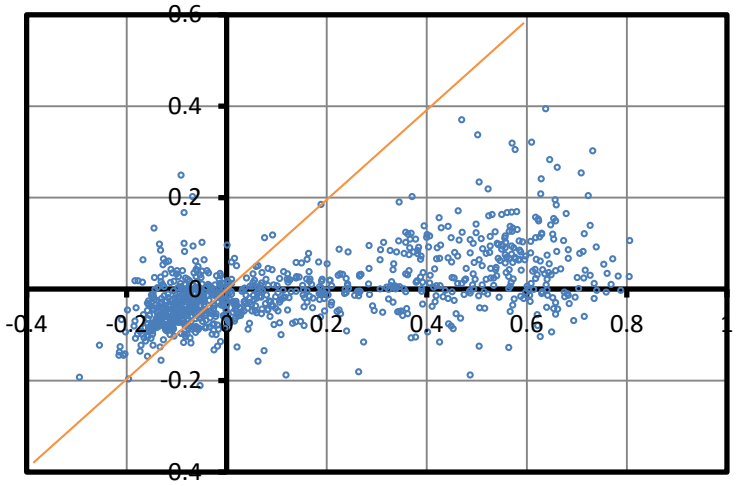
(b) **Model 2: MLC-Wald vs MLC-LC (typed)**

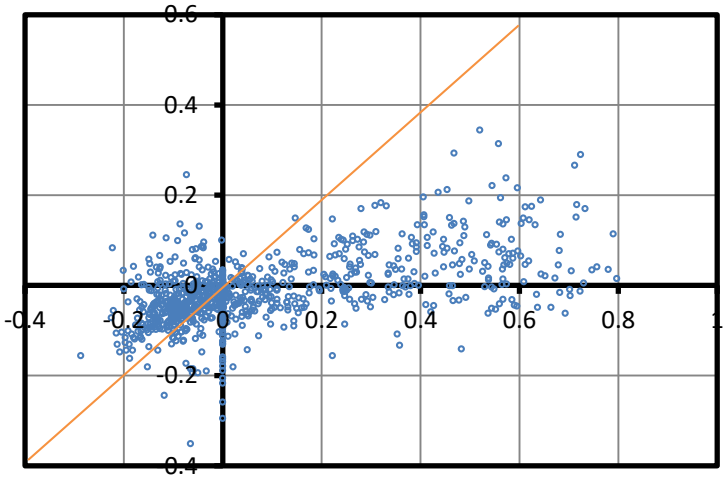


Model 2: MLC-Wald vs MLC-LC (untyped)

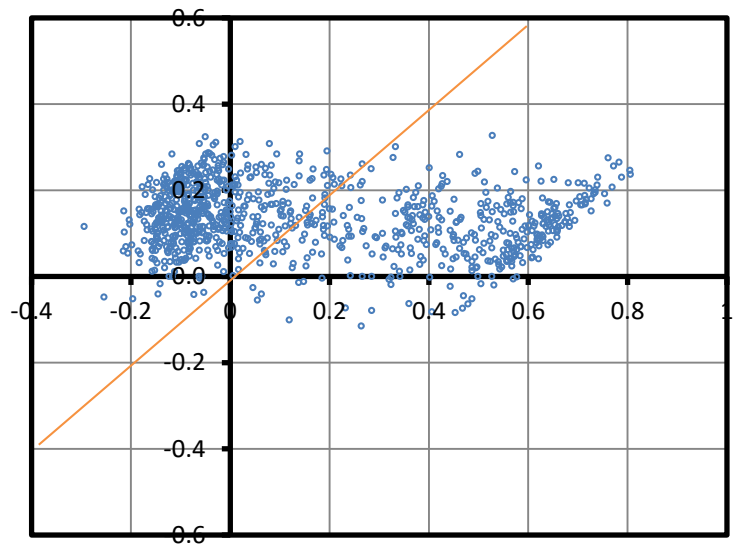


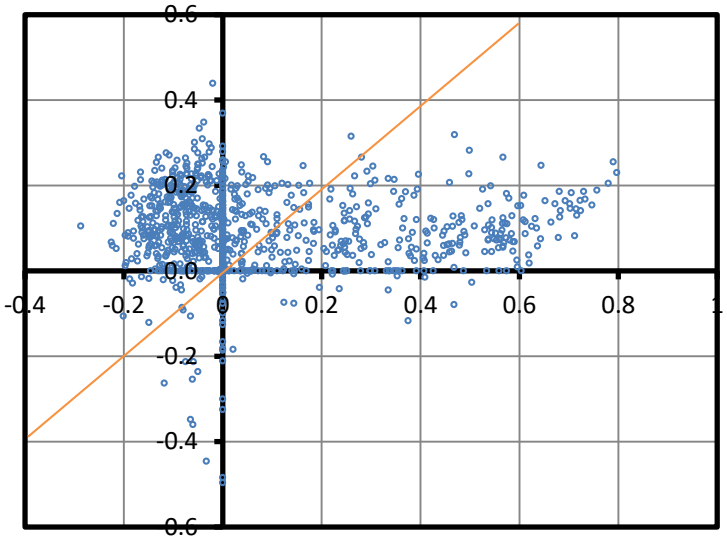
(a)


Model 3: MLC-minP vs MLC-LC (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

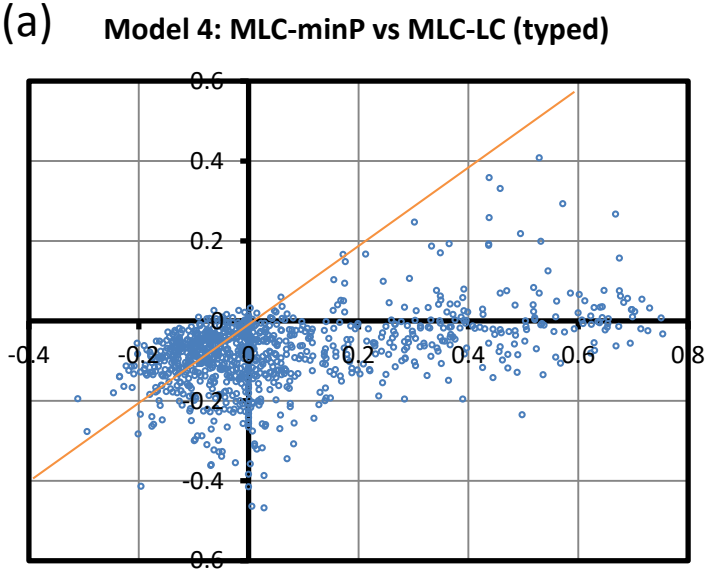

Model 3: MLC-minP vs MLC-LC (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

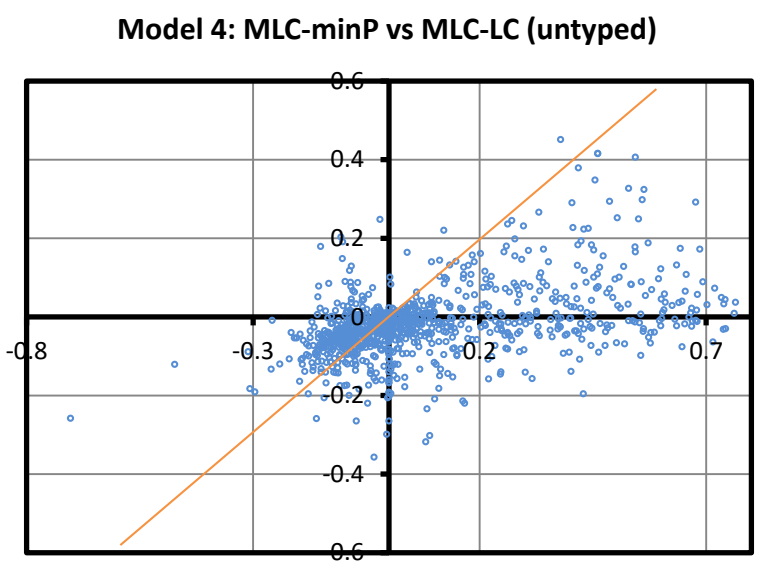
(b)


Model 3: MLC-Wald vs MLC-LC (typed)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

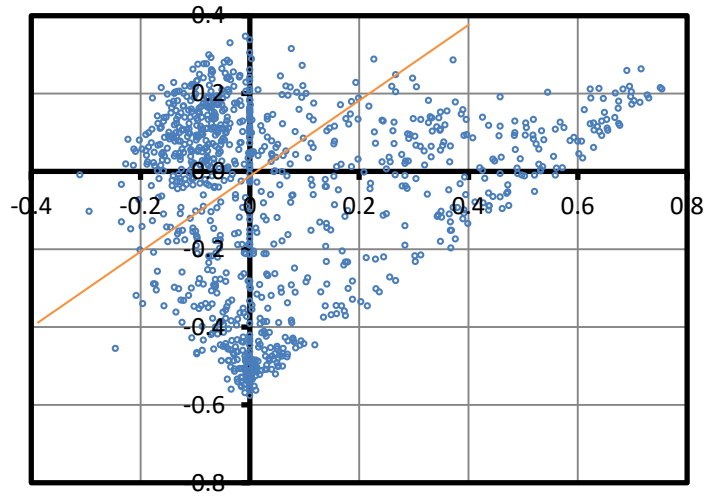

Model 3: MLC-Wald vs MLC-LC (untyped)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

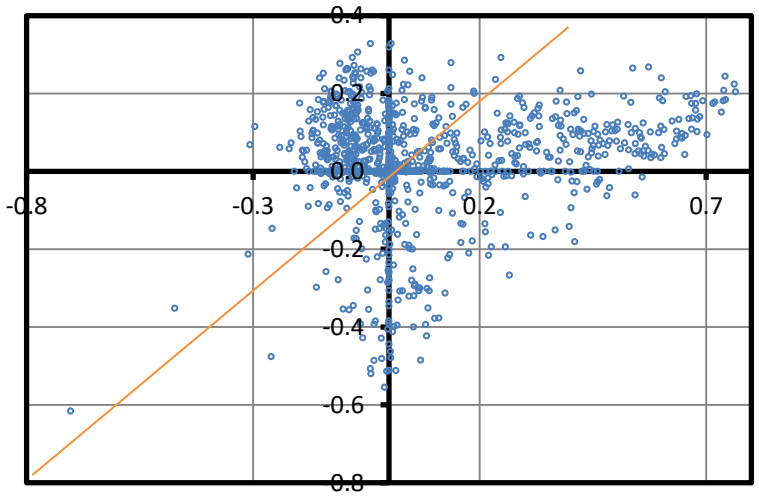
(a)


Model 4: MLC-minP vs MLC-LC (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8

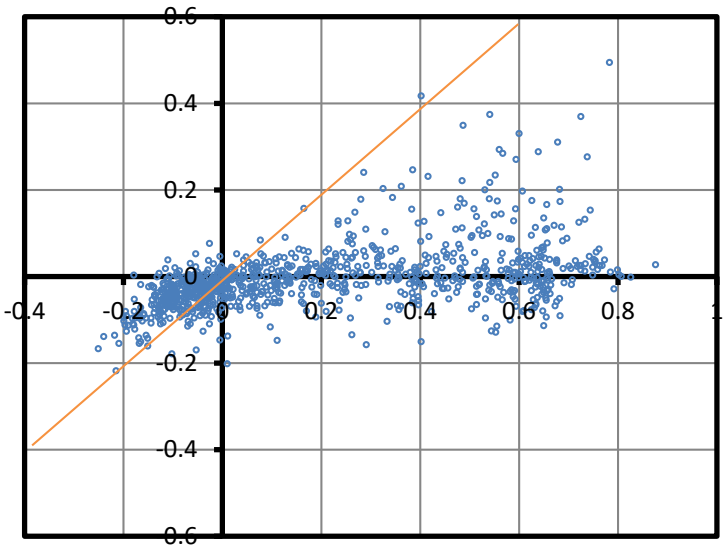

Model 4: MLC-minP vs MLC-LC (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-0.3
0.2
0.7

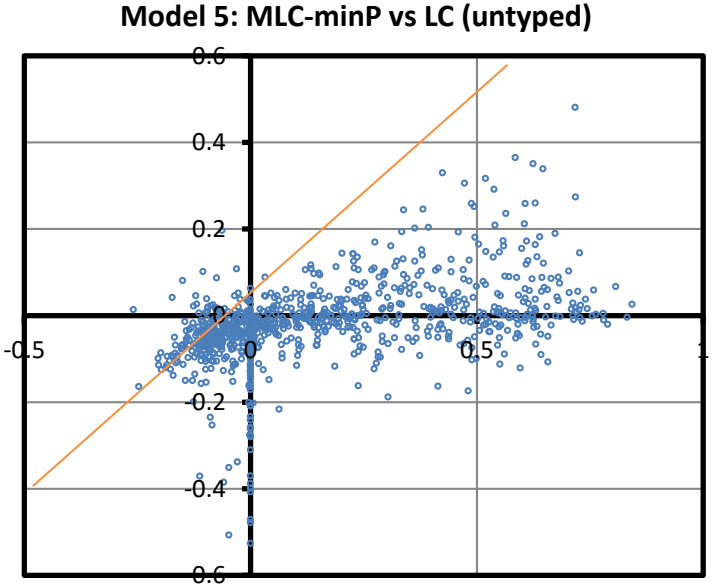
(b)


Model 4: MLC-Wald vs MLC-LC (typed)
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-0.4
-0.2
0
0.2
0.4
0.6
0.8

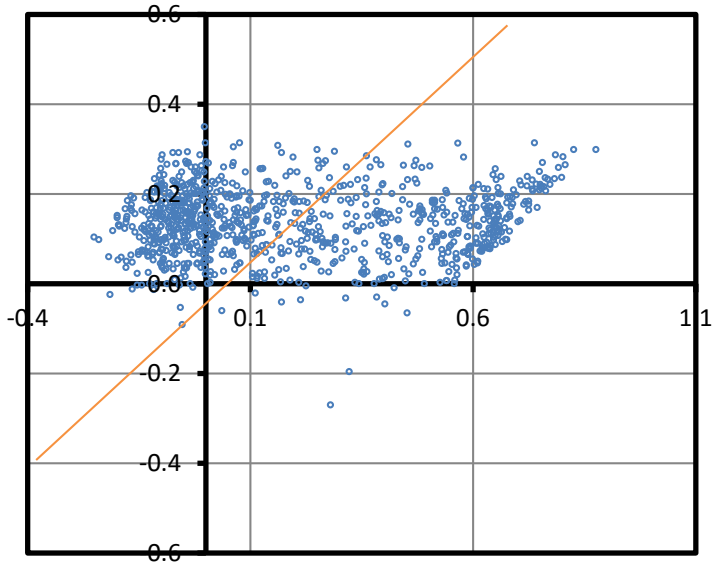

Model 4: MLC-Wald vs MLC-LC (untyped)
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-0.3
0.2
0.7

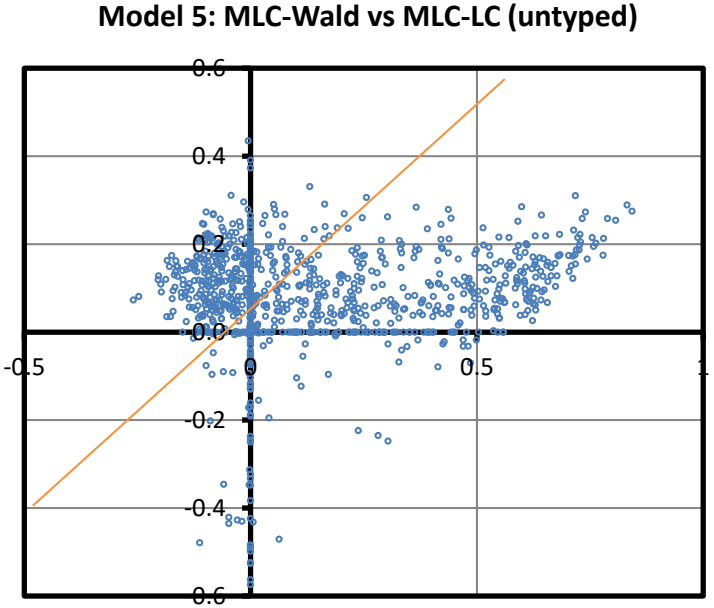
(a)


Model 5: MLC-minP vs MLC-LC (typed)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8


Model 5: MLC-minP vs LC (untyped)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.5
0
0.5

(b)


Model 5: MLC-Wald vs MLC-LC (typed)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.4
0.1
0.6
1.1


Model 5: MLC-Wald vs MLC-LC (untyped)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.5
0
0.5