对final_vector中的V——M加工变量和Q变量做ARIMA时间序列回归

首先是所有场次的回归，如下：

Q——point：

Model Description

			Model Type
Model ID	Q	Model_1	ARIMA(2,1,4)

Model Summary

Model Fit

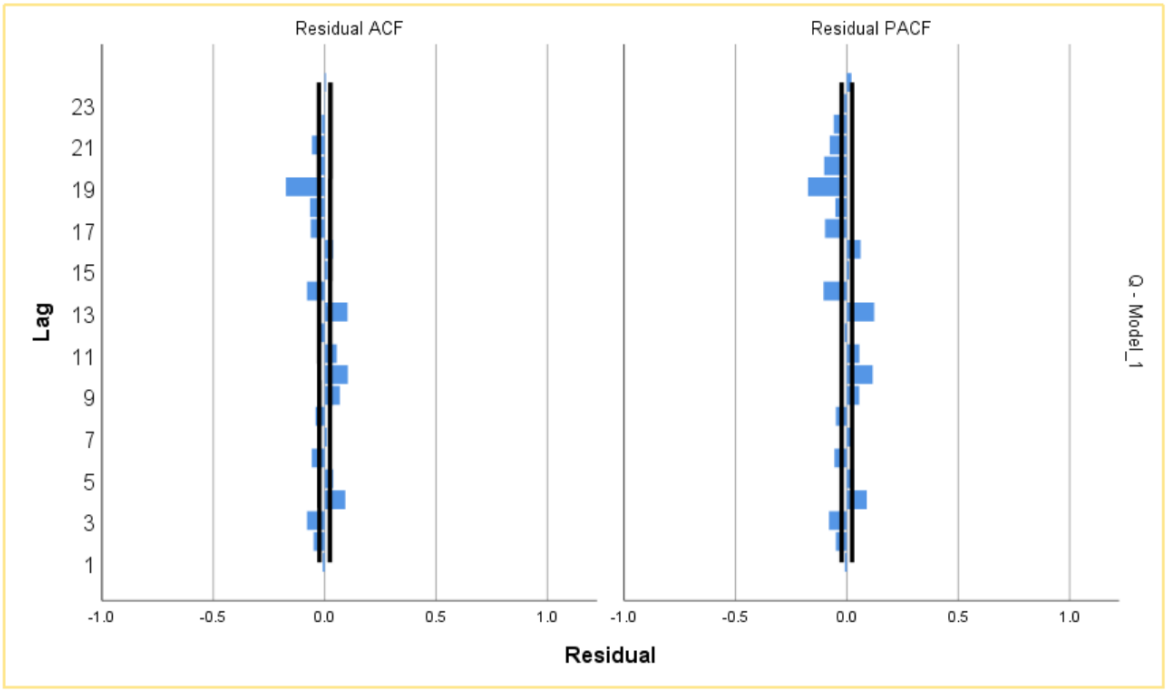
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.200	.	.200	.200	.200	.200	.200	.200	.200	.200	.200
R-squared	.986	.	.986	.986	.986	.986	.986	.986	.986	.986	.986
RMSE	.011	.	.011	.011	.011	.011	.011	.011	.011	.011	.011
MAPE	.883	.	.883	.883	.883	.883	.883	.883	.883	.883	.883
MaxAPE	185.353	.	185.353	185.353	185.353	185.353	185.353	185.353	185.353	185.353	185.353
MAE	.005	.	.005	.005	.005	.005	.005	.005	.005	.005	.005
MaxAE	.423	.	.423	.423	.423	.423	.423	.423	.423	.423	.423
Normalized BIC	-8.932	.	-8.932	-8.932	-8.932	-8.932	-8.932	-8.932	-8.932	-8.932	-8.932

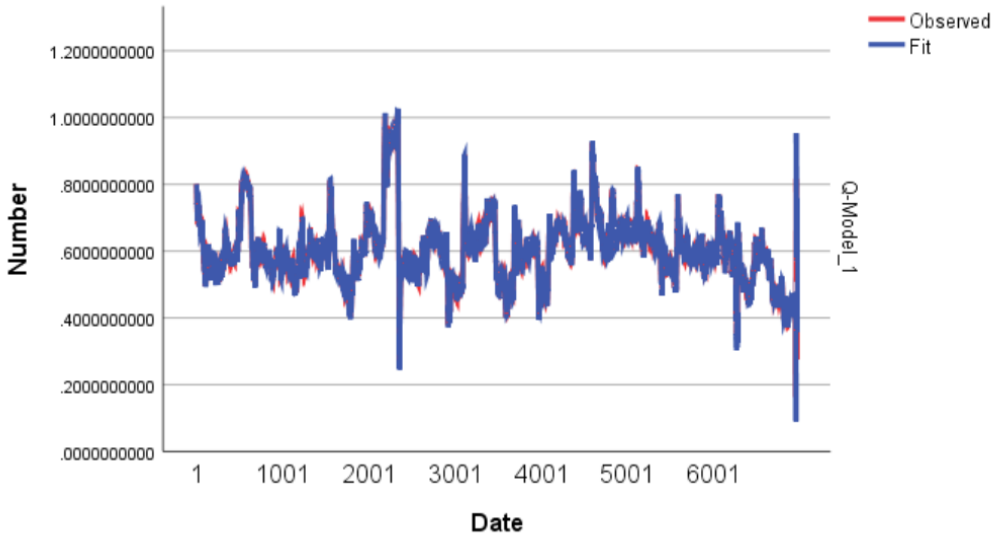
Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
Q-Model_1	0	.200	487.830	12	.000	0

ARIMA Model Parameters

					Estimate	SE	t	Sig.
Q-Model_1	Q	No Transformation	AR	Lag 1	-.406	.007	-58.406	.000
				Lag 2	-.938	.007	-136.167	.000
			Difference		1			
			MA	Lag 1	-.656	.013	-49.274	.000
				Lag 2	-1.126	.015	-75.140	.000
				Lag 3	-.494	.015	-33.644	.000
				Lag 4	-.045	.014	-3.304	.001


Residual ACF
Residual PACF
Lag
23
21
19
17
15
13
11
9
7
5
3
1
-1.0
-0.5
0.0
0.5
1.0
Residual
Q - Model_1


Observed
Fit
Number
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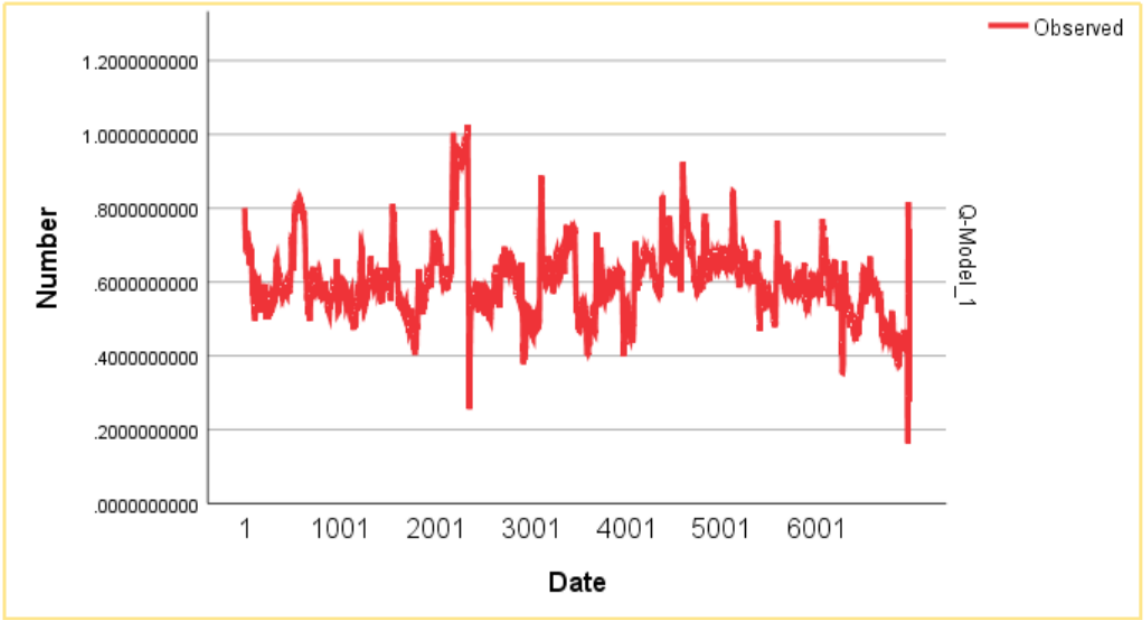
1.0000000000
.8000000000
.6000000000
.4000000000
.2000000000
.0000000000
1
1001
2001
3001
4001
5001
6001
Date
Q-Model_1

（原值如下：）


Observed
Number
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.8000000000
.6000000000
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.2000000000
.0000000000
1
1001
2001
3001
4001
5001
6001
Date
Q-Model_1

最终选择的是ARIMA（2,1,4）模型

可以看到acf和pacf的情况非常之差，也很难想象划分测试集和训练集后的测试情况将多么糟糕

然后是VM的模型：

Model Description

			Model Type
Model ID	VM	Model_1	ARIMA(3,0,15)

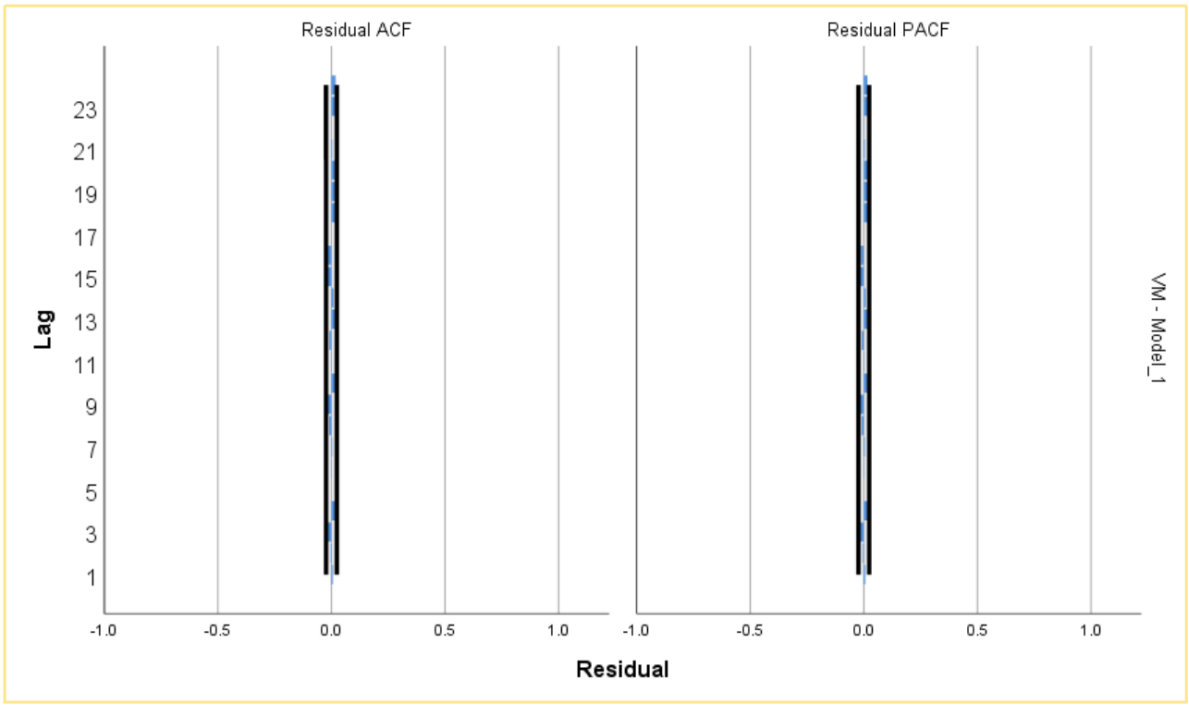
Model Summary

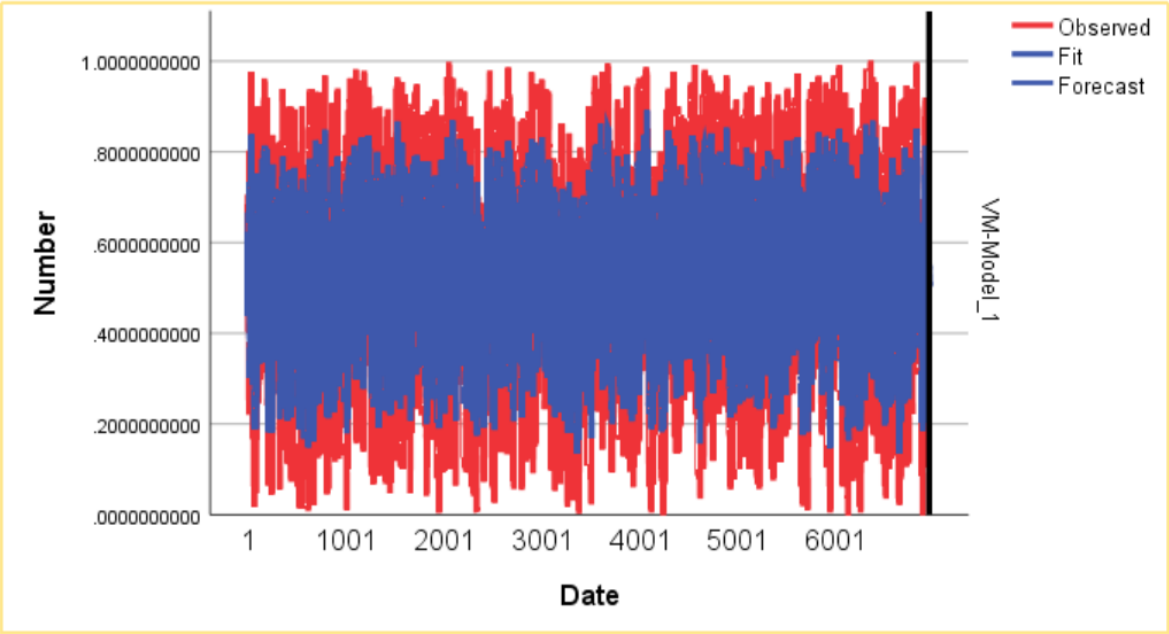
Model Fit

Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.487	.	.487	.487	.487	.487	.487	.487	.487	.487	.487
R-squared	.487	.	.487	.487	.487	.487	.487	.487	.487	.487	.487
RMSE	.148	.	.148	.148	.148	.148	.148	.148	.148	.148	.148
MAPE	53.418	.	53.418	53.418	53.418	53.418	53.418	53.418	53.418	53.418	53.418
MaxAPE	6651.744	.	6651.744	6651.744	6651.744	6651.744	6651.744	6651.744	6651.744	6651.744	6651.744
MAE	.132	.	.132	.132	.132	.132	.132	.132	.132	.132	.132
MaxAE	.406	.	.406	.406	.406	.406	.406	.406	.406	.406	.406
Normalized BIC	-3.813	.	-3.813	-3.813	-3.813	-3.813	-3.813	-3.813	-3.813	-3.813	-3.813

Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
VM-Model_1	0	.487	25.506	12	.013	0





可以发现VM的acf和pacf出奇地好，尽管拟合值相对要比真实值紧凑很多（要不然呢，VM本来就是通过近几场的胜负情况推导出来的）

接下来考虑对于单场比赛的分析

仍然选择温网2023决赛的VM与Q，首先分析Q，二者都选取前279个作为训练组，后面的作为测试组

Model Description

			Model Type
Model ID	testQ	Model_1	ARIMA(1,1,5)

Model Summary

Model Fit

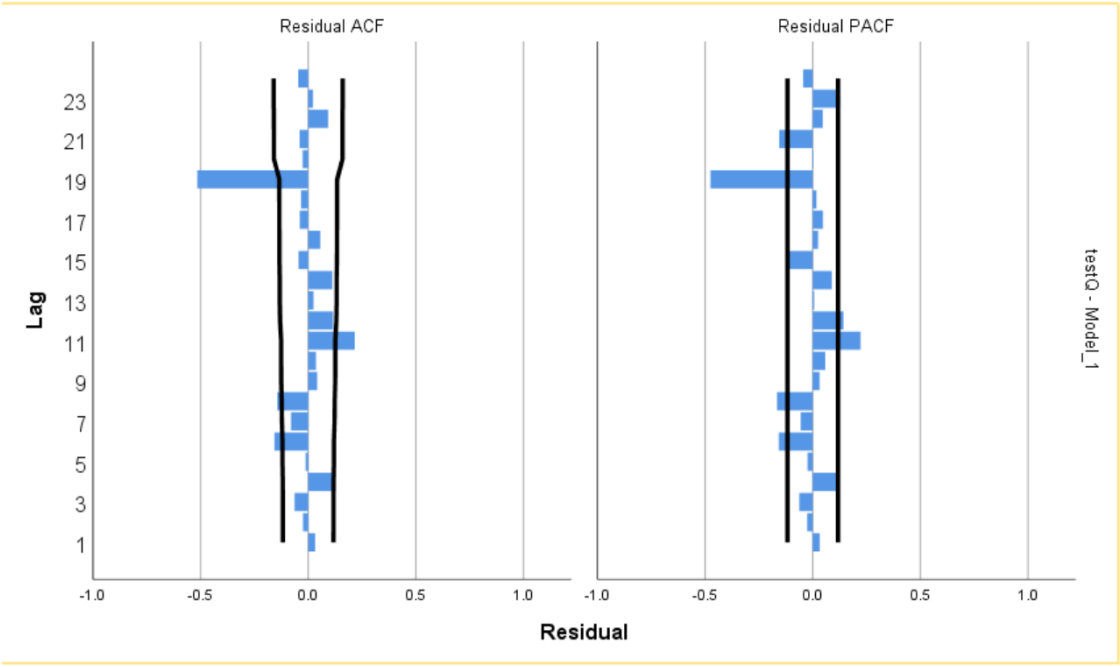
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.478	.	.478	.478	.478	.478	.478	.478	.478	.478	.478
R-squared	.994	.	.994	.994	.994	.994	.994	.994	.994	.994	.994
RMSE	.004	.	.004	.004	.004	.004	.004	.004	.004	.004	.004
MAPE	.657	.	.657	.657	.657	.657	.657	.657	.657	.657	.657
MaxAPE	3.156	.	3.156	3.156	3.156	3.156	3.156	3.156	3.156	3.156	3.156
MAE	.003	.	.003	.003	.003	.003	.003	.003	.003	.003	.003
MaxAE	.017	.	.017	.017	.017	.017	.017	.017	.017	.017	.017
Normalized BIC	-10.973	.	-10.973	-10.973	-10.973	-10.973	-10.973	-10.973	-10.973	-10.973	-10.973

Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
testQ-Model_1	0	.478	44.593	16	.000	0

ARIMA Model Parameters

					Estimate	SE	t	Sig.
testQ-Model_1	testQ	No Transformation	AR	Lag 1	.693	.045	15.540	.000
			Difference		1			
			MA	Lag 5	.207	.061	3.389	.001



一样，acf和pacf效果很差，拟合结果也罕见地出现了立即收束的情况；不过欣慰的是（？），预测值相比于测试组并没有太大的残差，测试组的数据也在预测组的拟合值（约为0.4314）上下浮动

Q	VM	point	testQ	testVM	Predicted _testQ_Model_1
.45583289	.26224066	304	.	.	.43138422
.44827643	.54224066	305	.	.	.43138437
.43932958	.44890733	306	.	.	.43138448
.43565920	.26178221	307	.	.	.43138455
.43283965	.49511555	308	.	.	.43138460
.43176827	.37844888	309	.	.	.43138464
.42941962	.56511555	310	.	.	.43138466
.43384928	.65844888	311	.	.	.43138468
.43922392	.71178221	312	.	.	.43138469
.43769585	.61277174	313	.	.	.43138470
.43630247	.72943841	314	.	.	.43138470
.43428079	.49610507	315	.	.	.43138471
.43285385	.68277174	316	.	.	.43138471
.42305414	.54277174	317	.	.	.43138471
.41407693	.46277174	318	.	.	.43138471
.41378244	.16294192	319	.	.	.43138471
.41424549	.51294192	320	.	.	.43138471
.41857273	.74627525	321	.	.	.43138471
.42634650	.79294192	322	.	.	.43138471
.43378809	.81627525	323	.	.	.43138471
.43300979	.63953544	324	.	.	.43138471
.43461854	.40620211	325	.	.	.43138471
.42985431	.28953544	326	.	.	.43138471
.42459633	.56953544	327	.	.	.43138471
.41943910	.47620211	328	.	.	.43138471
.42279721	.27587617	329	.	.	.43138471
.42582583	.50920950	330	.	.	.43138471
.42981888	.74254284	331	.	.	.43138471
.44051911	.50920950	332	.	.	.43138471
.45081288	.62587617	333	.	.	.43138471
.46094103	.69254284	334	.	.	.43138471

接下来是对VM的预测：

Model Description

			Model Type
Model ID	testVM	Model_1	ARIMA(1,0,0)

Model Summary

Model Fit

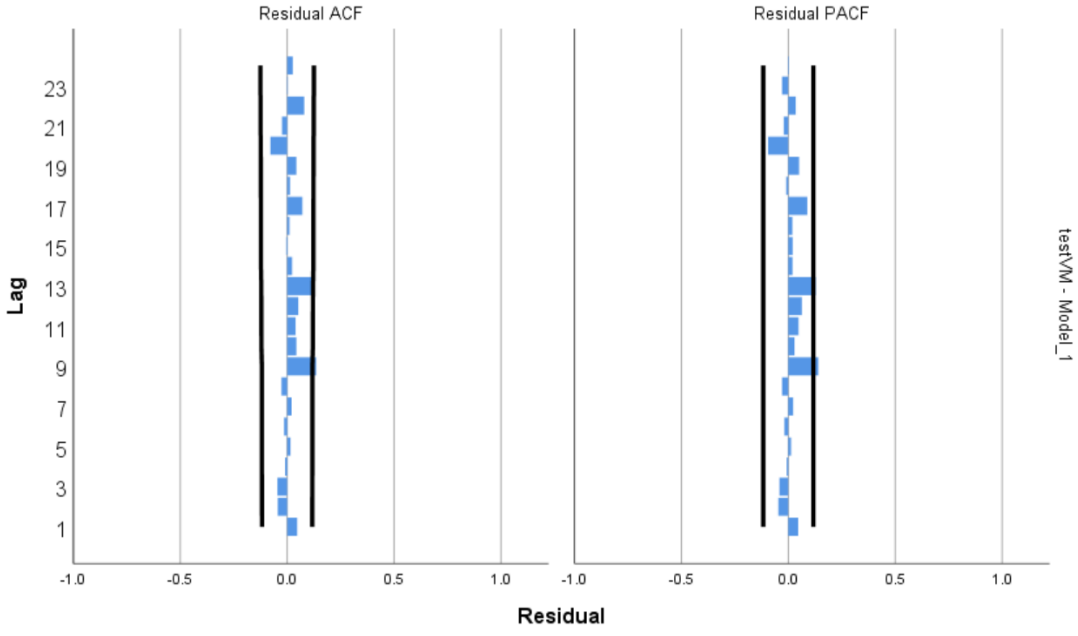
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.462	.	.462	.462	.462	.462	.462	.462	.462	.462	.462
R-squared	.462	.	.462	.462	.462	.462	.462	.462	.462	.462	.462
RMSE	.149	.	.149	.149	.149	.149	.149	.149	.149	.149	.149
MAPE	93.267	.	93.267	93.267	93.267	93.267	93.267	93.267	93.267	93.267	93.267
MaxAPE	6169.371	.	6169.371	6169.371	6169.371	6169.371	6169.371	6169.371	6169.371	6169.371	6169.371
MAE	.130	.	.130	.130	.130	.130	.130	.130	.130	.130	.130
MaxAE	.366	.	.366	.366	.366	.366	.366	.366	.366	.366	.366
Normalized BIC	-3.761	.	-3.761	-3.761	-3.761	-3.761	-3.761	-3.761	-3.761	-3.761	-3.761

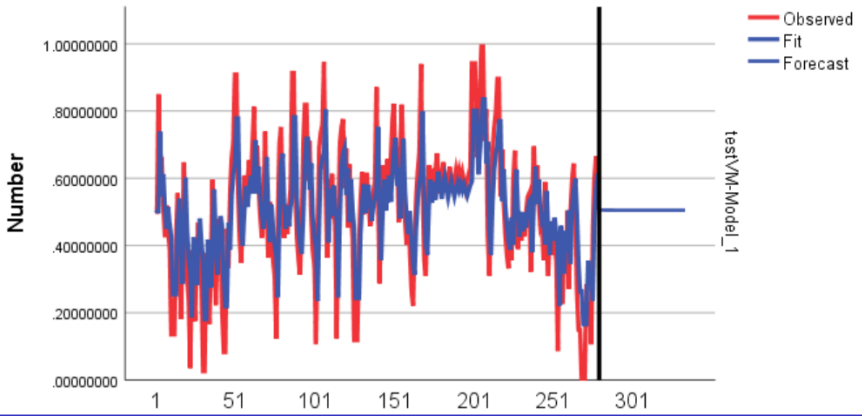
Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
testVM-Model_1	0	.462	15.145	17	.585	0

ARIMA Model Parameters

				Estimate	SE	t	Sig.
testVM-Model_1	testVM	No Transformation	Constant	.505	.028	18.340	.000
			AR Lag 1	.678	.044	15.378	.000





事实证明ARIMA压根不适合拟合20个以后的预测数值，在这里VM在测试组发生了巨大的震荡，而拟合值却迅速收束

于是打算拿出前320来预测后14

首先是Q

Time Series Modeler

Model Description

			Model Type
Model ID	testQ	Model_1	ARIMA(1,1,6)

Model Summary

Model Fit

					Percentile						
Fit Statistic	Mean	SE	Minimum	Maximum	5	10	25	50	75	90	95
Stationary R-squared	.496	.	.496	.496	.496	.496	.496	.496	.496	.496	.496
R-squared	.994	.	.994	.994	.994	.994	.994	.994	.994	.994	.994
RMSE	.004	.	.004	.004	.004	.004	.004	.004	.004	.004	.004
MAPE	.652	.	.652	.652	.652	.652	.652	.652	.652	.652	.652
MaxAPE	3.083	.	3.083	3.083	3.083	3.083	3.083	3.083	3.083	3.083	3.083
MAE	.003	.	.003	.003	.003	.003	.003	.003	.003	.003	.003
MaxAE	.016	.	.016	.016	.016	.016	.016	.016	.016	.016	.016
Normalized BIC	-11.005	.	-11.005	-11.005	-11.005	-11.005	-11.005	-11.005	-11.005	-11.005	-11.005

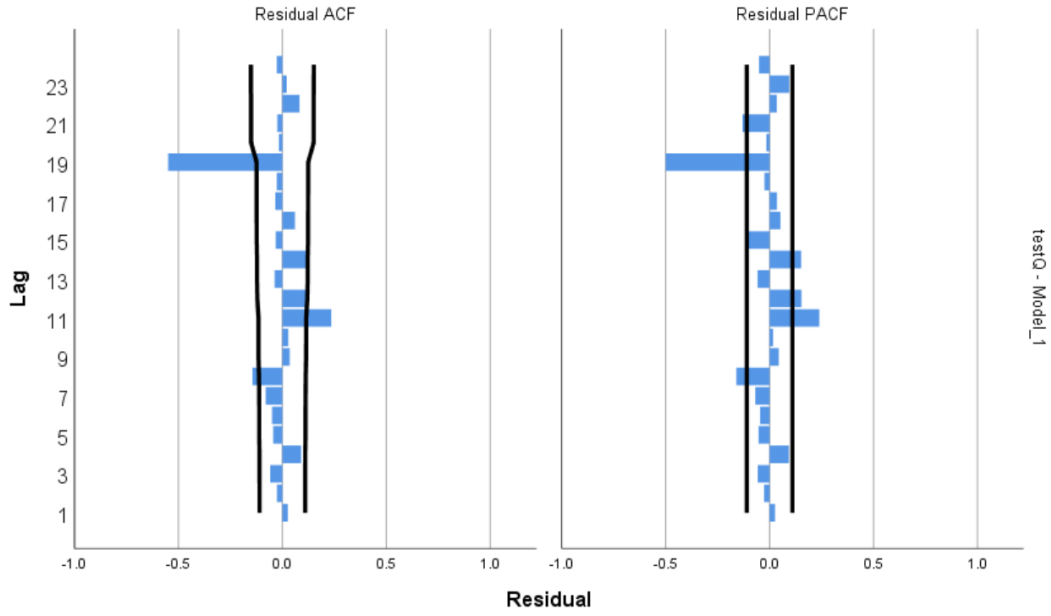
Model Statistics

		Model Fit statistics	Ljung-Box Q(18)			
Model	Number of Predictors	Stationary R-squared	Statistics	DF	Sig.	Number of Outliers
testQ-Model_1	0	.496	46.461	15	.000	0

ARIMA Model Parameters

					Estimate	SE	t	Sig.
testQ-Model_1	testQ	No Transformation	AR	Lag 1	.697	.042	16.743	.000
			Difference		1			
			MA	Lag 5	.162	.057	2.870	.004
				Lag 6	.136	.056	2.429	.016

Lag 6	.136	.056	2.429	.016



.41857273
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.42981888
.44051911
.45081288
.46094103

.41467298
.41614902
.41866414
.41994570
.42007900
.42012301
.42015367
.42017502
.42018990

.42020026
.42020748
.42021250
.42021600
.42021844 这两行分别为测试组和拟合值在321~334的值，可以发现较大的误差

下面是VM：

Time Series Modeler

Model Description

			Model Type
Model ID	testVM	Model_1	ARIMA(1,0,0)

Model Summary

Model Fit

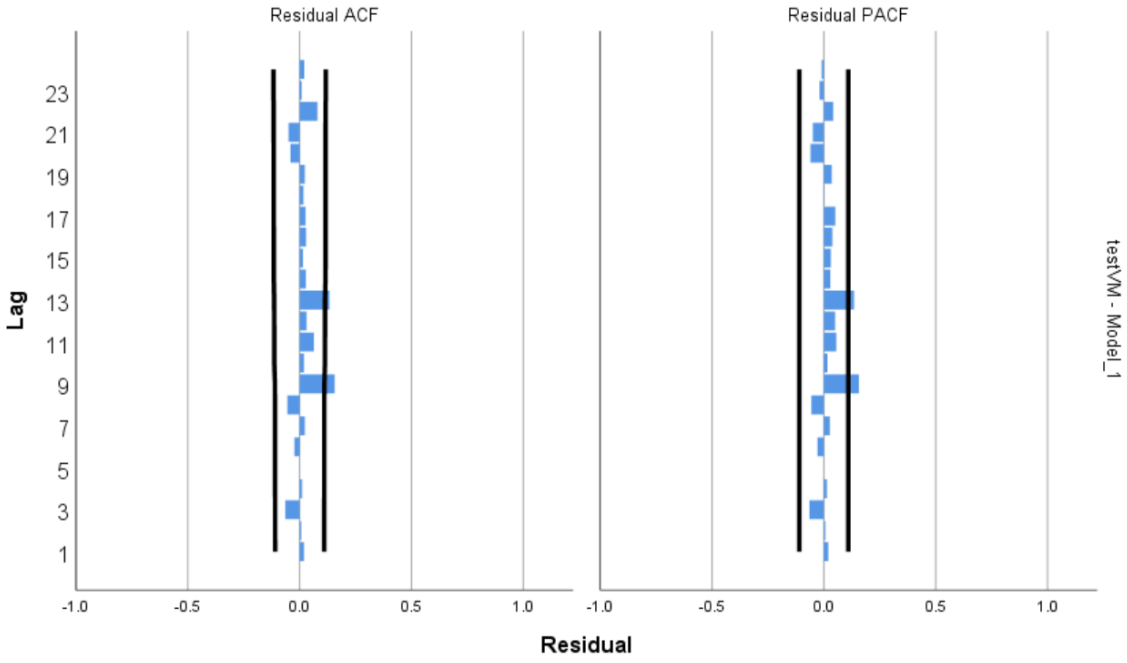
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.444	.	.444	.444	.444	.444	.444	.444	.444	.444	.444
R-squared	.444	.	.444	.444	.444	.444	.444	.444	.444	.444	.444
RMSE	.151	.	.151	.151	.151	.151	.151	.151	.151	.151	.151
MAPE	88.130	.	88.130	88.130	88.130	88.130	88.130	88.130	88.130	88.130	88.130
MaxAPE	6318.505	.	6318.505	6318.505	6318.505	6318.505	6318.505	6318.505	6318.505	6318.505	6318.505
MAE	.132	.	.132	.132	.132	.132	.132	.132	.132	.132	.132
MaxAE	.365	.	.365	.365	.365	.365	.365	.365	.365	.365	.365
Normalized BIC	-3.742	.	-3.742	-3.742	-3.742	-3.742	-3.742	-3.742	-3.742	-3.742	-3.742

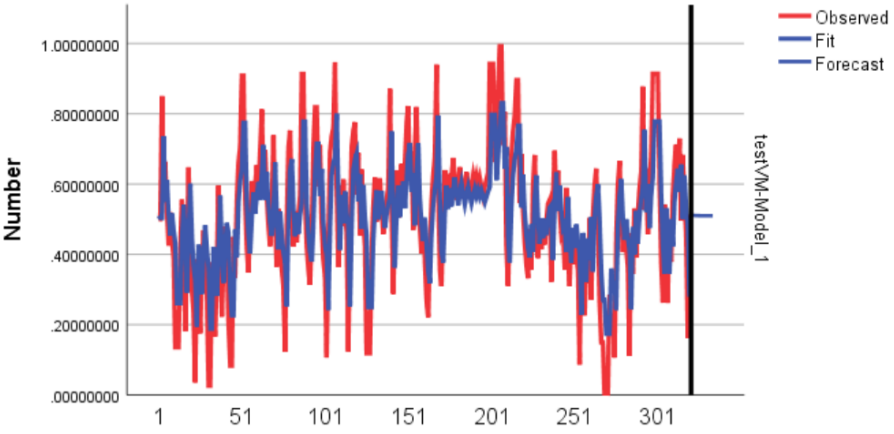
Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
testVM-Model_1	0	.444	19.749	17	.287	0

ARIMA Model Parameters

					Estimate	SE	t	Sig.
testVM-Model_1	testVM	No Transformation	Constant		.510	.025	20.373	.000
			AR	Lag 1	.664	.042	15.885	.000





可以发现拟合值同样迅速收束，压根没法预测

当然只要说明有时间序列的特性即可，因此选用决赛的数据（上面有全部比赛的数据，但全部比赛的无论是技术指标涉及人员还是场次都跨多场，有时间序列特性才怪

首先是Q：

Model Description

			Model Type
Model ID	Q	Model_1	ARIMA(1,1,6)

Model Summary

Model Fit

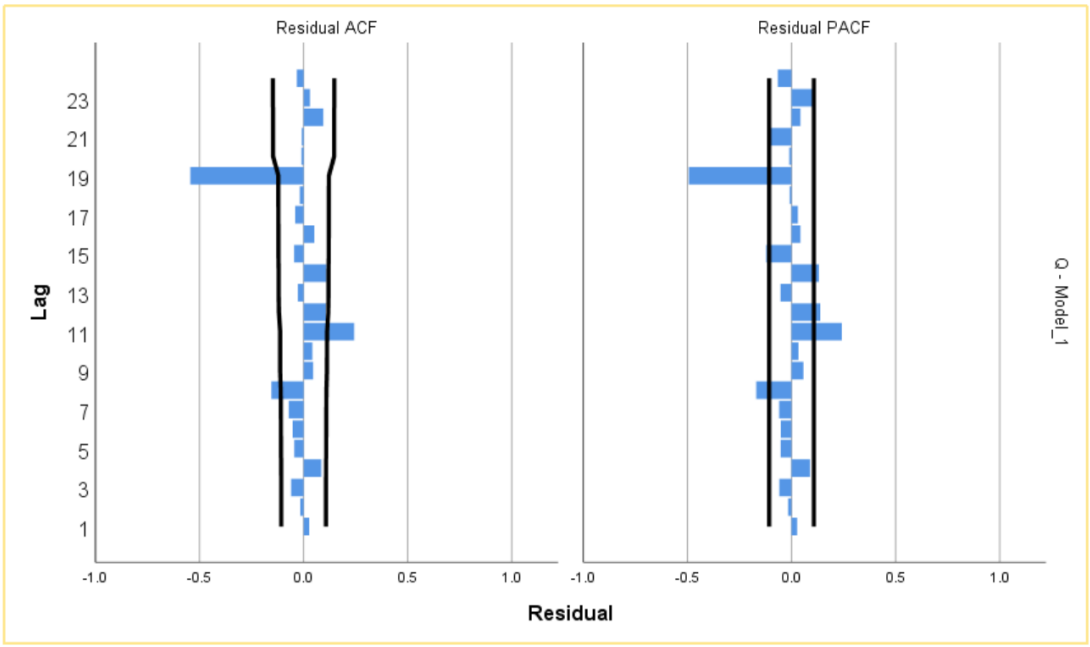
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.506	.	.506	.506	.506	.506	.506	.506	.506	.506	.506
R-squared	.994	.	.994	.994	.994	.994	.994	.994	.994	.994	.994
RMSE	.004	.	.004	.004	.004	.004	.004	.004	.004	.004	.004
MAPE	.655	.	.655	.655	.655	.655	.655	.655	.655	.655	.655
MaxAPE	3.093	.	3.093	3.093	3.093	3.093	3.093	3.093	3.093	3.093	3.093
MAE	.003	.	.003	.003	.003	.003	.003	.003	.003	.003	.003
MaxAE	.016	.	.016	.016	.016	.016	.016	.016	.016	.016	.016
Normalized BIC	-11.010	.	-11.010	-11.010	-11.010	-11.010	-11.010	-11.010	-11.010	-11.010	-11.010

Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
Q-Model_1	0	.506	48.182	15	.000	0

ARIMA Model Parameters

					Estimate	SE	t	Sig.
Q-Model_1	Q	No Transformation	AR	Lag 1	.703	.041	17.309	.000
			Difference		1			
			MA	Lag 5	.181	.055	3.290	.001
				Lag 6	.130	.055	2.388	.017



然后是VM：

Model Description

			Model Type
Model ID	VM	Model_1	ARIMA(1,0,0)

Model Summary

Model Fit

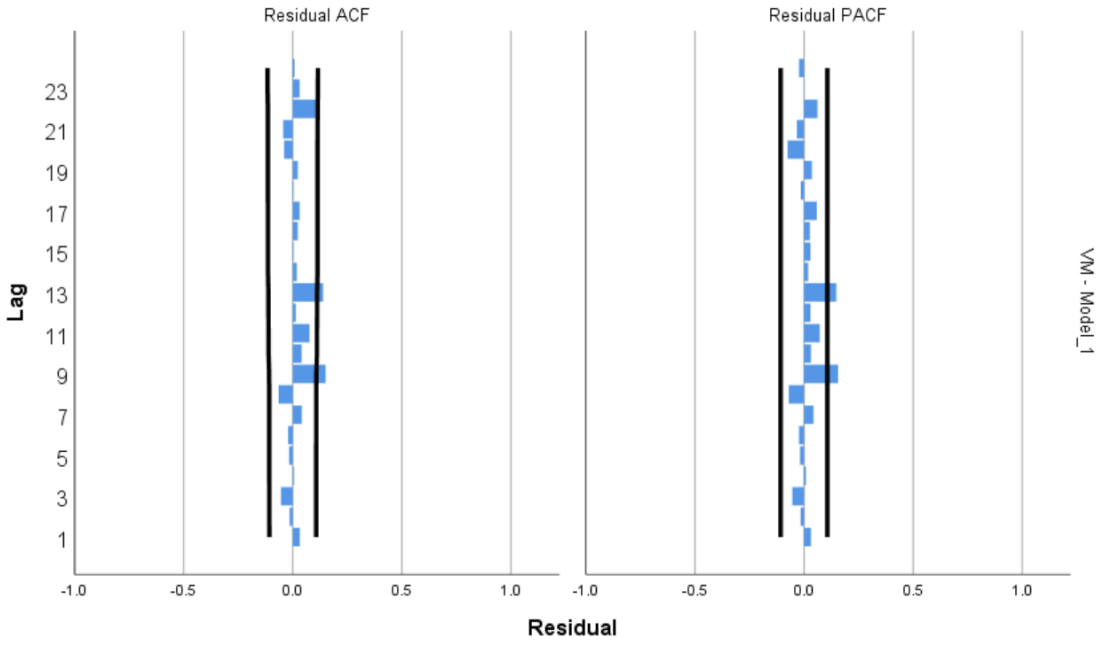
Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.436	.	.436	.436	.436	.436	.436	.436	.436	.436	.436
R-squared	.436	.	.436	.436	.436	.436	.436	.436	.436	.436	.436
RMSE	.152	.	.152	.152	.152	.152	.152	.152	.152	.152	.152
MAPE	86.719	.	86.719	86.719	86.719	86.719	86.719	86.719	86.719	86.719	86.719
MaxAPE	6394.565	.	6394.565	6394.565	6394.565	6394.565	6394.565	6394.565	6394.565	6394.565	6394.565
MAE	.133	.	.133	.133	.133	.133	.133	.133	.133	.133	.133
MaxAE	.364	.	.364	.364	.364	.364	.364	.364	.364	.364	.364
Normalized BIC	-3.737	.	-3.737	-3.737	-3.737	-3.737	-3.737	-3.737	-3.737	-3.737	-3.737

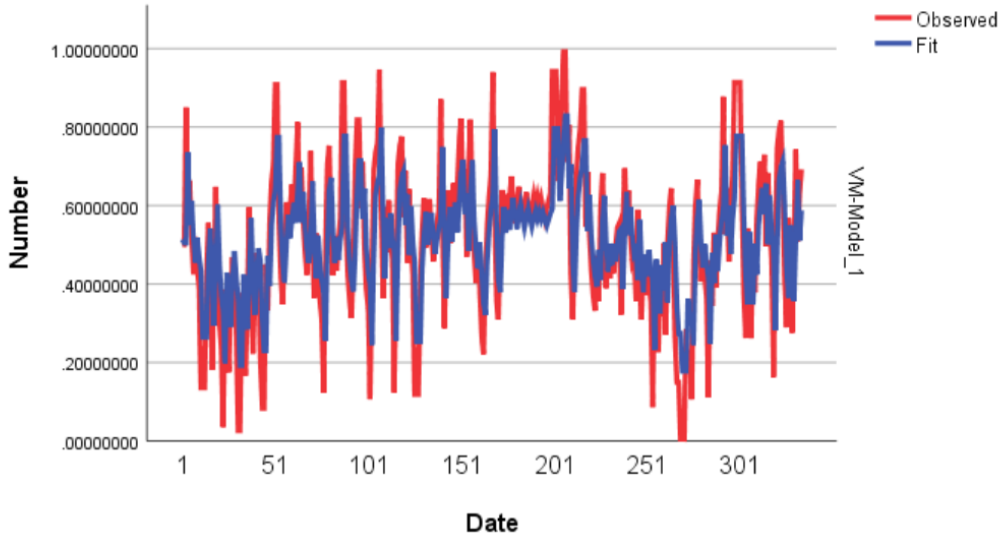
Model Statistics

Model	Number of Predictors	Model Fit statistics: Stationary R-squared	Ljung-Box Q(18): Statistics	DF	Sig.	Number of Outliers
VM-Model_1	0	.436	21.708	17	.196	0

ARIMA Model Parameters

				Estimate	SE	t	Sig.
VM-Model_1	VM	No Transformation	Constant	.514	.024	21.223	.000
			AR Lag 1	.659	.041	15.967	.000





在这一范围内，ARIMA对于Q和VM的建模效果都很好；可以说明momentum并不是随机的，而是能够解释为随着point的深入而相关