

# Evaluation of MK Test

Charles Perretti

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## A simulation test of the MK test corrected for autocorrelation

The MK test corrected for autocorrelation ostensibly guards against detecting a trend if it is merely driven by autocorrelation. Here I evaluate its performance on time series of length that we are applying it on.

First, generate 1000 autocorrelated random time series of length 40.

```
set.seed(123456) # for reproducibility

# Create some autocorrelated error
T <- 40 # Number of observations
n_reps <- 1000 # Number of replicates
ar_err <- matrix(data = NA, nrow = T, ncol = n_reps)
ar_err[1,] <- 0 # Initial condition

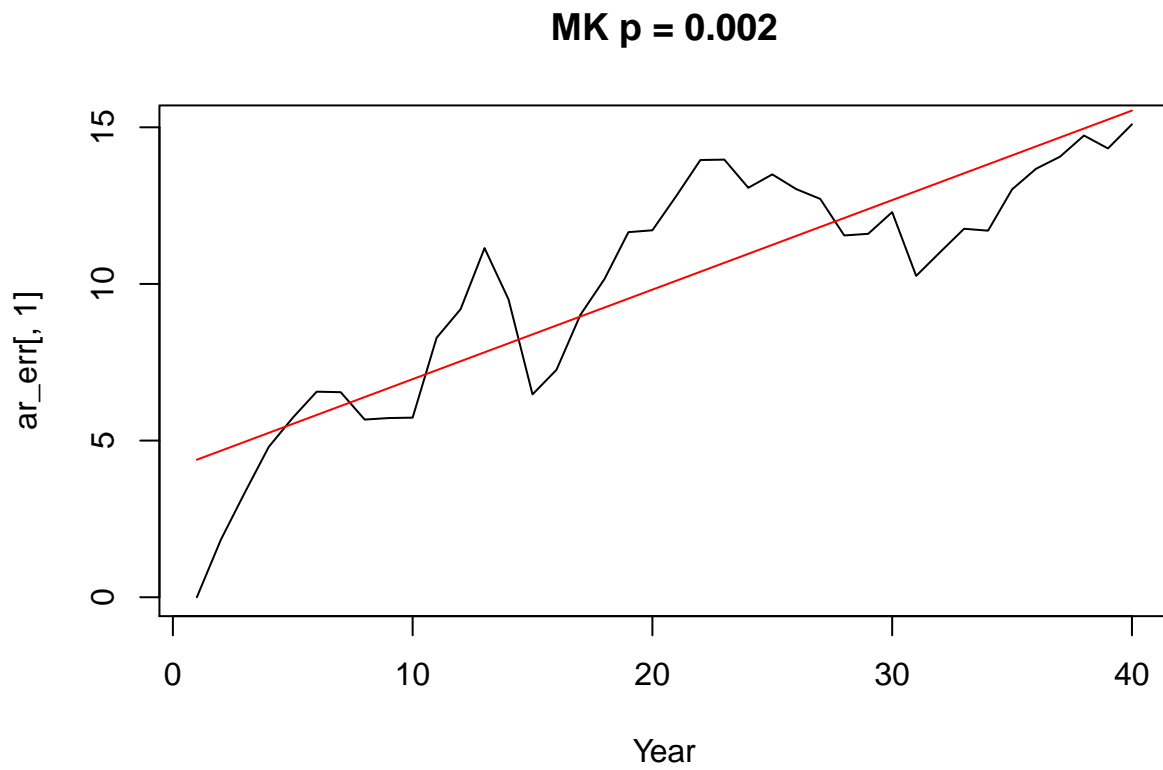
for (t in 2:T) {
  ar_err[t,] <- 0.9 * ar_err[t-1,] + rnorm(1, n = n_reps)
}
```

Next, apply the MK Test corrected for autocorrelation.

```
# Apply the mk-test corrected for autocorrelation
mk_out <- apply(ar_err, 2, zyp::zyp.trend.vector)
```

Plot an example time series, linear trend fit, and p-value from the autocorrelation corrected MK Test. This should not detect a trend.

```
# Plot an example with linear trend line
Year <- 1:T
plot(Year, ar_err[, 1], type = "l")
lines(x= Year, y = predict(lm(formula = ar_err[, 1] ~ Year)), col = "red")
title(paste("MK p =", round(mk_out["sig", 1], 3)))
```



Plot a histogram of all of the p-values from the 1000 simulations. This should not be clustered at  $p < 0.05$ .

```
# Histogram of p-values  
hist(mk_out["sig",], breaks = seq(0, 1, 0.05))
```

**Histogram of mk\_out["sig", ]**

