RegressionToTrend

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We determine whether the All Ordinaries' deviation from trend is indicative of future equity market returns. We use a real return price series for the All Ordinaries.

```
#read in the data
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 3.2.3
```

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.2.3
```

```
setwd("/Users/Jake/Projects/MarketValuation/Data/")

cpi = read.csv("cpi.csv")
cpi$Date = as.Date(as.character(cpi$Date), format = "%d/%m/%Y")
cpi = cpi[c(1,2)]

#use cubic spline to interpolate monthly figures

xao = read.csv("xao.csv")
xao$Date = as.Date(as.character(xao$Date), format = "%d/%m/%Y")
xao = xao[c(1,2)]

data = merge(cpi, xao, by = "Date")
data = data[-c(1,2),]
```

We adjust the time series for inflation and fit a semi-log regression to the resulting time series. We use the resulting regression to calculate the deviation from trend.

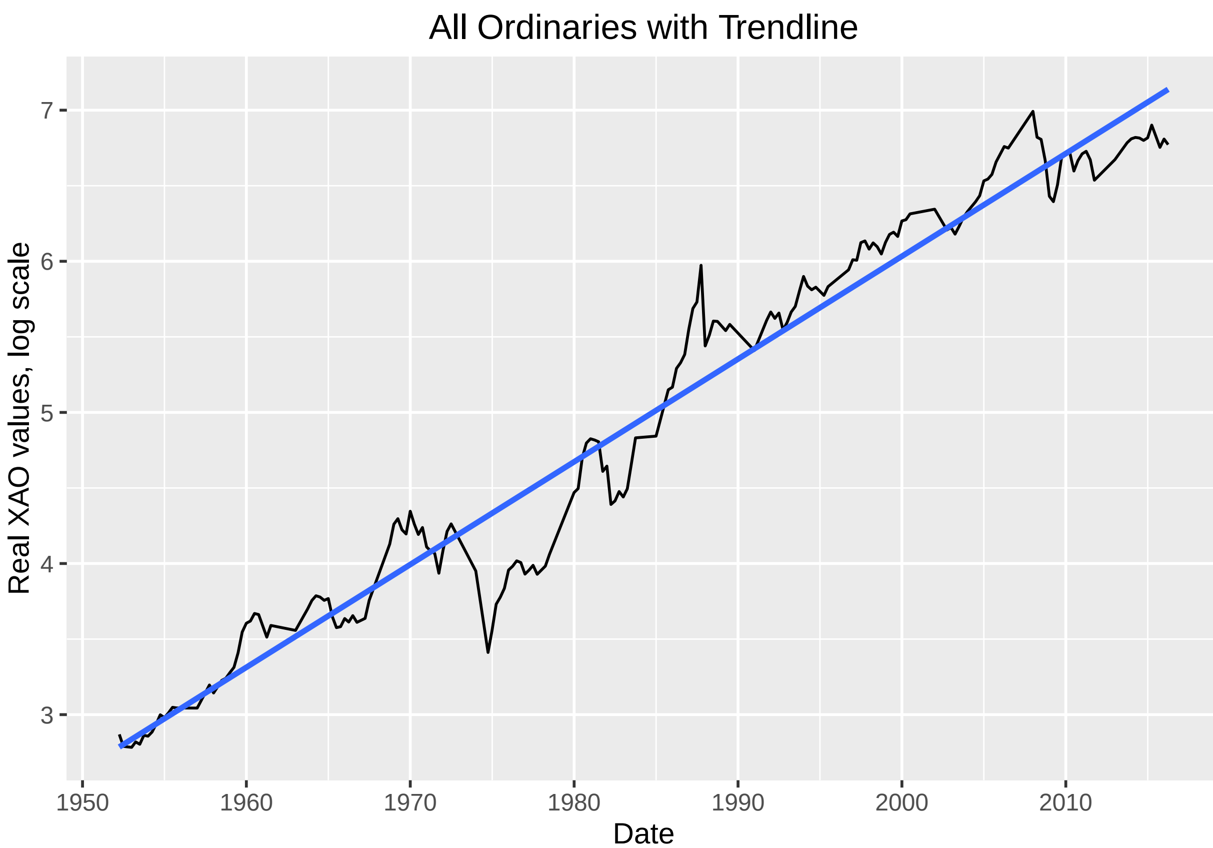
```r
#Adjust closes for inflation
base_cpi = data$CPI[1]


data = mutate(data,
              adjusted_xao = XAO/base_cpi,
              log_adjusted_xao = log(adjusted_xao),
              observation = as.numeric(rownames(data)))


#fit
fit = lm(log_adjusted_xao ~ Date, data = data)
#get coefficients:
coef(fit)
```

```
##  (Intercept)         Date
## 3.9934147765 0.0001861633
```

```r
data$predictions = predict(fit, data)
ggplot(data = data, aes(Date, log_adjusted_xao)) + geom_line() + geom_smooth(method = 'lm', se = FALSE)
  ggtitle("All Ordinaries with Trendline") +
  ylab("Real XAO values, log scale")
```

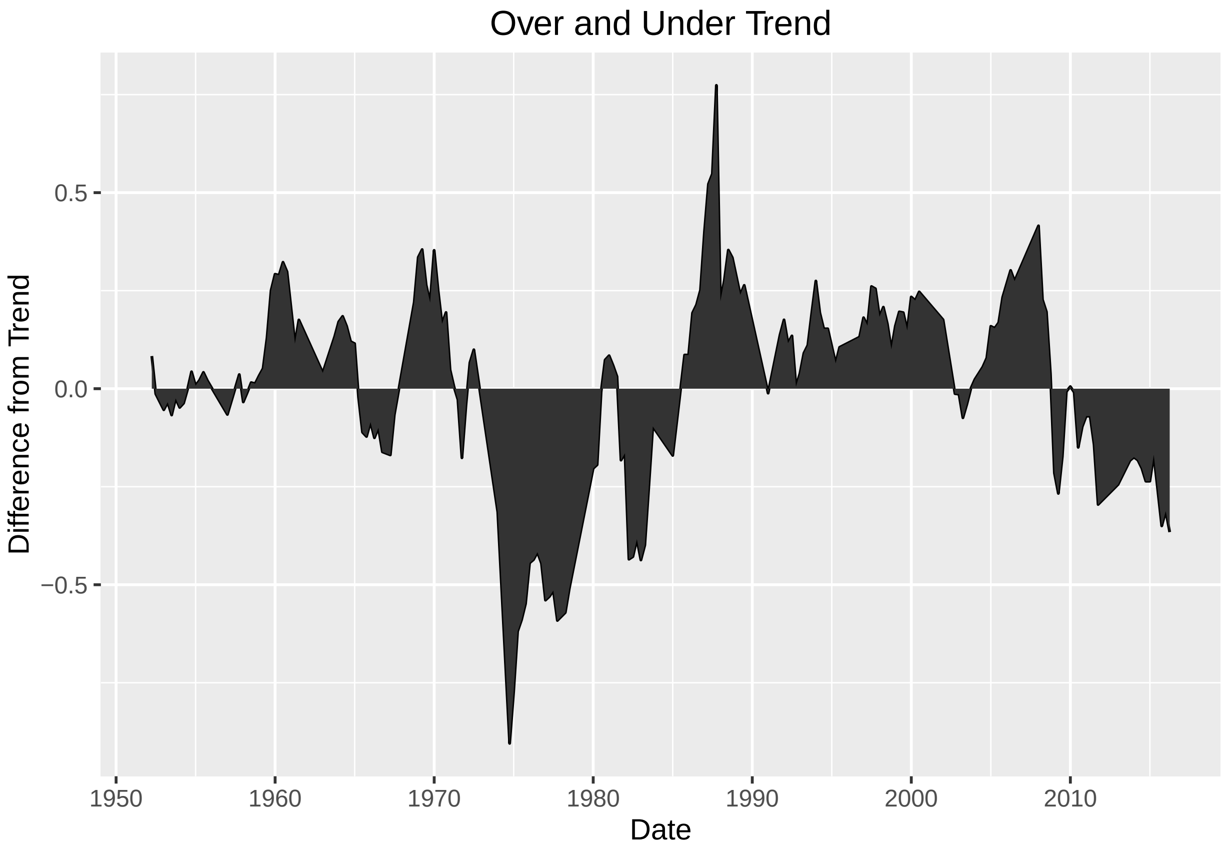



```r
#CHECK THAT LINE IS ACCURATE:
#ggplot(data = data, aes(Date, log_adjusted_xao)) + geom_line() + geom_abline(intercept = coef(fit)[1],
```

```
data = mutate(data, difference = (log_adjusted_xao - predictions))
```

The below charts the over and under of the time series over time.

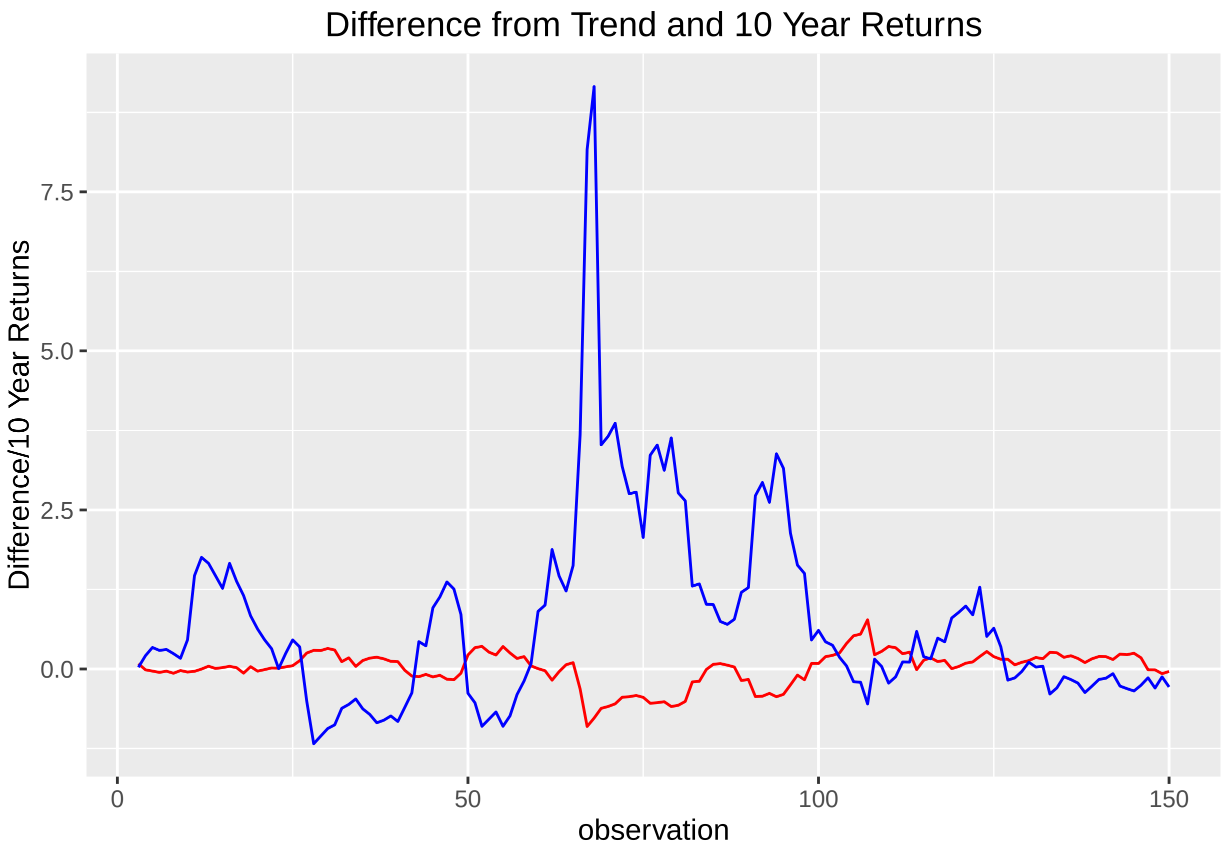
```
#plot the over vs under trends
ggplot(data, aes(Date, difference)) + geom_line()  + geom_area() +
  ggtitle("Over and Under Trend") +
  ylab("Difference from Trend")
```



We calculate ten year performance at each observation.

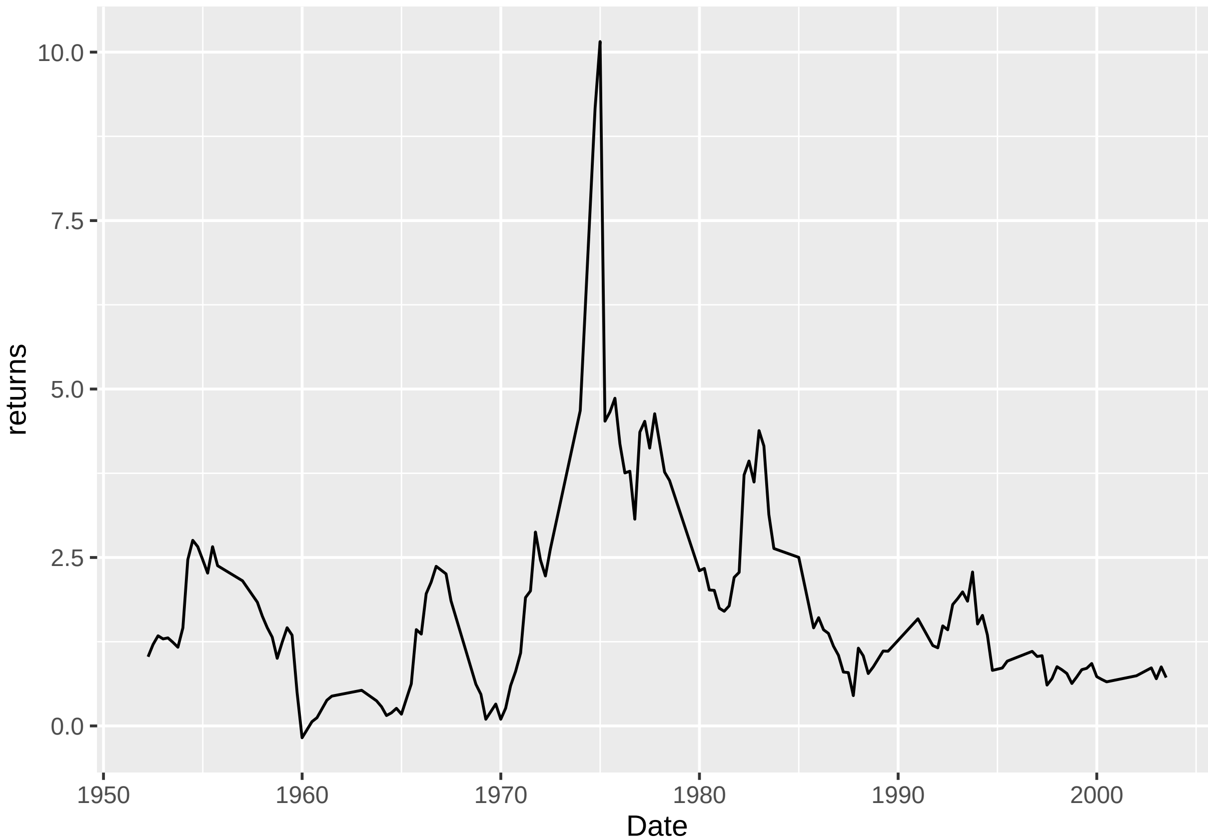
```
#Calculate subsequent 10 year performance from first obs.
#take obs 40-187, append as column leagged returns,
ten_years = data$adjusted_xao[40:187]
new_data = data[1:148,]
new_data$ten_years = ten_years
new_data = mutate(new_data, returns = (ten_years - adjusted_xao)/adjusted_xao)

ggplot() + geom_line(data = new_data, colour = "red",aes(observation, difference)) +
  geom_line(data = new_data, colour = "blue", aes(x = observation, y= returns-1)) +
  ggtitle("Difference from Trend and 10 Year Returns") +
  ylab("Difference/10 Year Returns")
```



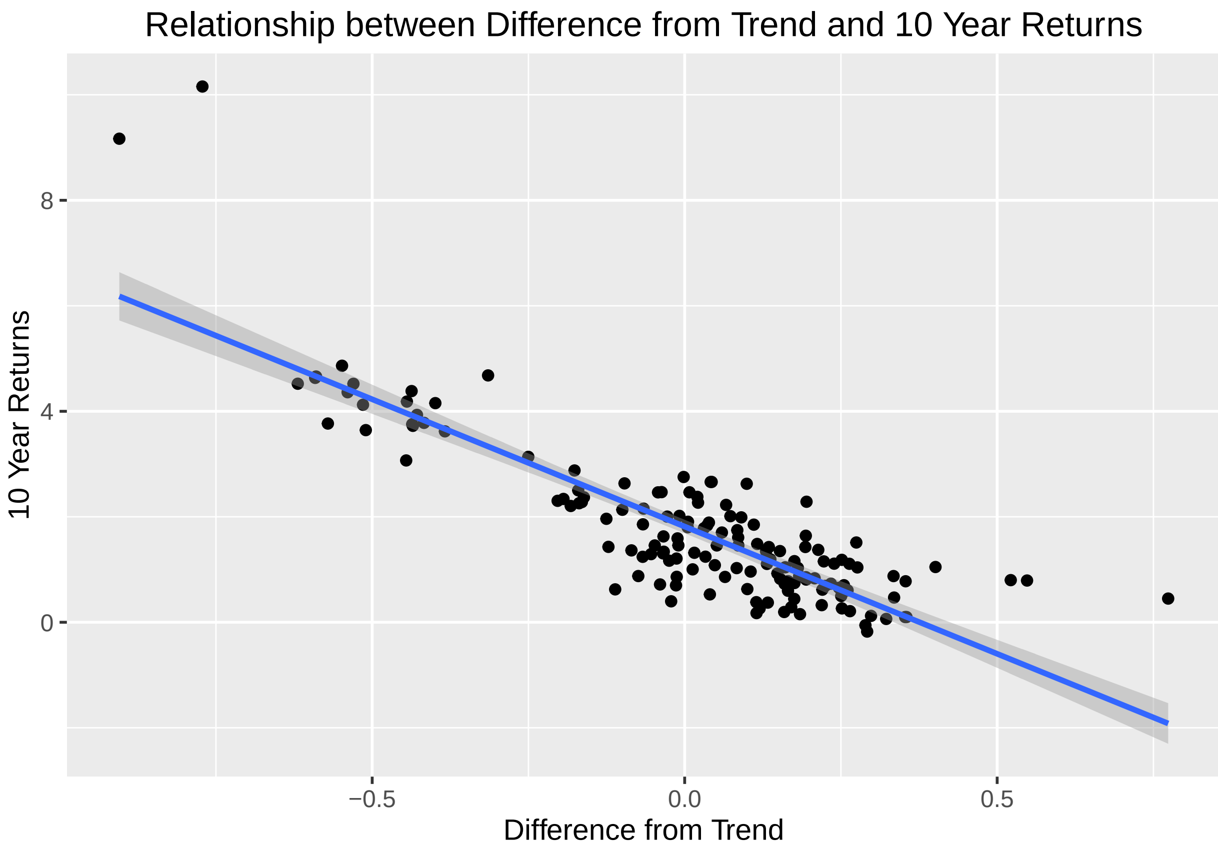
And we now chart 10 year returns over the time period.

```
#returns graph
ggplot(new_data, aes(x = Date, y = returns)) + geom_line()
```



By regressing 10 year returns on difference from trend, we can observe the relationship between the two variables. The linear model is reasonably descriptive. The line of best fit is exponential owing to the outliers.

```
#relationship with difference from trend vs 10 year returns
ggplot(new_data, aes(x = difference, y = returns)) + geom_point()+geom_smooth(method = lm) +
  ggtitle("Relationship between Difference from Trend and 10 Year Returns") +
  xlab("Difference from Trend") +
  ylab("10 Year Returns")
```



Lastly, by determining the current difference from trend, we can look at the prospective range of returns with some guidance.

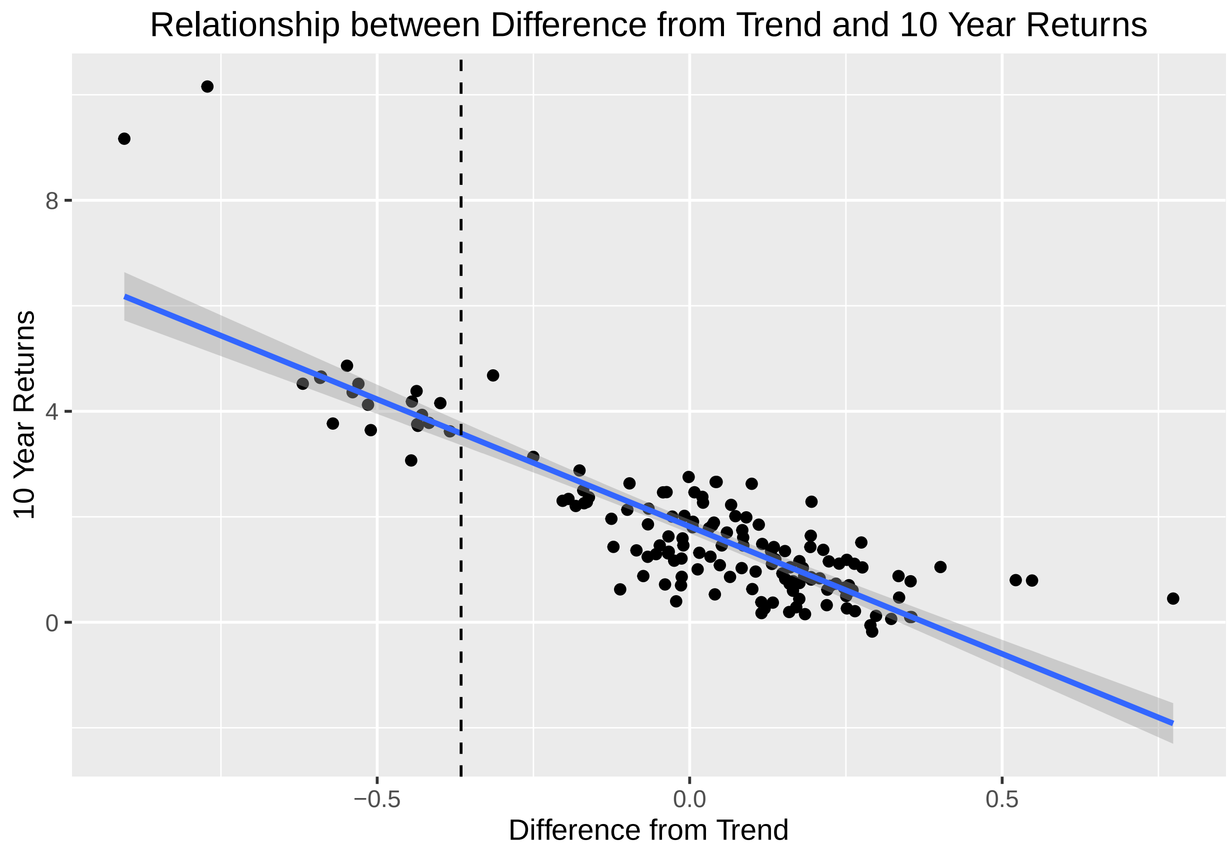
```r
#new fit
new_fit = lm(ten_years ~ difference, data = new_data)

#coefficients
coef(new_fit)
```

```
## (Intercept)  difference
##    357.7987    229.3336
```

```r
#Now predicted 10 year returns:
last_difference = tail(data$difference, n = 1)

#we can also draw a horizontal line at the last difference value, to show where we stand.
ggplot(new_data, aes(x = difference, y = returns)) + geom_point()+geom_smooth(method = lm) +
  ggtitle("Relationship between Difference from Trend and 10 Year Returns") +
  xlab("Difference from Trend") +
  ylab("10 Year Returns") +
  geom_vline(xintercept = last_difference, linetype = "dashed")
```


Relationship between Difference from Trend and 10 Year Returns
10 Year Returns
8
4
0
−0.5
0.0
0.5
Difference from Trend