Project NFP - Spectral Analysis

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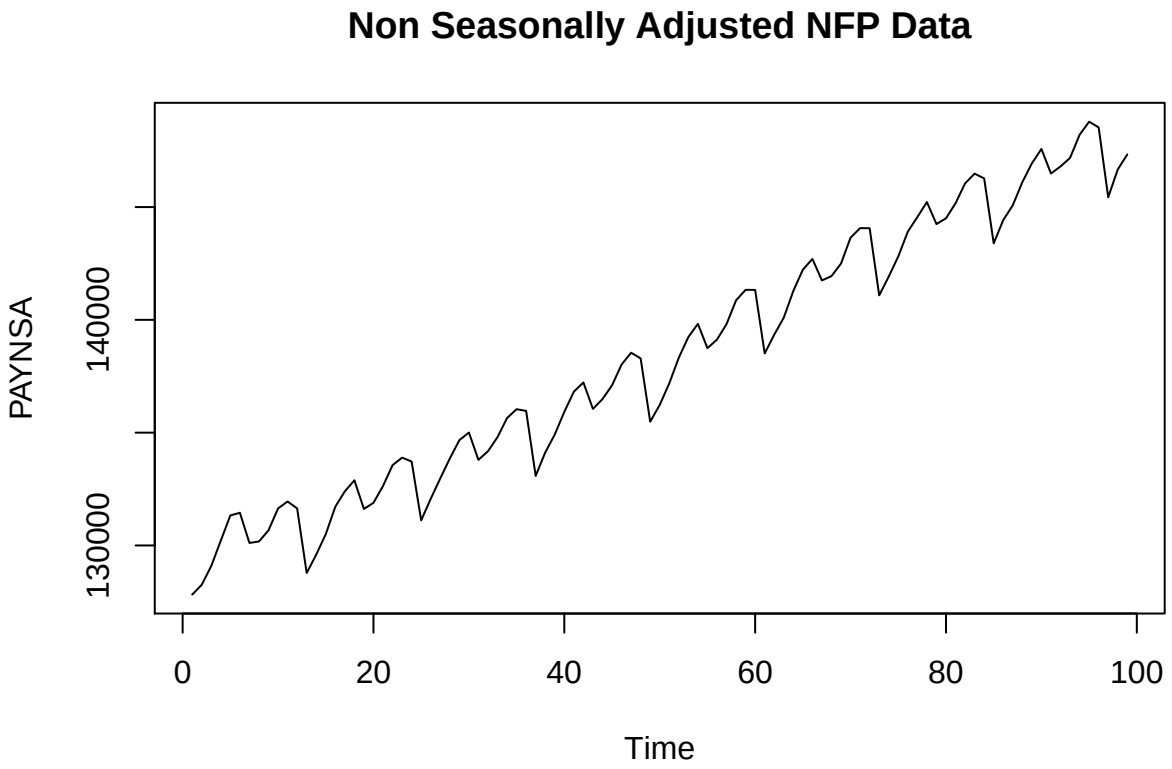
Spectral Analysis

We aim to use spectral analysis to find the key frequencies of variation in the non-seasonally adjusted NFP time series.

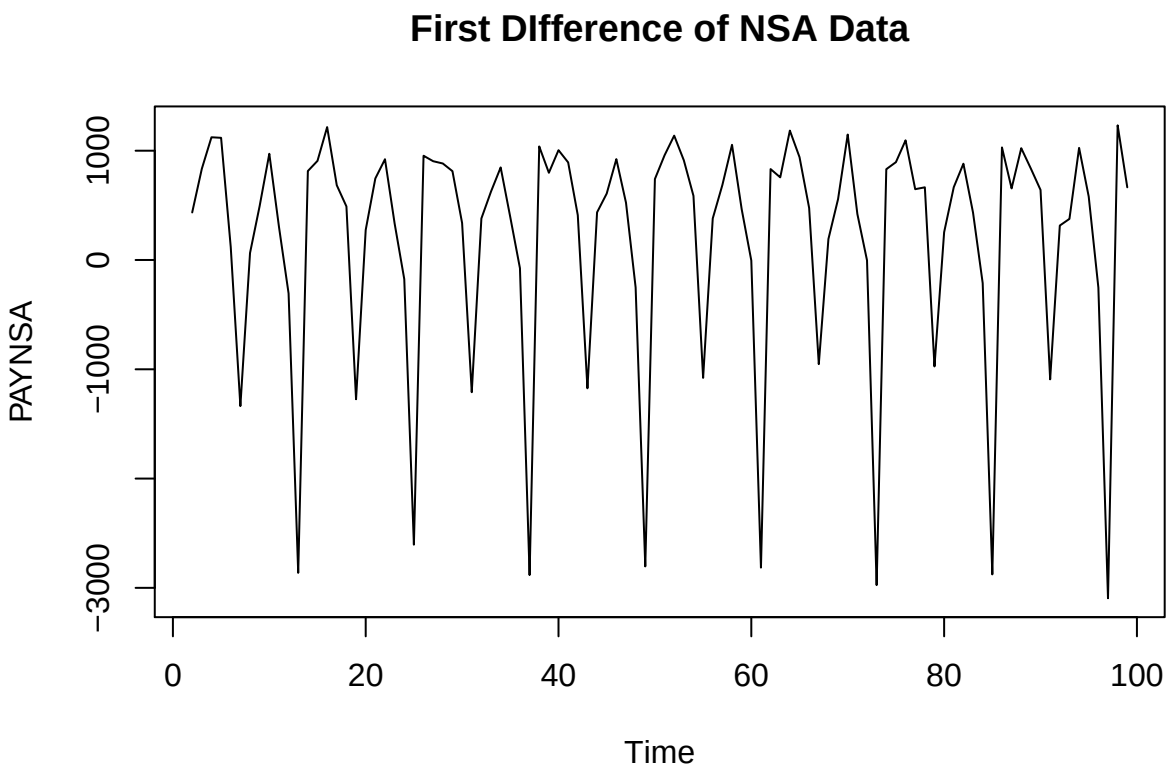
Raw Periodogram

We begin our spectral analysis by detrending the spectral density using a first difference and estimating the spectral density of the detrended time series using a raw periodogram.

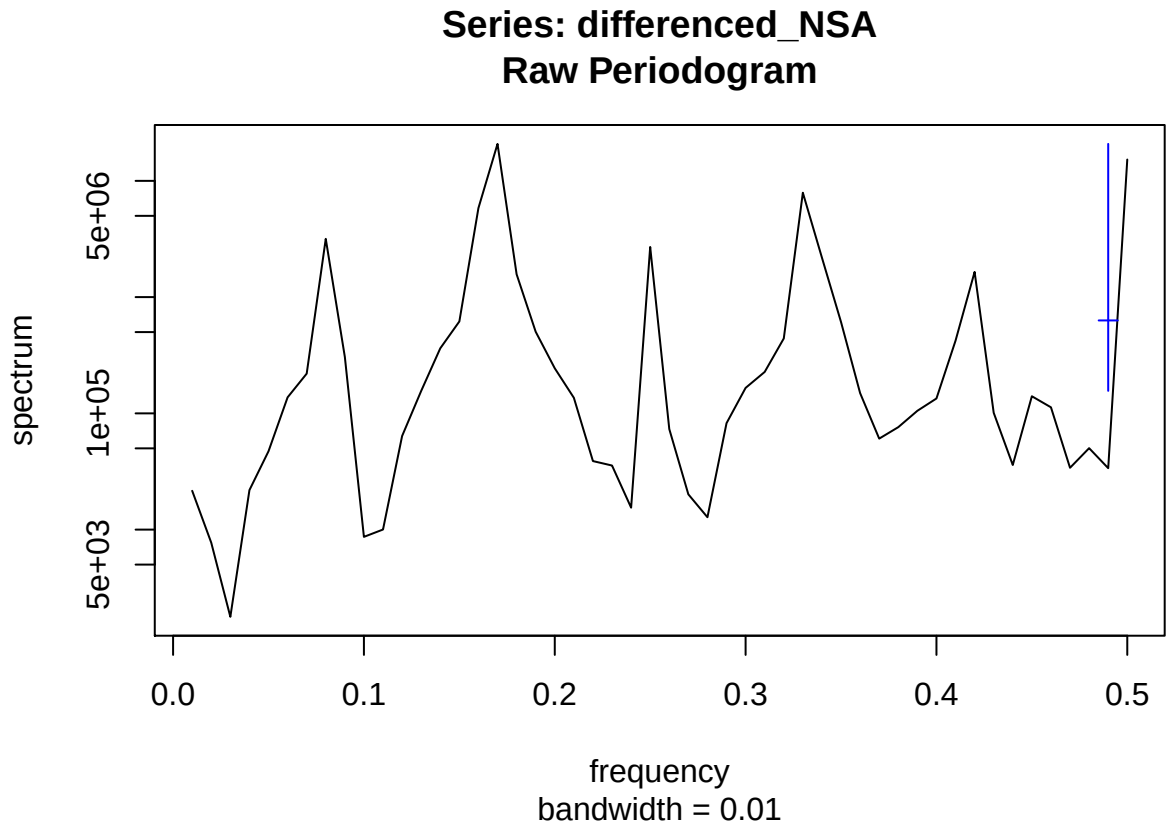
```
PAYNSA <- read.csv(file = "PAYNSA.csv", header = TRUE, sep = ",")
nfp_nsa_ts_2010_2018 <- ts(PAYNSA[853:951, ][2])
plot.ts(nfp_nsa_ts_2010_2018, main = "Non Seasonally Adjusted NFP Data")
```




```
differenced_NSA <- diff(nfp_nsa_ts_2010_2018)
plot.ts(differenced_NSA, main = "First DIfference of NSA Data")
```




```
# mvspec(nfp_nsa_ts_2010_2018)
mvspec(differenced_NSA, detrend = FALSE)
```

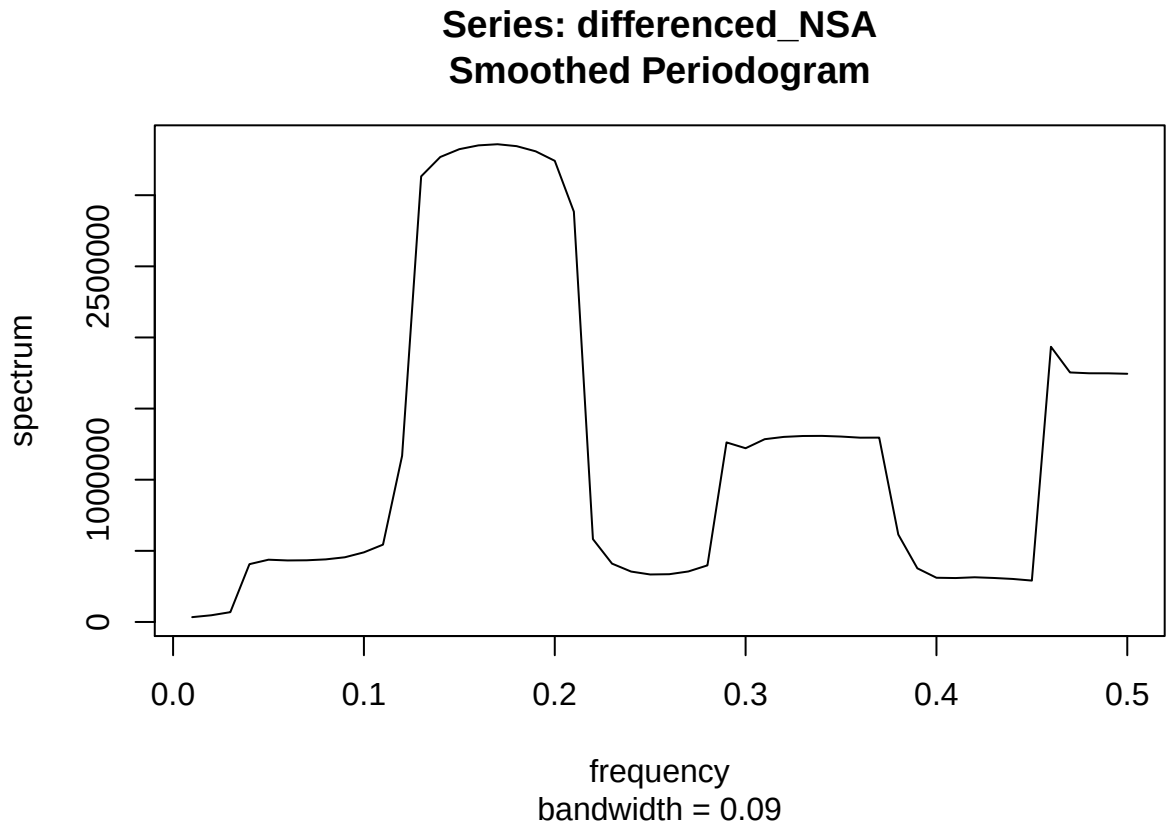


The raw periodogram shows 5 major peaks corresponding to cycles of approximately 12 months, 6 months, 4 months, 3 months, and 2.5 months.

Smoothing the Periodogram

To improve our spectral estimator, we will smooth the periodogram using various parameters to find a better estimate of the spectral density. First we use a daniell kernel with m = 4.

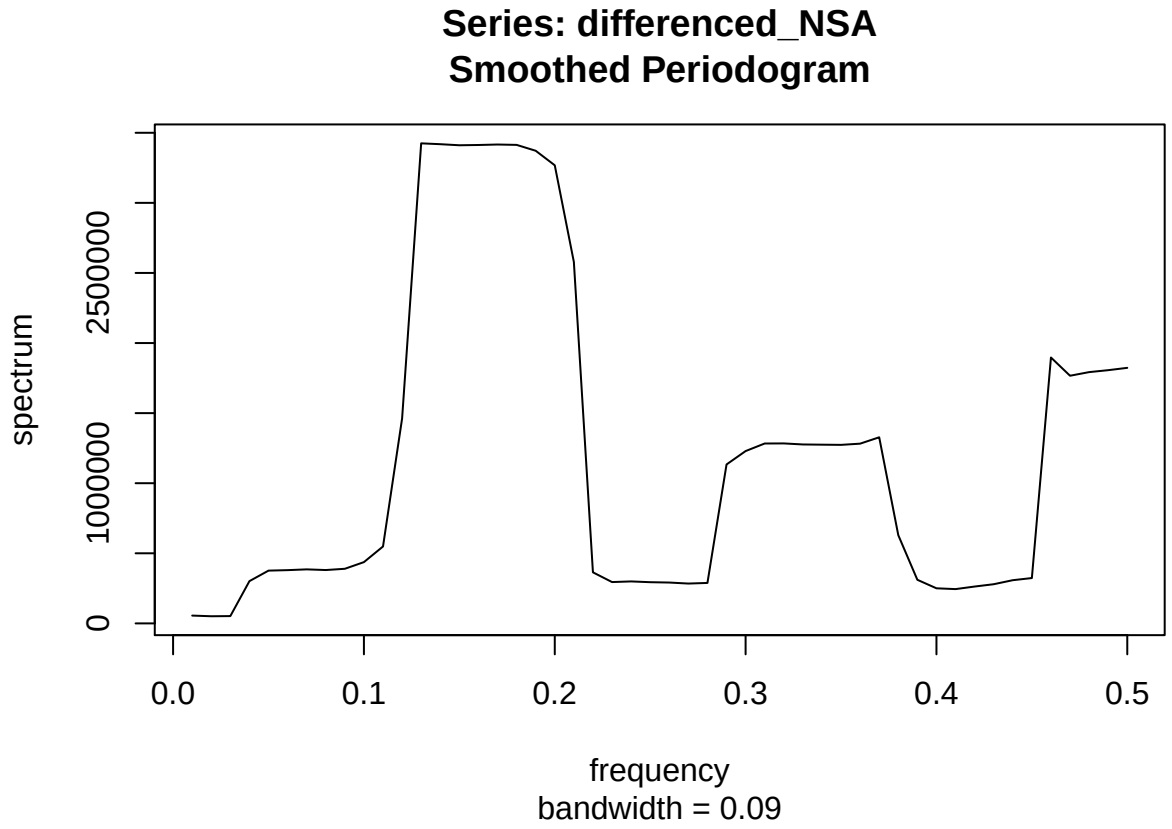
```
k = kernel("daniell", 4)
# mvspec(nfp_nsa_ts_2010_2018, k, log="no")
mvspec(differenced_NSA, k, log="no")
```



The smoothed periodgram shows the greatest variance in the 0.13 to 0.21 frequency range, which corresponds to one cycle every 5-7 months, or approximately a semiannual cycle. There is also a smaller peak at 0.46, corresponding to a cycle every 2 months, and a third peak at 0.29 to 0.37, corresponding to a cycle every 2.7-3.4 months, or a quarterly cycle.

Now we set taper to 0.1. ADD REASONING.

```
# mvspec(nfp_nsa_ts_2010_2018, k, log="no", taper = 0.1)
mvspec(differenced_NSA, k, log="no", taper = 0.1)
```



The tapering does not change the estimate spectral density significantly and the same frequency peaks remain.