Comprehensive Food Import Analysis (World Data)

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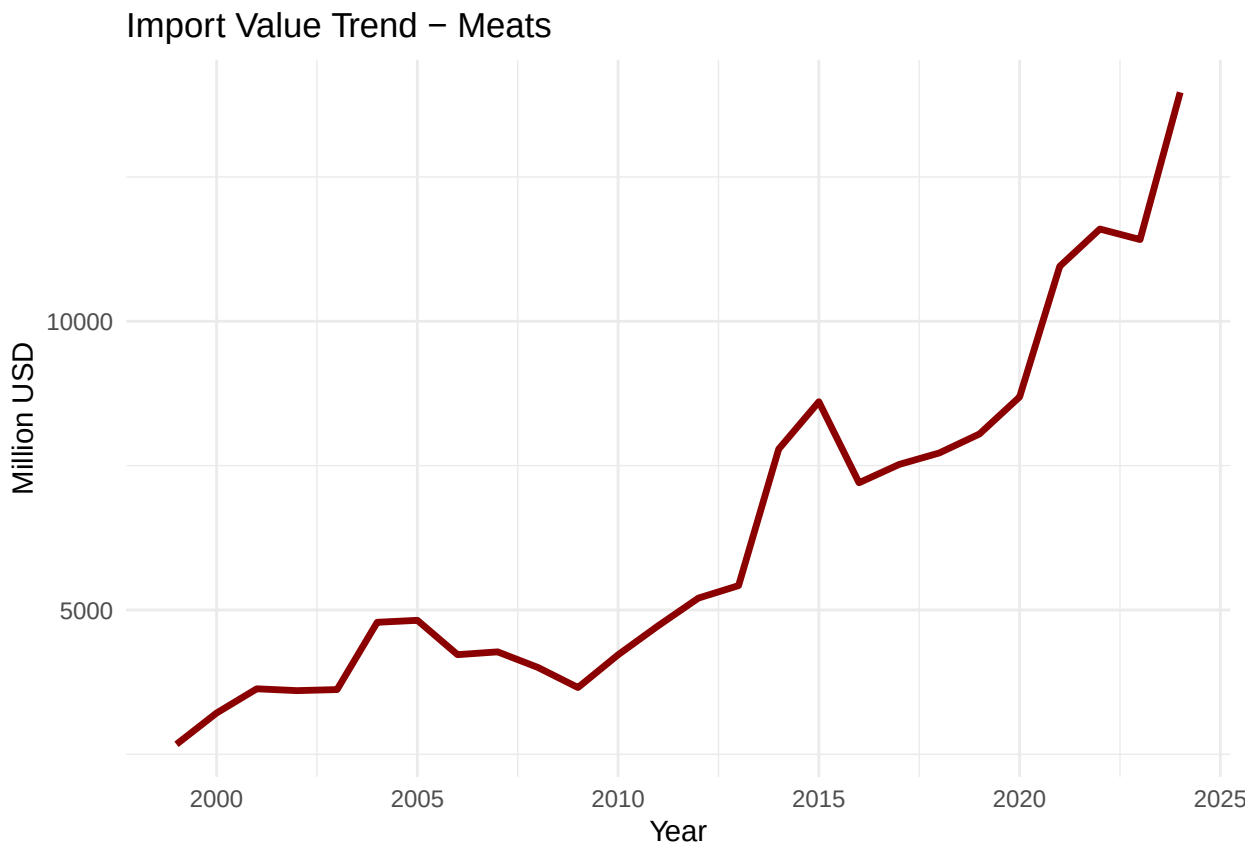
Contents

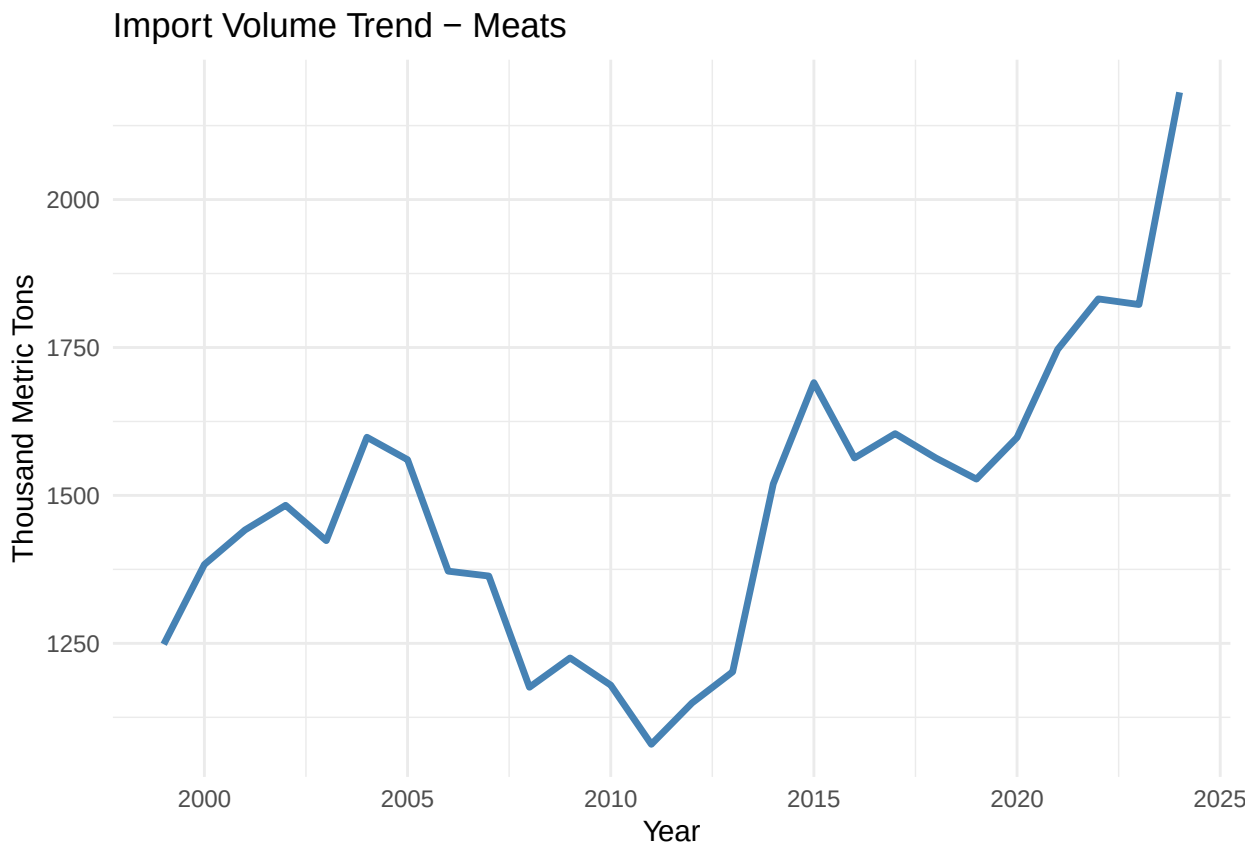
Meats

1. Trend: Value & Volume

```
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "meatsValueWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "meatsVolumeWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Meats_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Meats_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Meats", y = "Million USD") +
  theme_minimal()
```

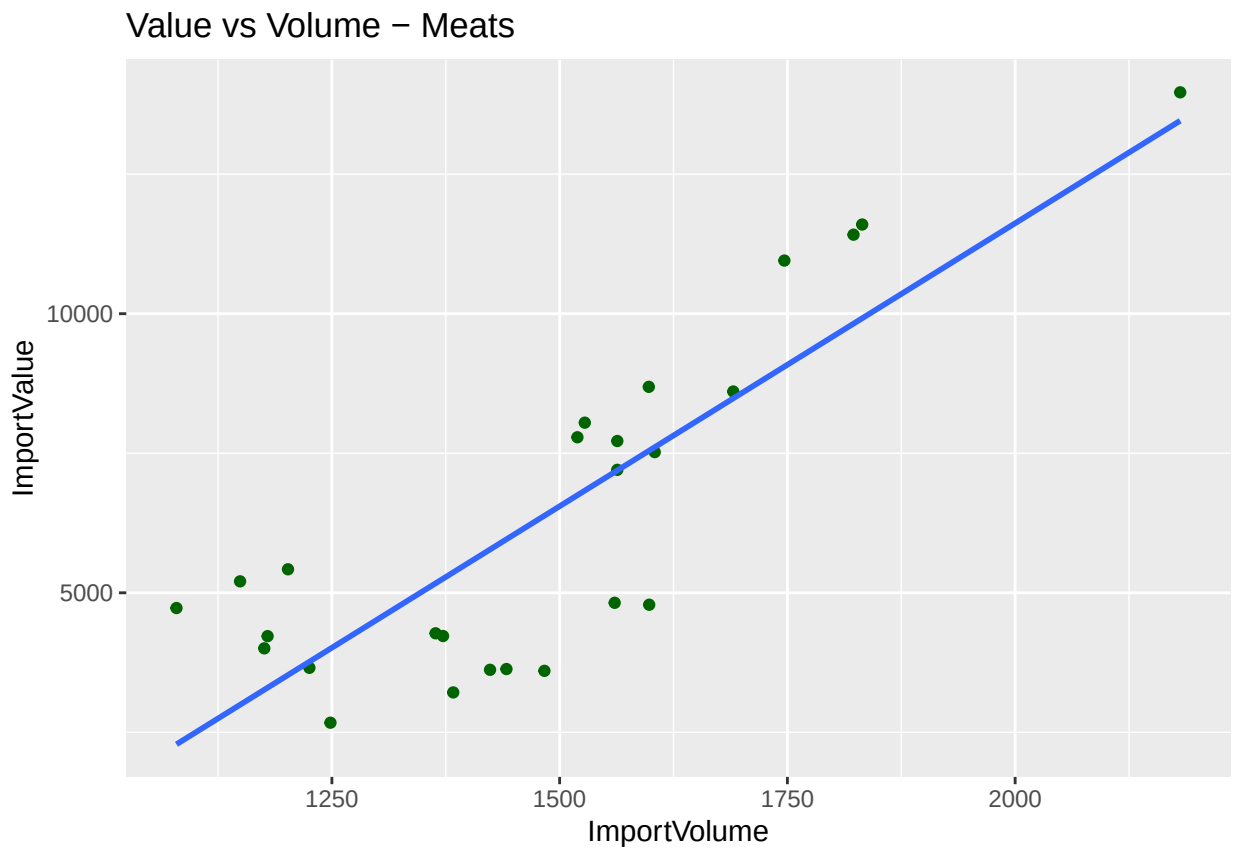



```
ggplot(Meats_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Meats", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Meats_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Meats")
```

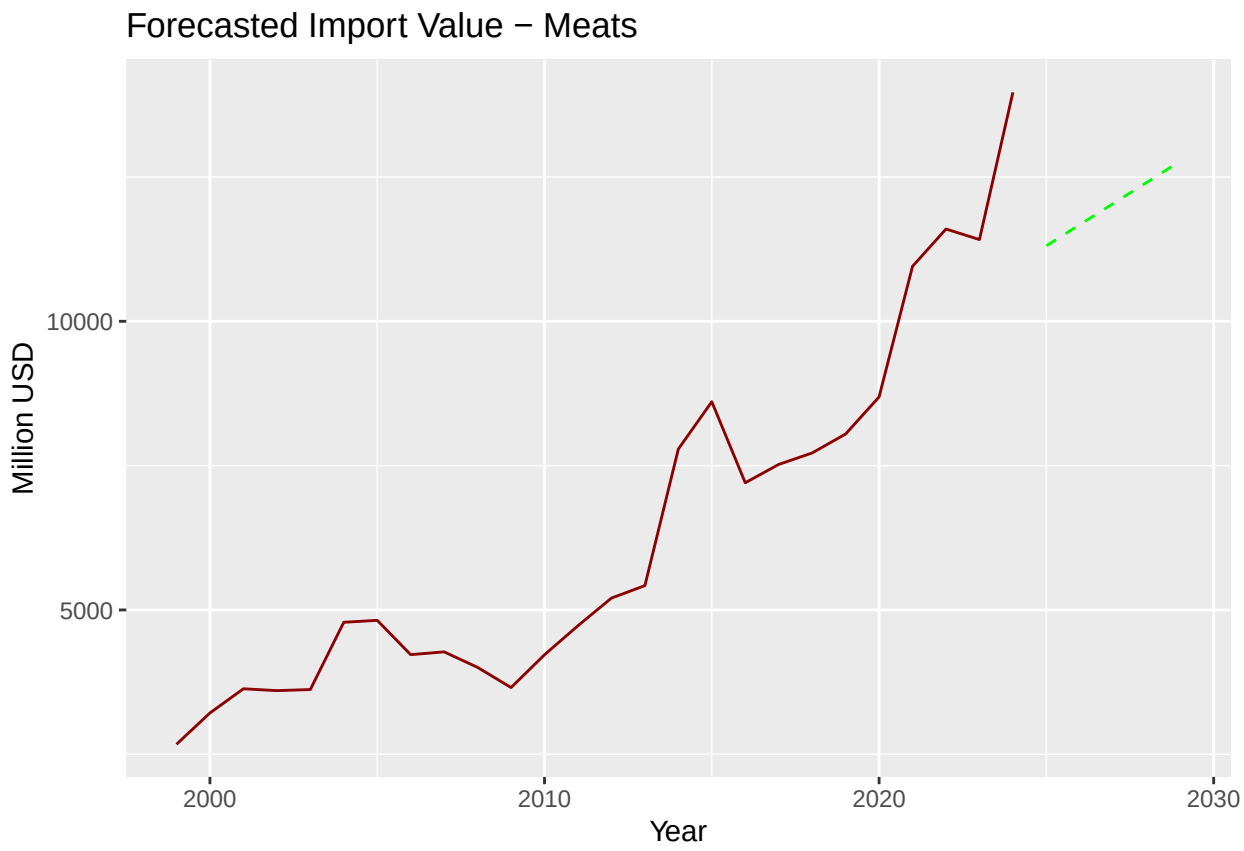



```
cor(Meats_df$ImportVolume, Meats_df$ImportValue, use = "complete.obs")
```

```
## [1] 0.8407386
```

3. Forecast (Linear Regression Only)

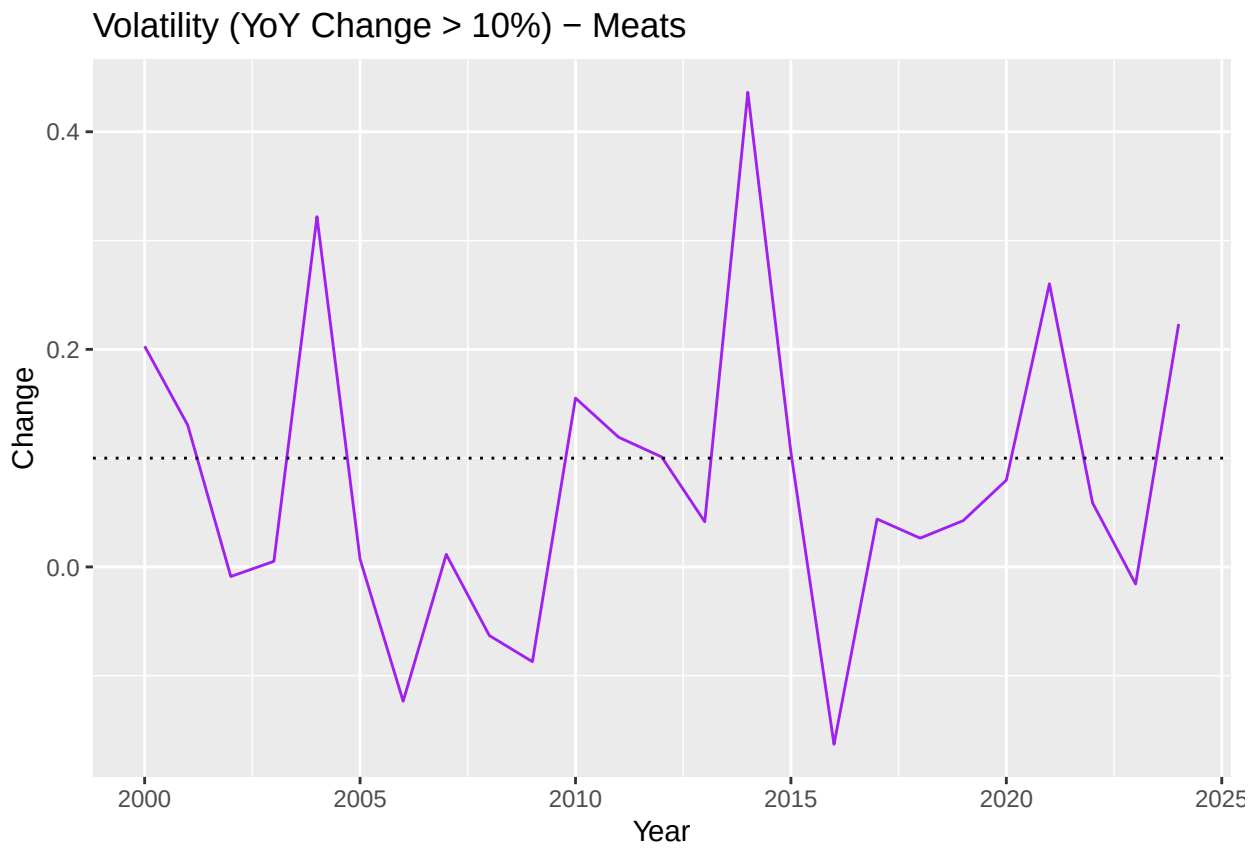
```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Meats_df)
future_yrs <- data.frame(Year = seq(max(Meats_df$Year) + 1, max(Meats_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Meats_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Meats_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Meats", y = "Million USD")
```




```
ggplot() +
  geom_line(data = Meats_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Meats", y = "Thousand Metric Tons")
```

4. Volatility Analysis

```
Meats_df <- Meats_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Meats_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Meats")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Meats_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Meats_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.24330 -0.09289 -0.02664  0.07771  0.35909
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.5426120  9.4217993   0.376    0.711
## ImportVolume  0.0001551  0.0001374   1.128    0.271
## Year         -0.0018377  0.0047412  -0.388    0.702
##
## Residual standard error: 0.1392 on 22 degrees of freedom
## Multiple R-squared:  0.05906,    Adjusted R-squared:  -0.02648
## F-statistic: 0.6905 on 2 and 22 DF,  p-value: 0.5119
```

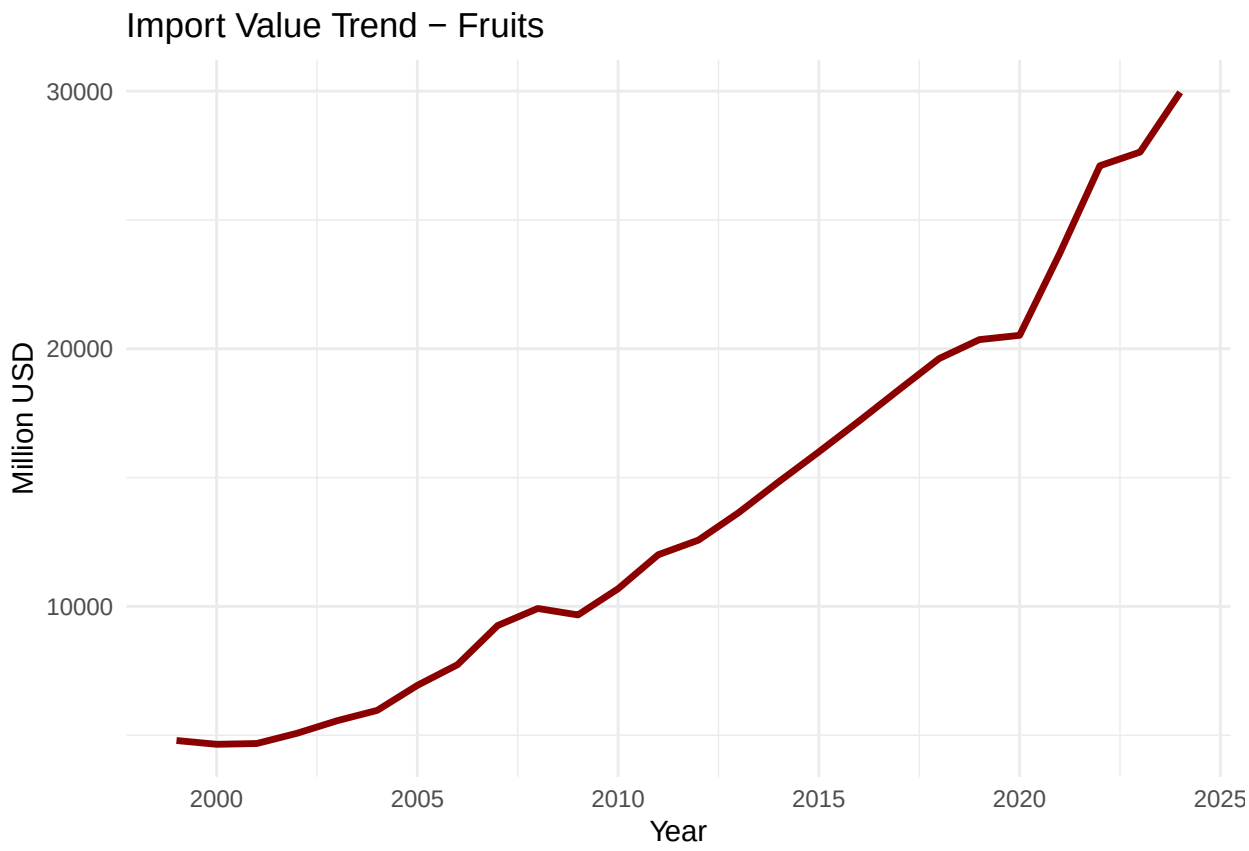
5. Prescriptive Insight

```r
cat("**Years with >10% import change in Meats may require diversification, inventory buffering, or trade
```

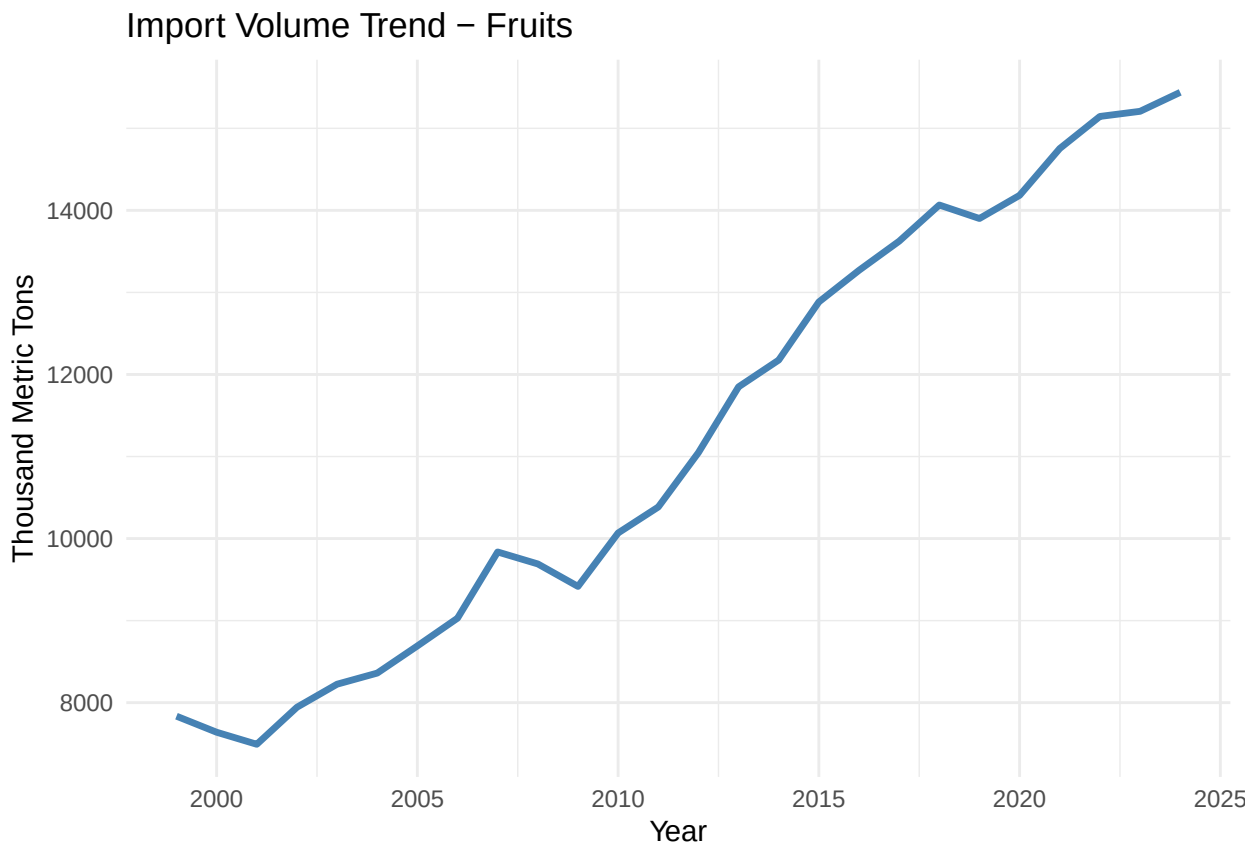
**Years with >10% import change in Meats may require diversification, inventory buffering, or trade policy coordination.

```r
# Fruits

## 1. Trend: Value & Volume
```

```r
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "fruitsValueWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "fruitsVolumeWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Fruits_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Fruits_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Fruits", y = "Million USD") +
  theme_minimal()
```

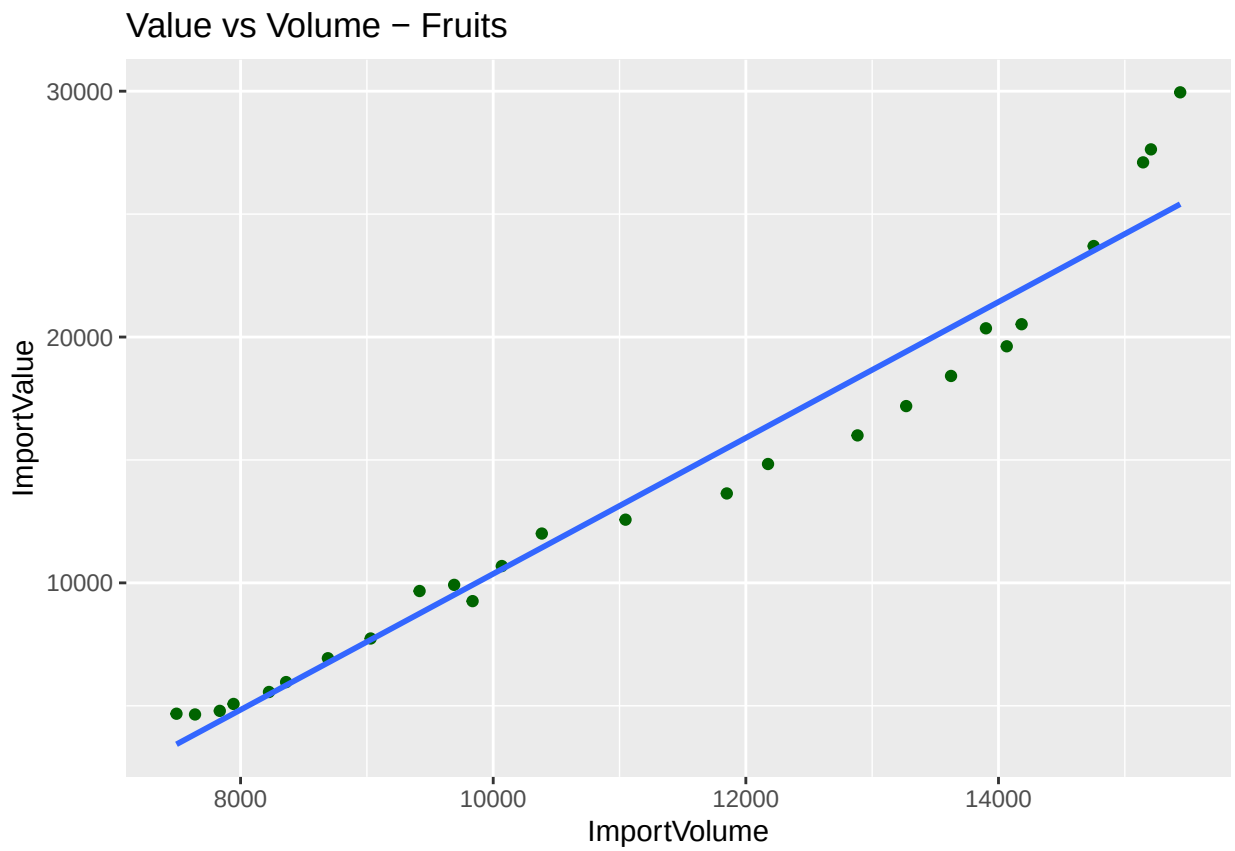



```
ggplot(Fruits_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Fruits", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Fruits_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Fruits")
```

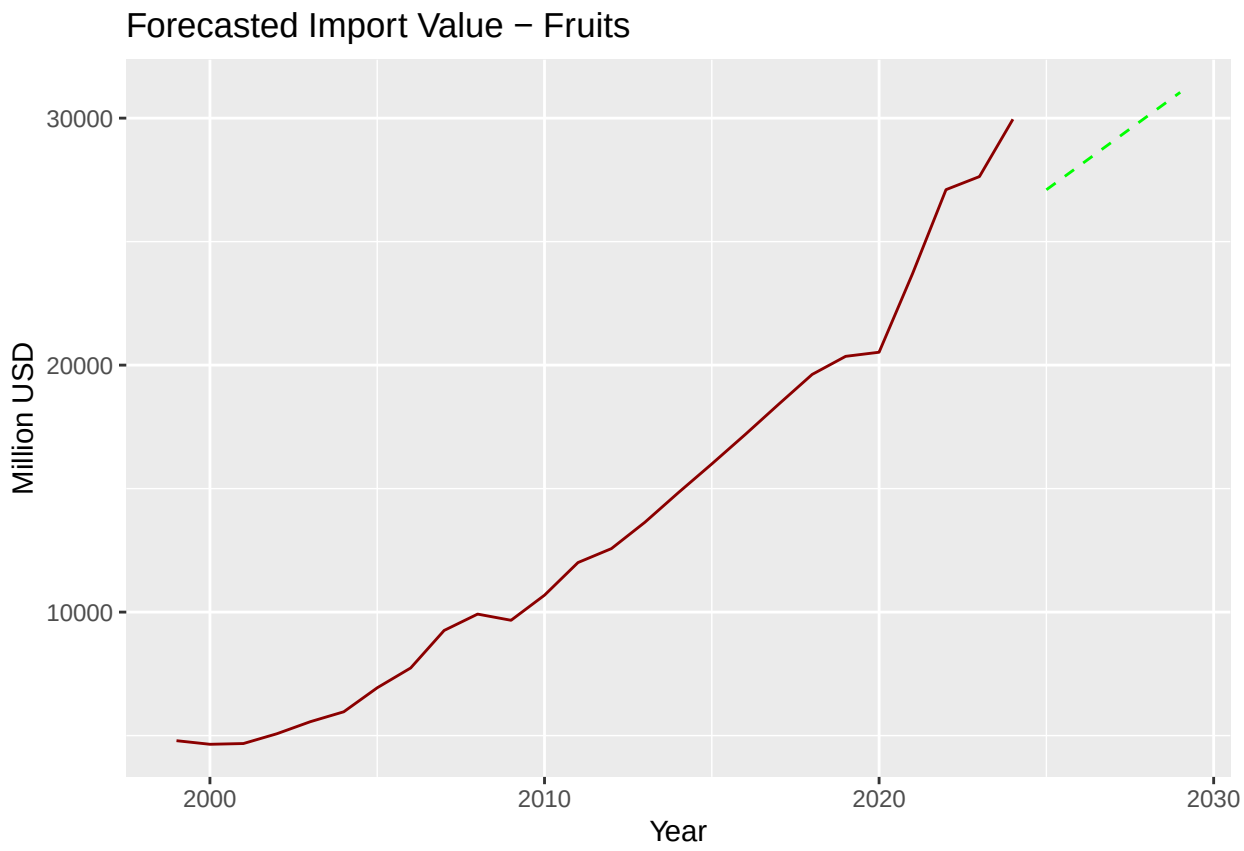



```
cor(Fruits_df$ImportVolume, Fruits_df$ImportValue, use = "complete.obs")
```

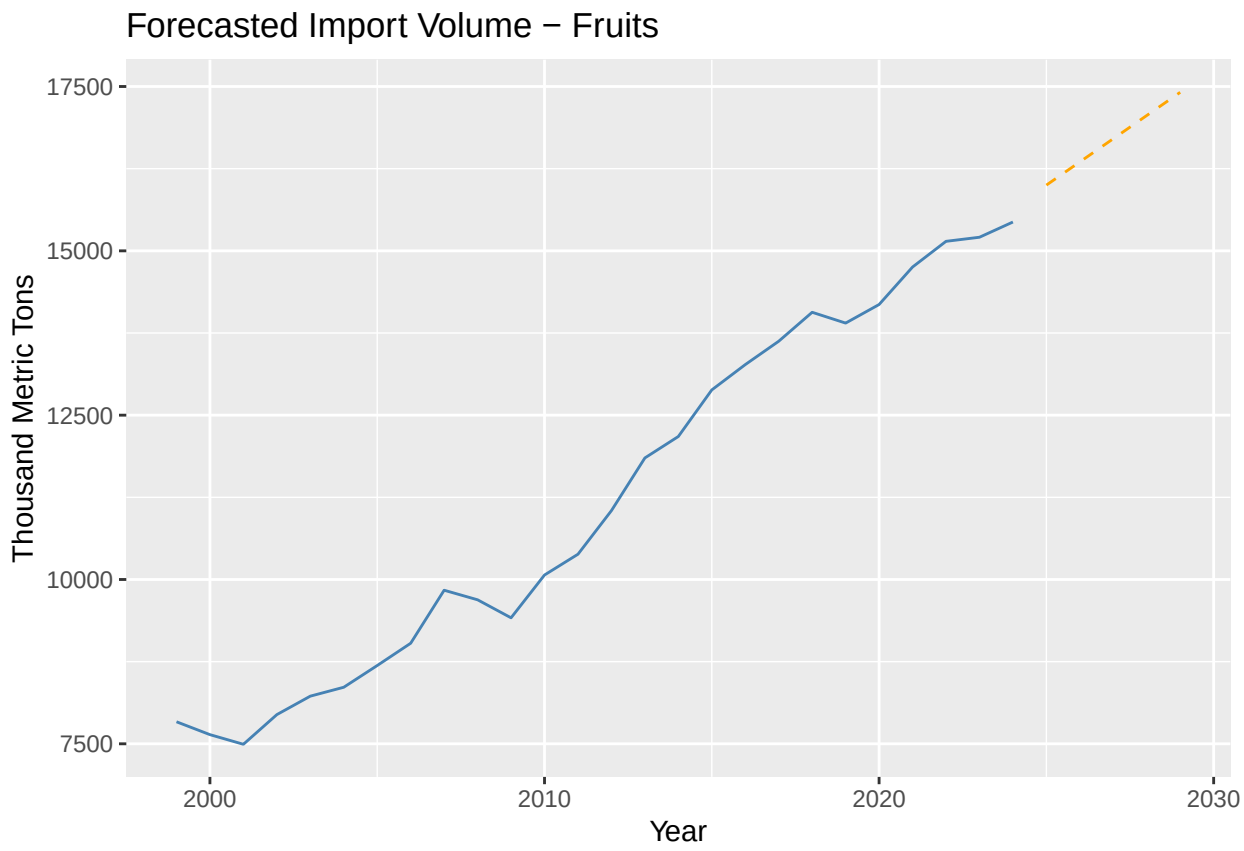
```
## [1] 0.9773826
```

3. Forecast (Linear Regression Only)

```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Fruits_df)
future_yrs <- data.frame(Year = seq(max(Fruits_df$Year) + 1, max(Fruits_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Fruits_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Fruits_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Fruits", y = "Million USD")
```

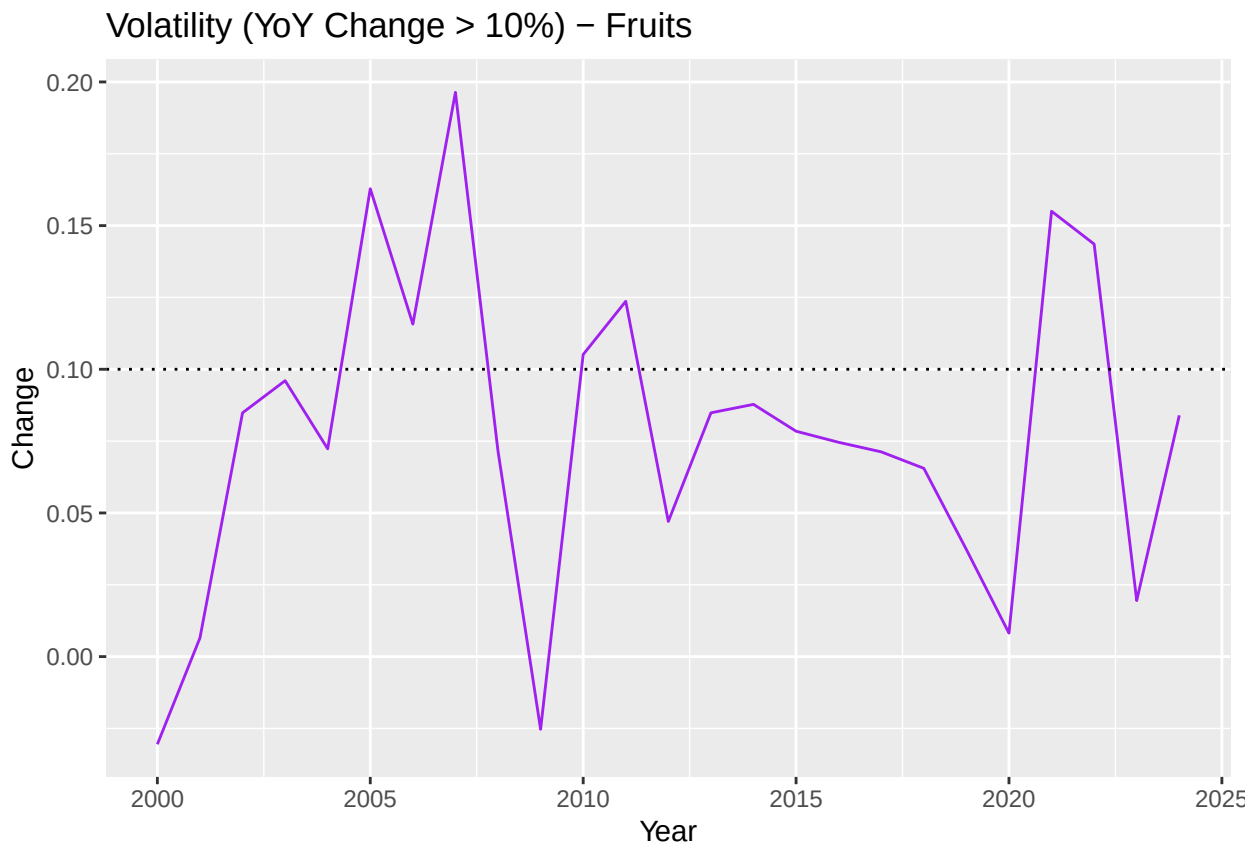



```
ggplot() +
  geom_line(data = Fruits_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Fruits", y = "Thousand Metric Tons")
```



4. Volatility Analysis

```
Fruits_df <- Fruits_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Fruits_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Fruits")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Fruits_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Fruits_df)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.107332 -0.028006 -0.000844  0.032836  0.119061
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   4.509e+00  2.351e+01   0.192    0.850
## ImportVolume  7.383e-06  3.240e-05   0.228    0.822
## Year         -2.244e-03  1.187e-02  -0.189    0.852
##
## Residual standard error: 0.05822 on 22 degrees of freedom
## Multiple R-squared:  0.005628,   Adjusted R-squared:  -0.08477
## F-statistic: 0.06226 on 2 and 22 DF,  p-value: 0.9398
```

5. Prescriptive Insight

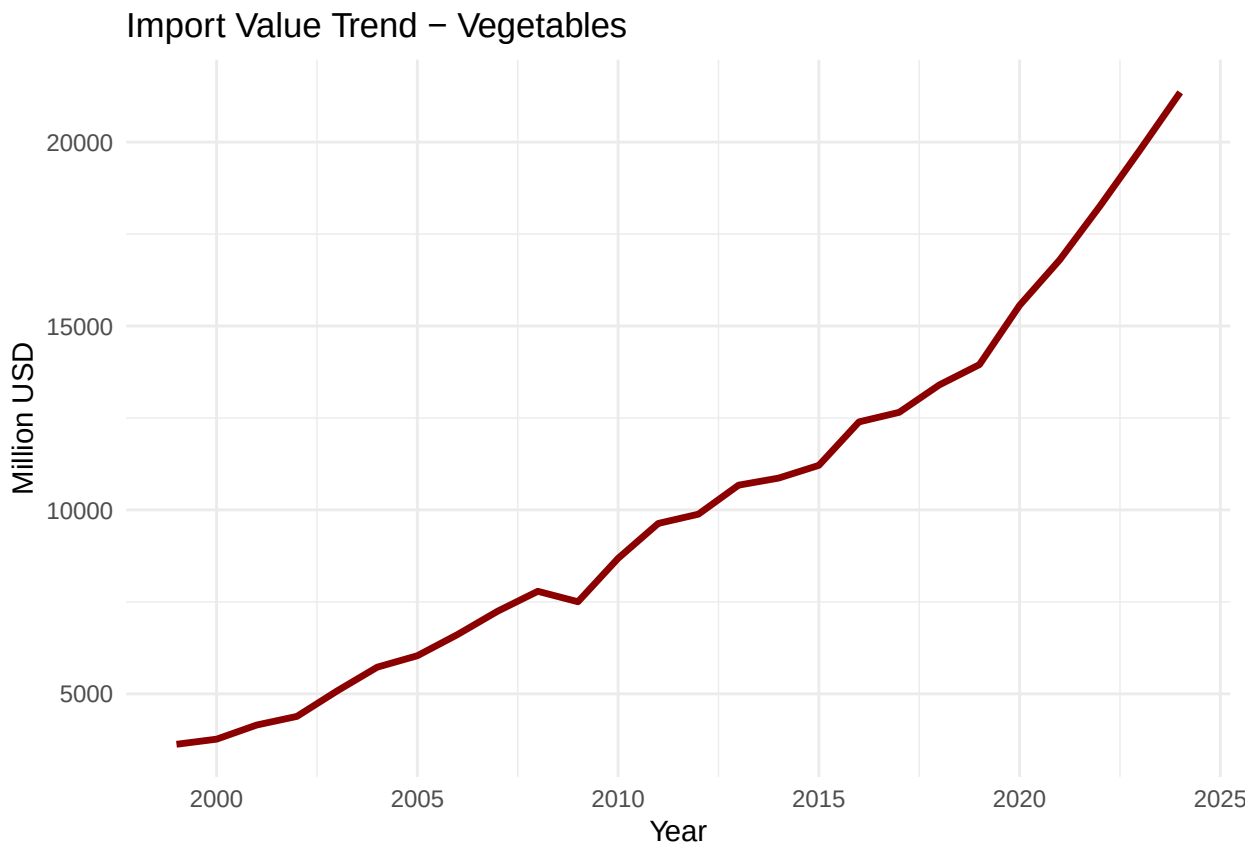
```
cat("**Years with >10% import change in Fruits may require diversification, inventory buffering, or trad
```

**Years with >10% import change in Fruits may require diversification, inventory buffering, or trade policy coordination.

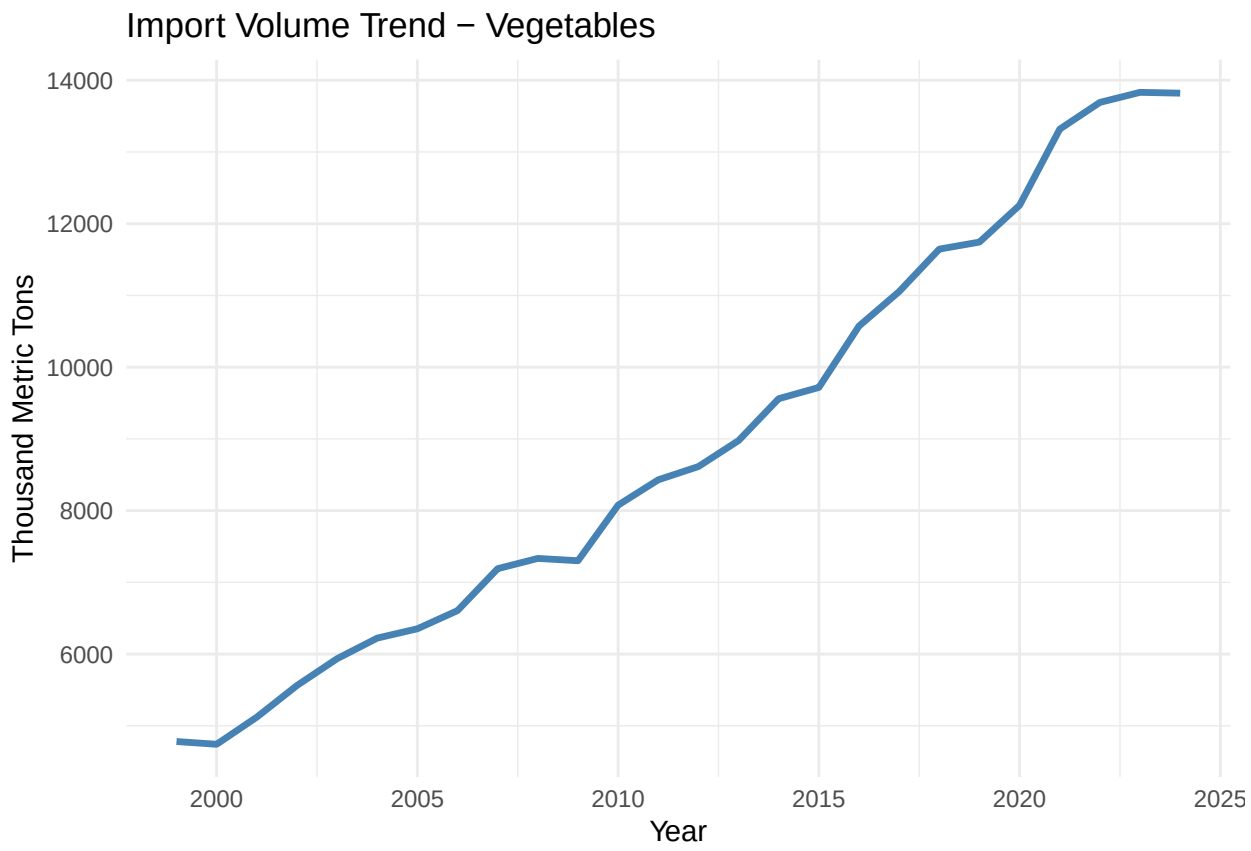
Vegetables

1. Trend: Value & Volume

```
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "vegetablesValueWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "vegetablesVolumeWorld") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Vegetables_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Vegetables_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Vegetables", y = "Million USD") +
  theme_minimal()
```

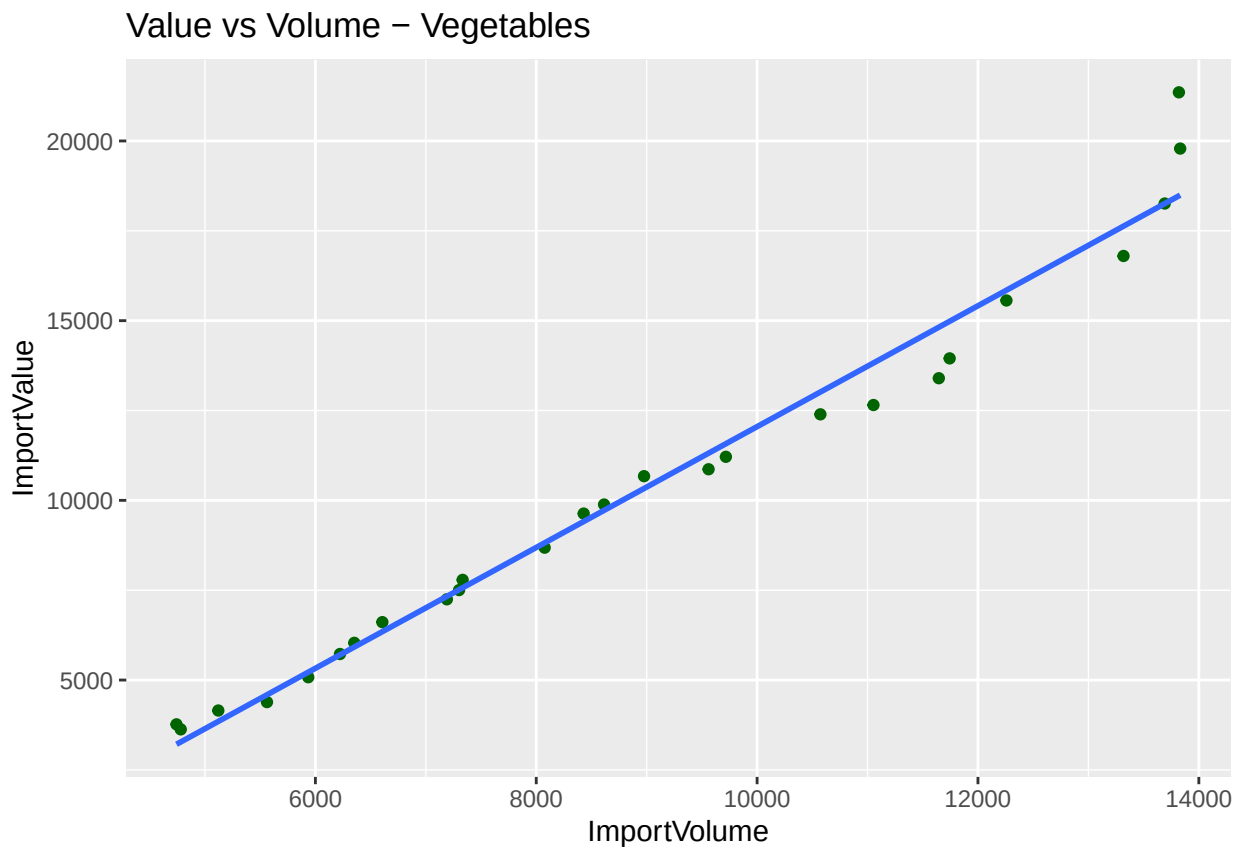



```
ggplot(Vegetables_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Vegetables", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Vegetables_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Vegetables")
```

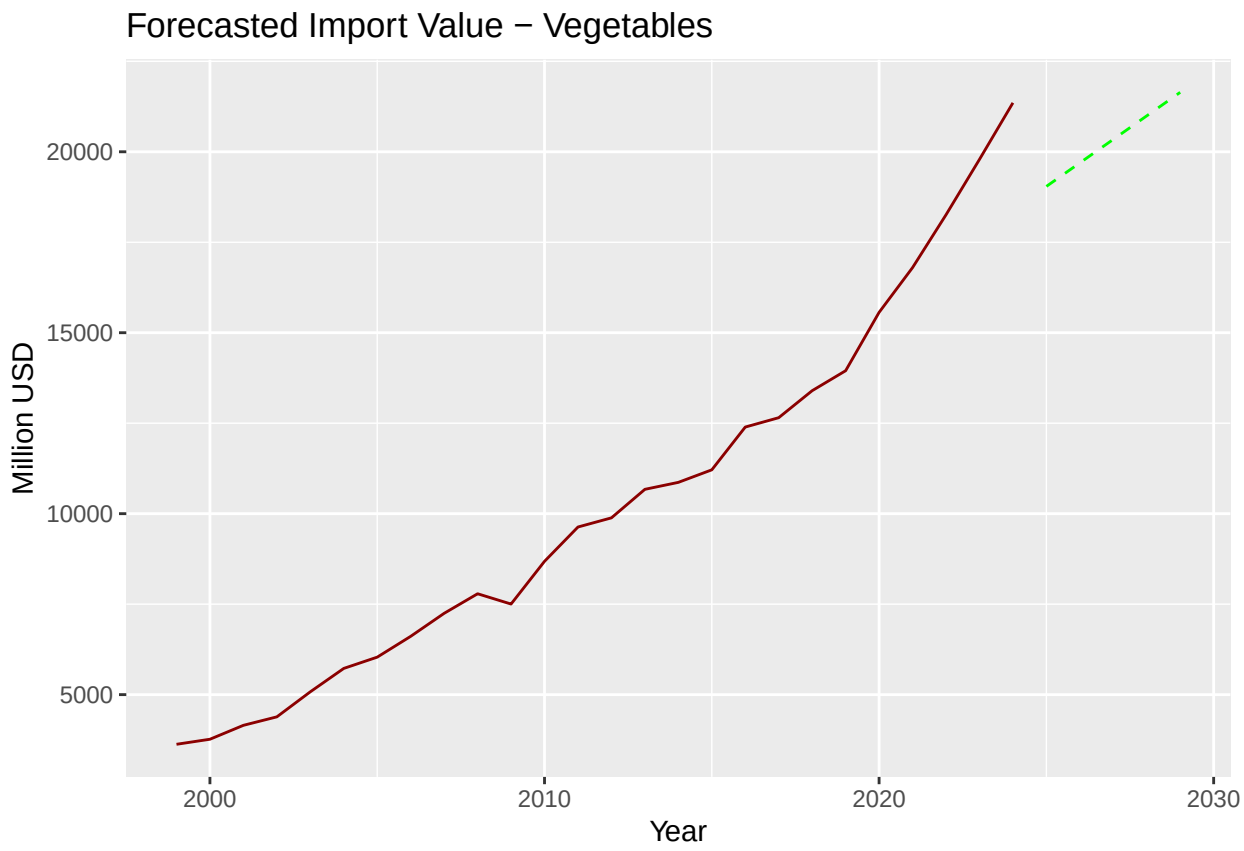



```
cor(Vegetables_df$ImportVolume, Vegetables_df$ImportValue, use = "complete.obs")
```

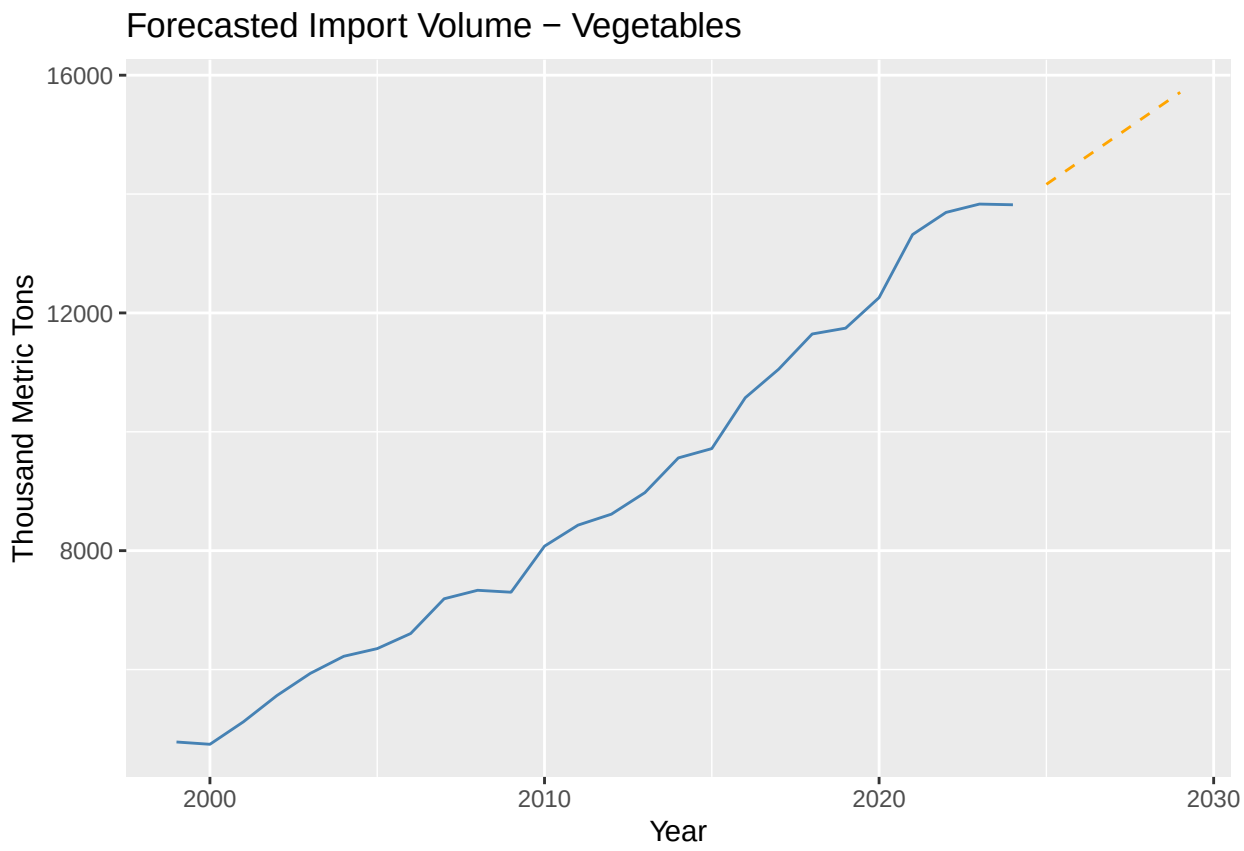
```
## [1] 0.9868773
```

3. Forecast (Linear Regression Only)

```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Vegetables_df)
future_yrs <- data.frame(Year = seq(max(Vegetables_df$Year) + 1, max(Vegetables_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Vegetables_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Vegetables_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Vegetables", y = "Million USD")
```

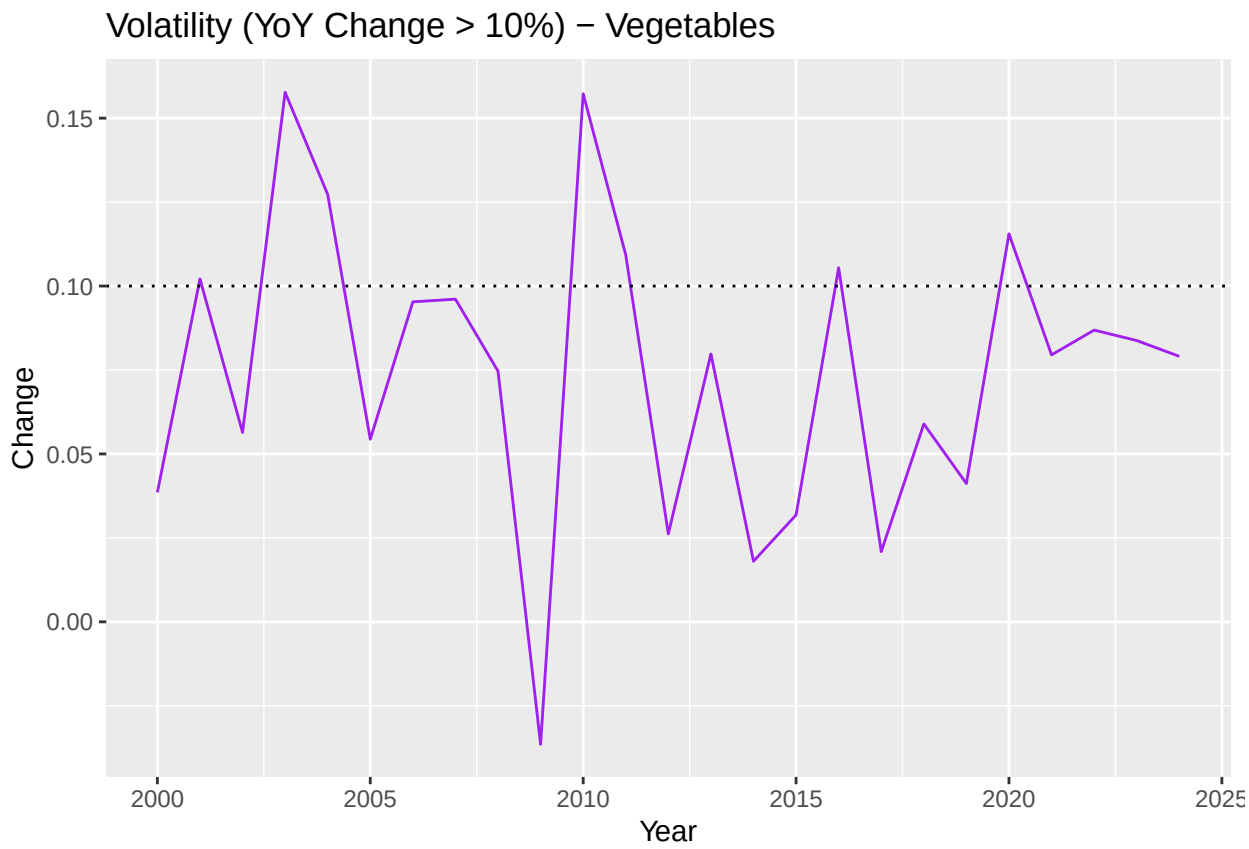



```
ggplot() +
  geom_line(data = Vegetables_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Vegetables", y = "Thousand Metric Tons")
```



4. Volatility Analysis

```
Vegetables_df <- Vegetables_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Vegetables_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Vegetables")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Vegetables_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Vegetables_df)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.083862 -0.024768 -0.001495  0.030421  0.092851
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.779e+01  1.889e+01   2.001   0.0579 .
## ImportVolume  4.644e-05  2.393e-05   1.941   0.0652 .
## Year         -1.895e-02  9.494e-03  -1.996   0.0584 .
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## Residual standard error: 0.04303 on 22 degrees of freedom
## Multiple R-squared:  0.1566, Adjusted R-squared:  0.07994
## F-statistic: 2.043 on 2 and 22 DF,  p-value: 0.1536
```

5. Prescriptive Insight

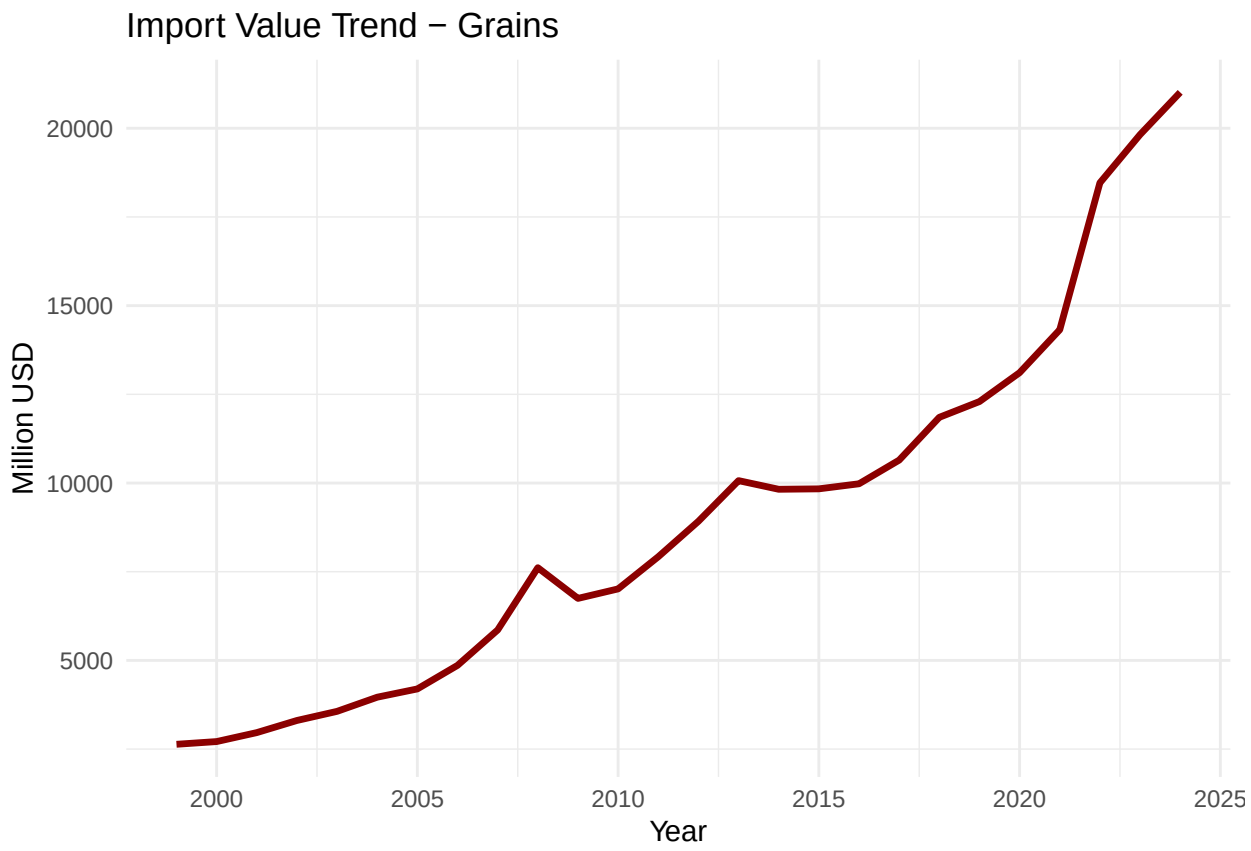
```
cat("Years with >10% import change in Vegetables may require diversification, inventory buffering, or t
```

```
## Years with >10% import change in Vegetables may require diversification, inventory buffering, or trac
```

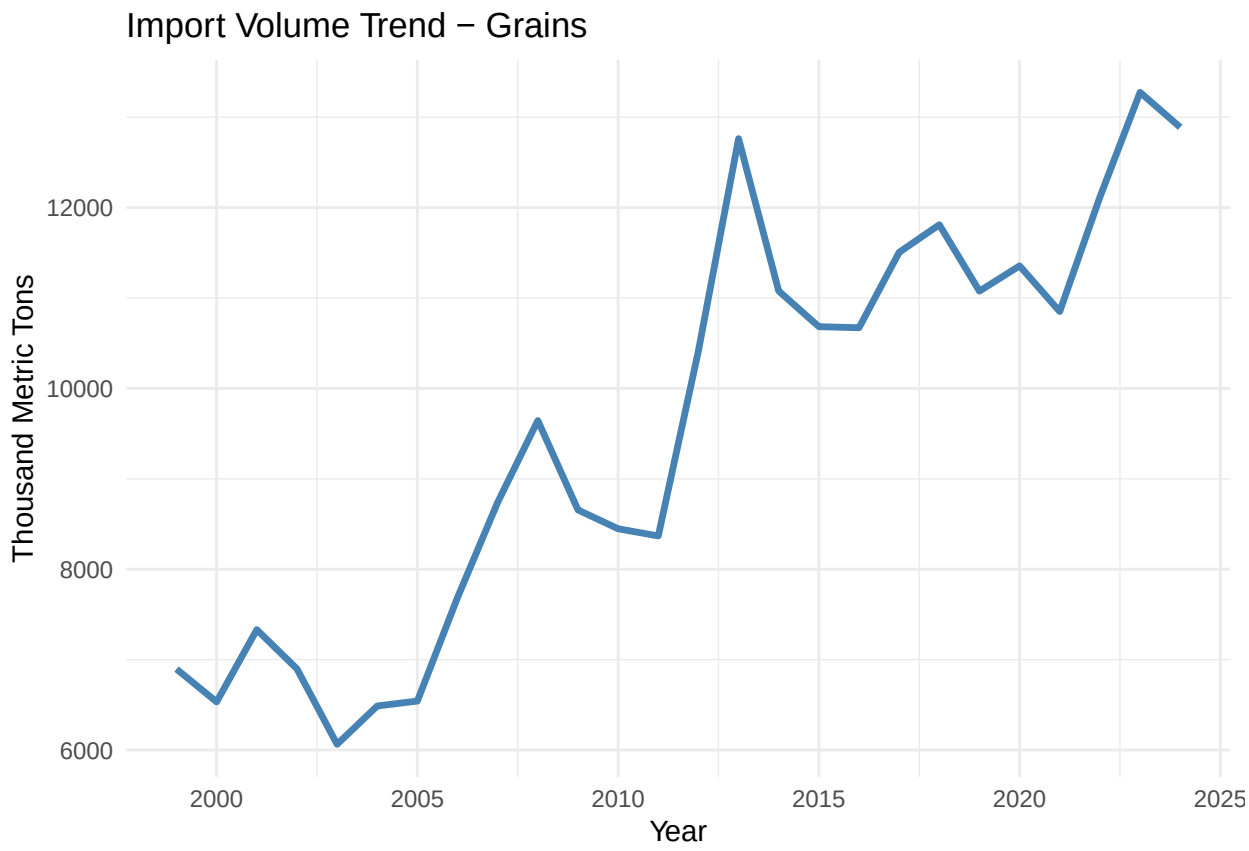
Grains

1. Trend: Value & Volume

```
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "World grainsValue") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "worldgrainsVolume") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Grains_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Grains_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Grains", y = "Million USD") +
  theme_minimal()
```

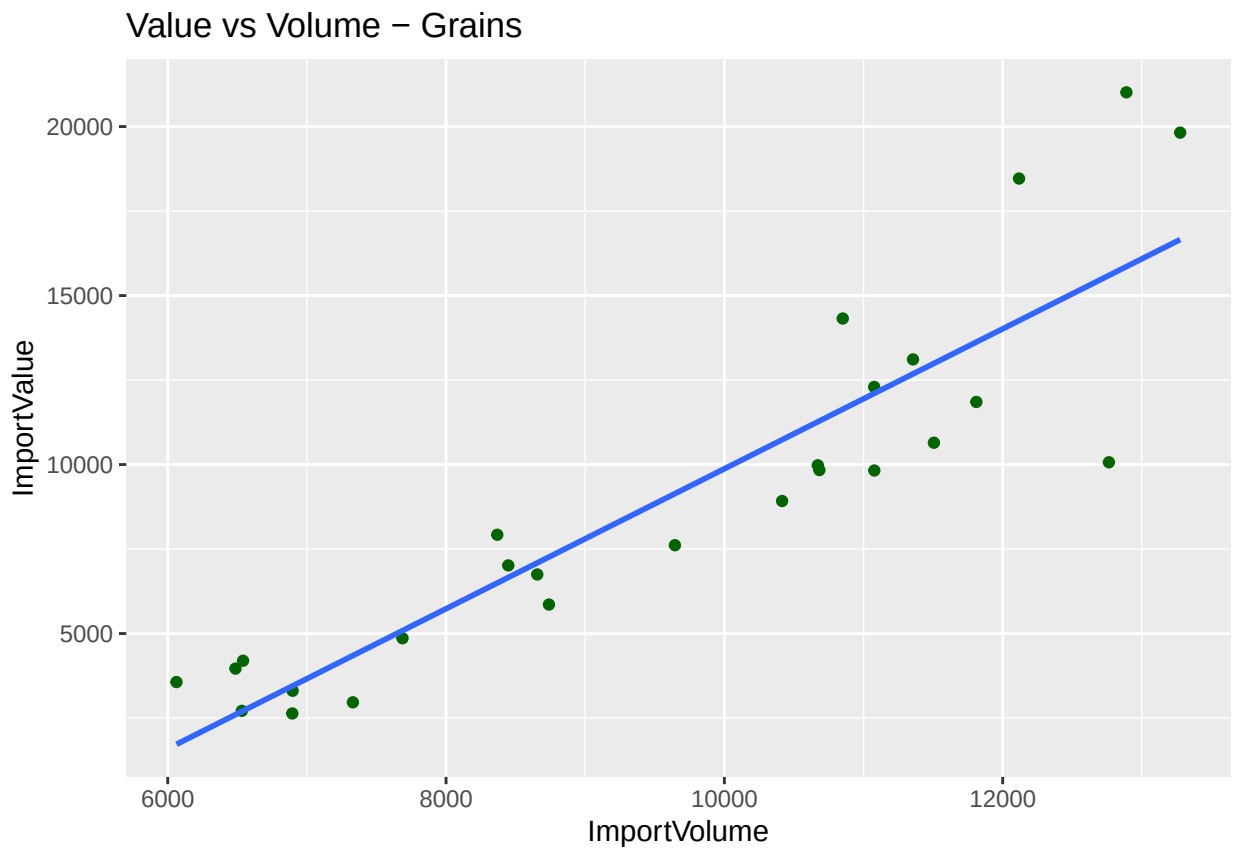



```
ggplot(Grains_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Grains", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Grains_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Grains")
```

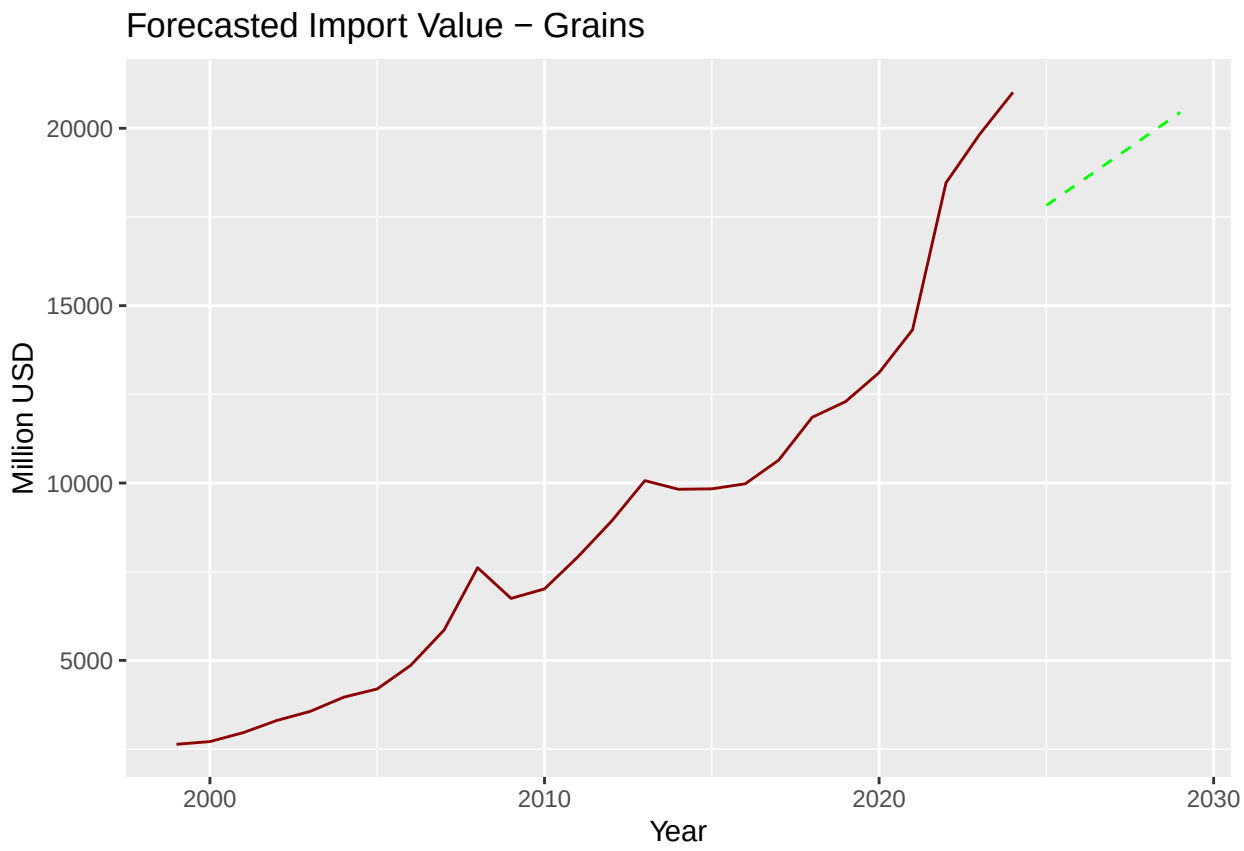



```
cor(Grains_df$ImportVolume, Grains_df$ImportValue, use = "complete.obs")
```

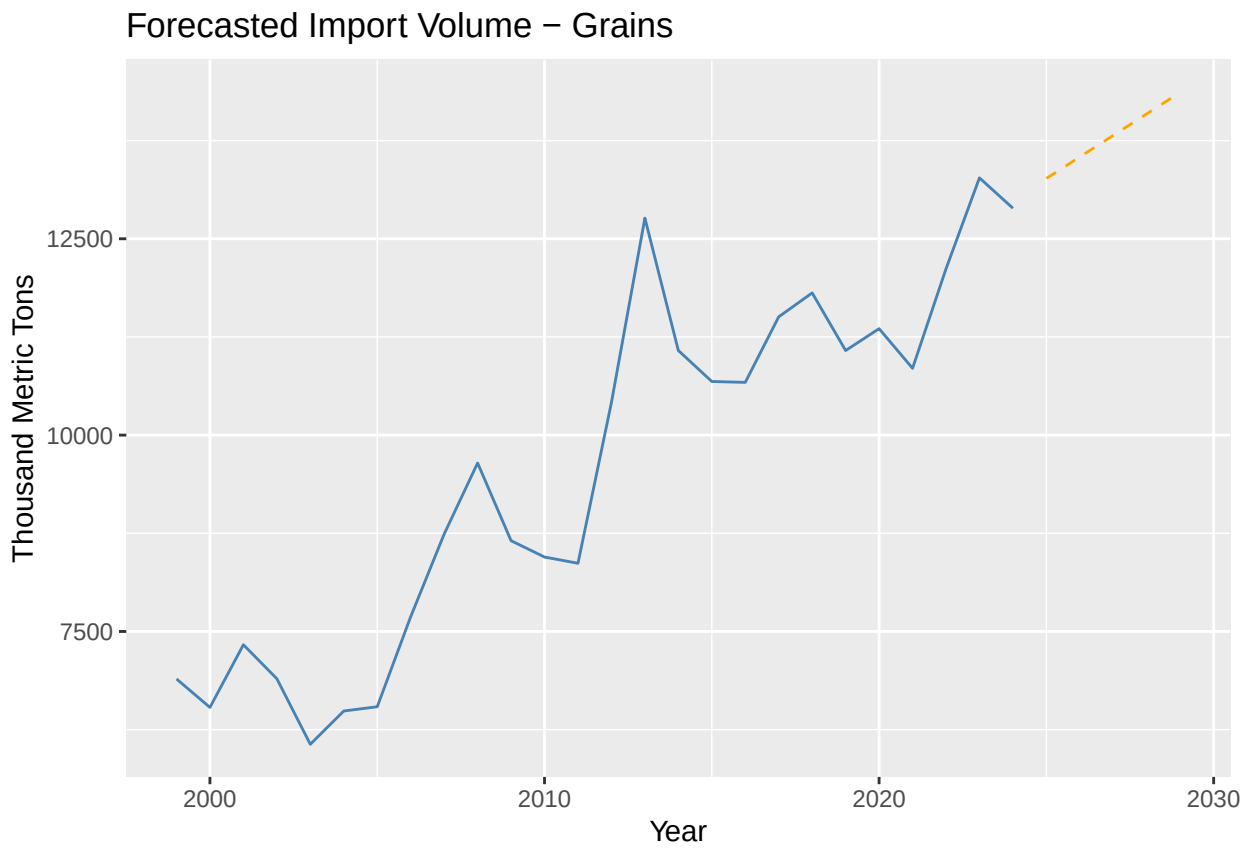
```
## [1] 0.9006012
```

3. Forecast (Linear Regression Only)

```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Grains_df)
future_yrs <- data.frame(Year = seq(max(Grains_df$Year) + 1, max(Grains_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Grains_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Grains_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Grains", y = "Million USD")
```

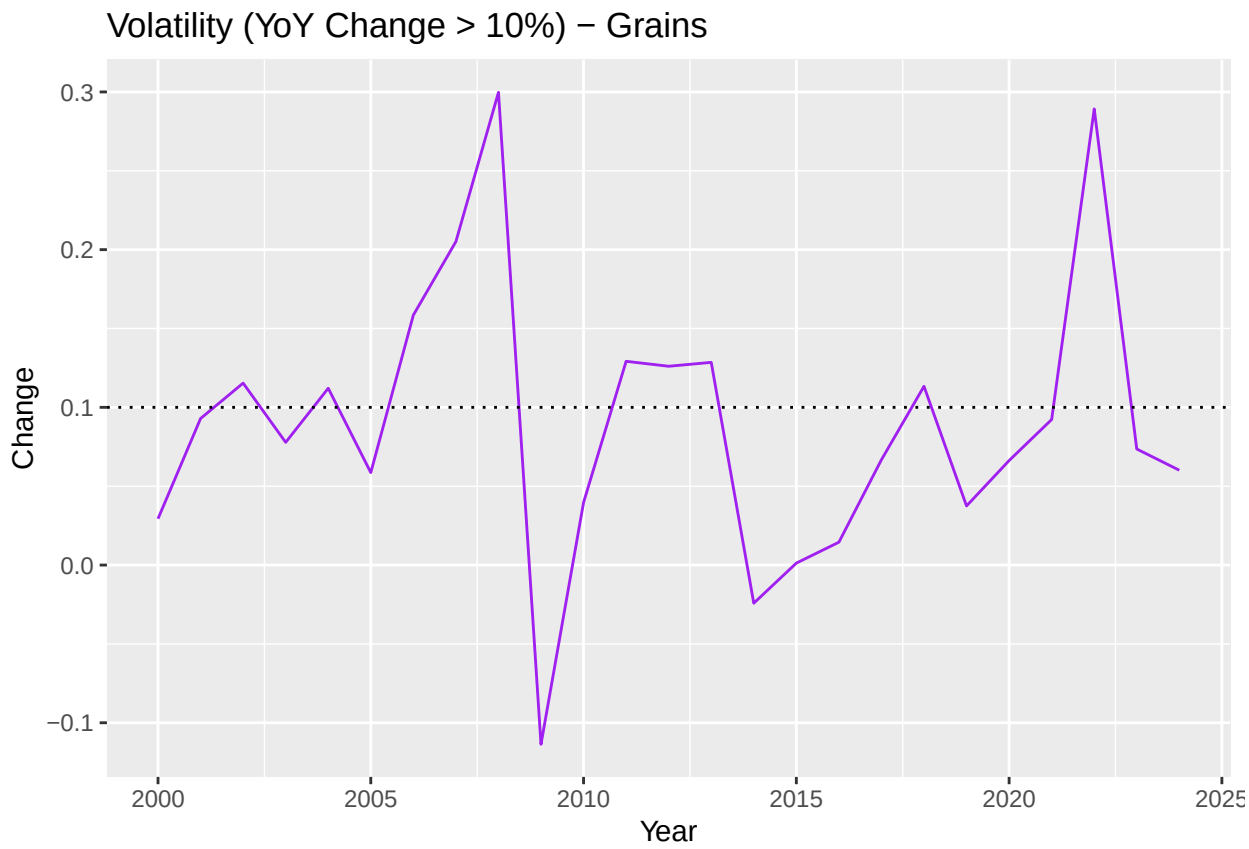



```
ggplot() +
  geom_line(data = Grains_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Grains", y = "Thousand Metric Tons")
```



4. Volatility Analysis

```
Grains_df <- Grains_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Grains_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Grains")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Grains_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Grains_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.20176 -0.04042 -0.01216  0.02633  0.20803
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   9.458e+00  1.258e+01   0.752    0.460
## ImportVolume  1.578e-05  2.065e-05   0.764    0.453
## Year         -4.732e-03  6.342e-03  -0.746    0.463
##
## Residual standard error: 0.09124 on 22 degrees of freedom
## Multiple R-squared:  0.0264, Adjusted R-squared:  -0.06211
## F-statistic: 0.2983 on 2 and 22 DF,  p-value: 0.745
```

5. Prescriptive Insight

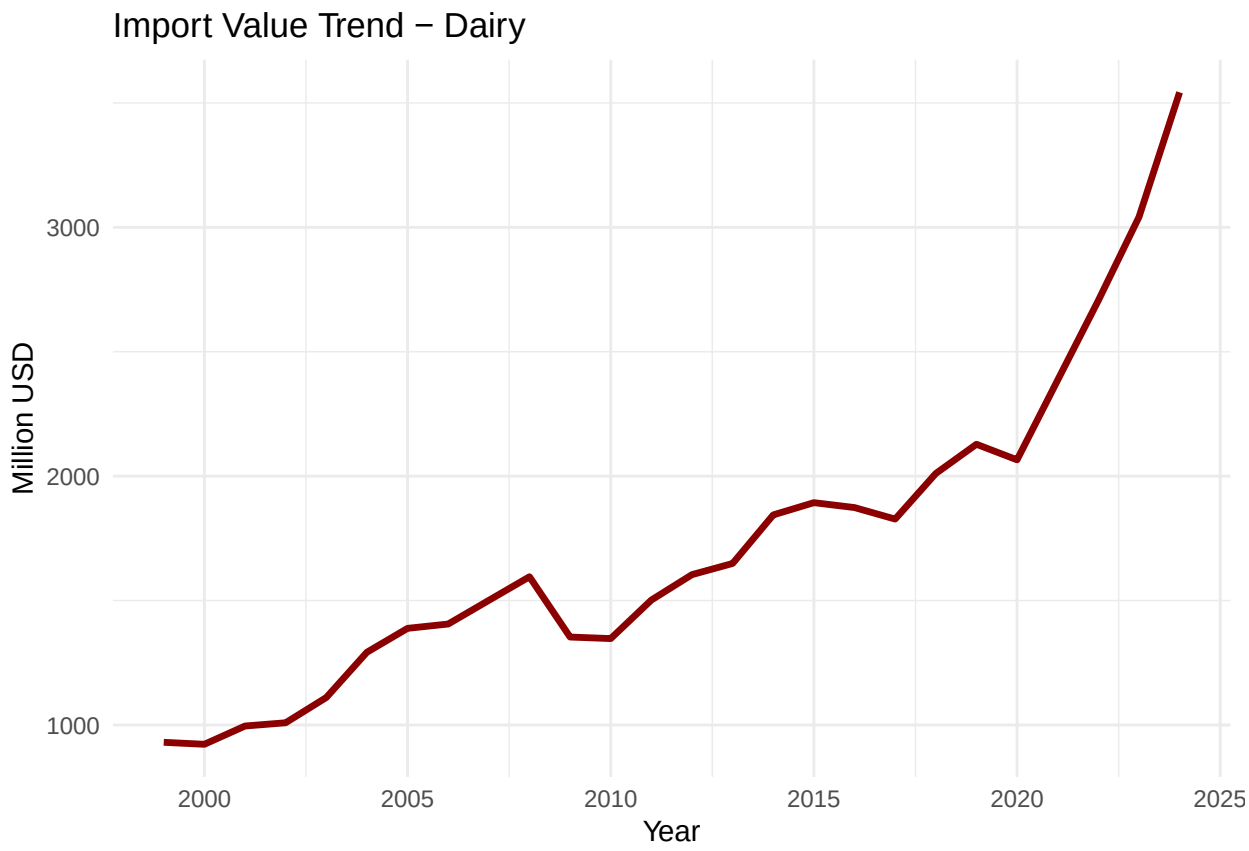
```
cat("Years with >10% import change in Grains may require diversification, inventory buffering, or trade
```

```
## Years with >10% import change in Grains may require diversification, inventory buffering, or trade p
```

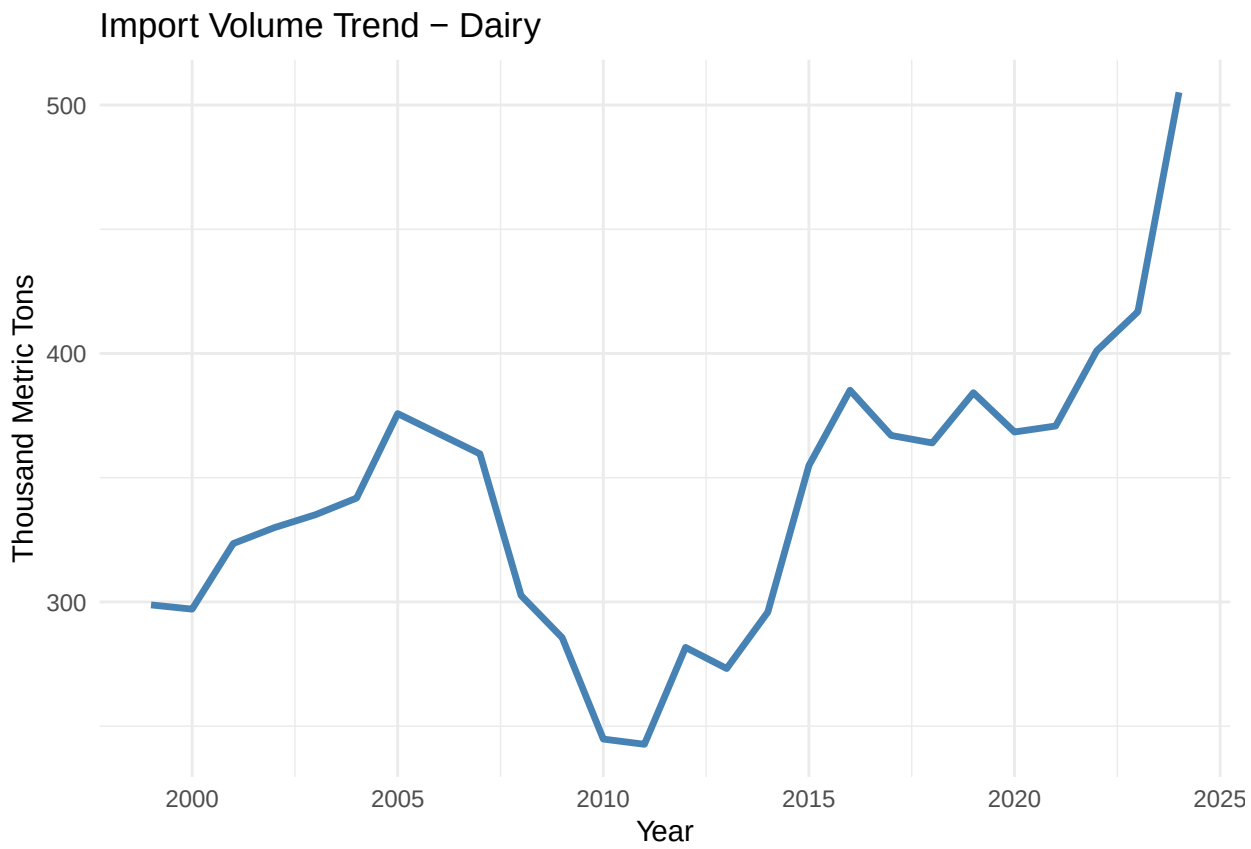
Dairy

1. Trend: Value & Volume

```
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "WorlddairyValue") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "WorlddairyVolume") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Dairy_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Dairy_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Dairy", y = "Million USD") +
  theme_minimal()
```

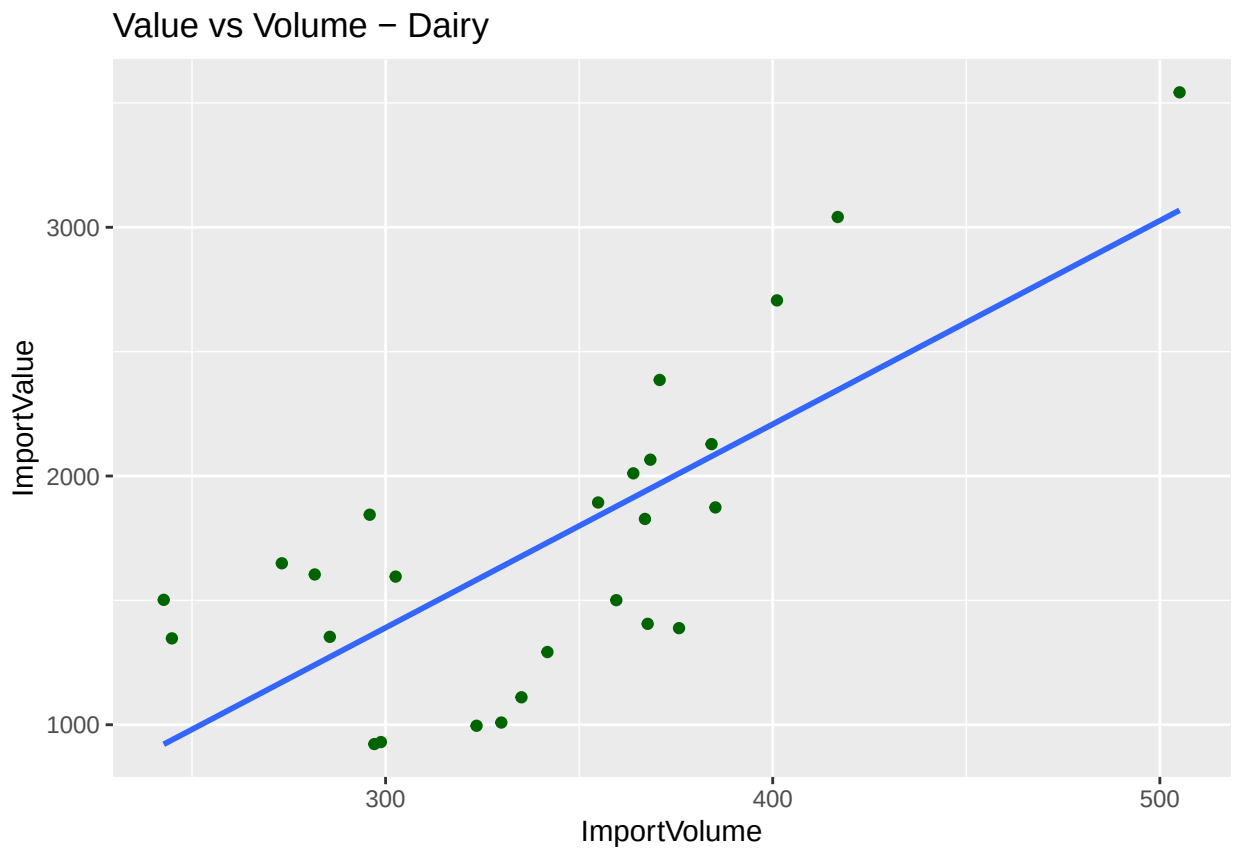



```
ggplot(Dairy_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Dairy", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Dairy_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Dairy")
```

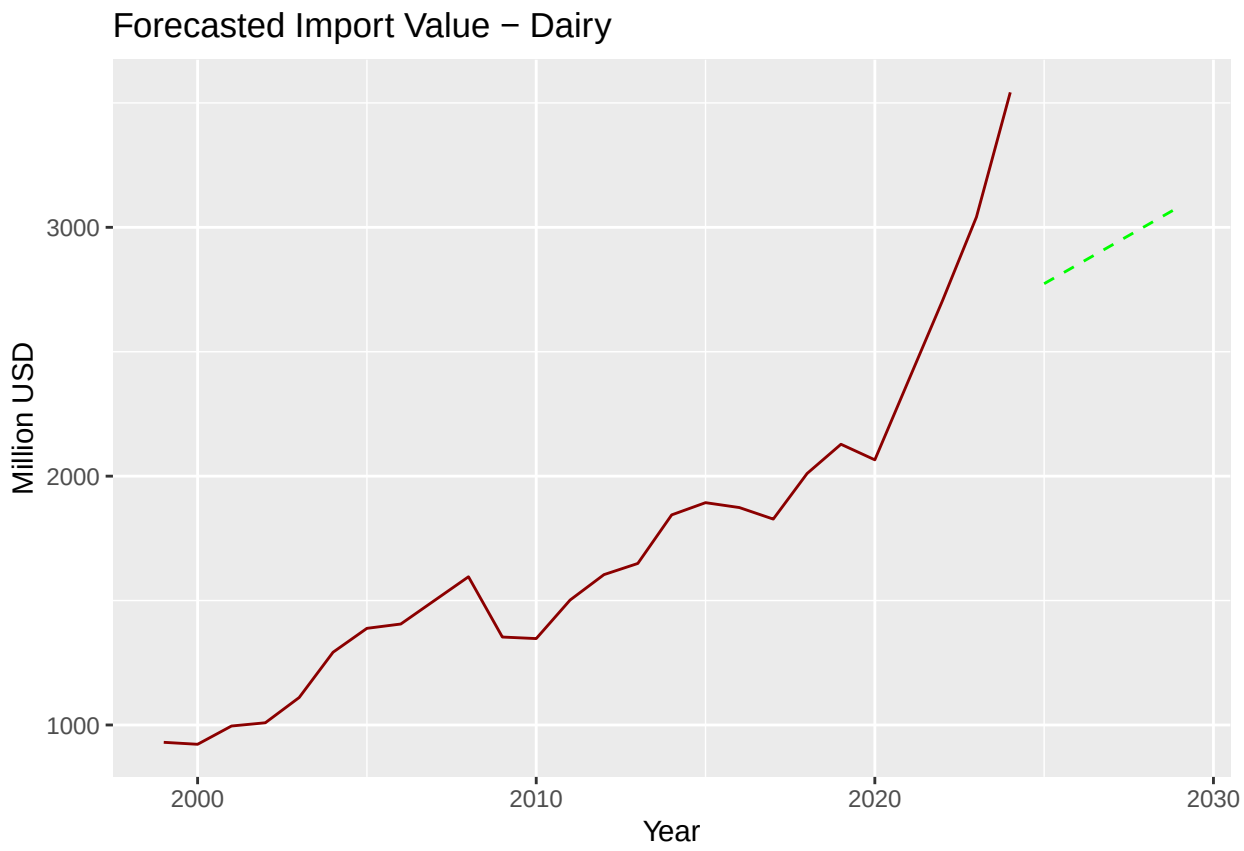



```
cor(Dairy_df$ImportVolume, Dairy_df$ImportValue, use = "complete.obs")
```

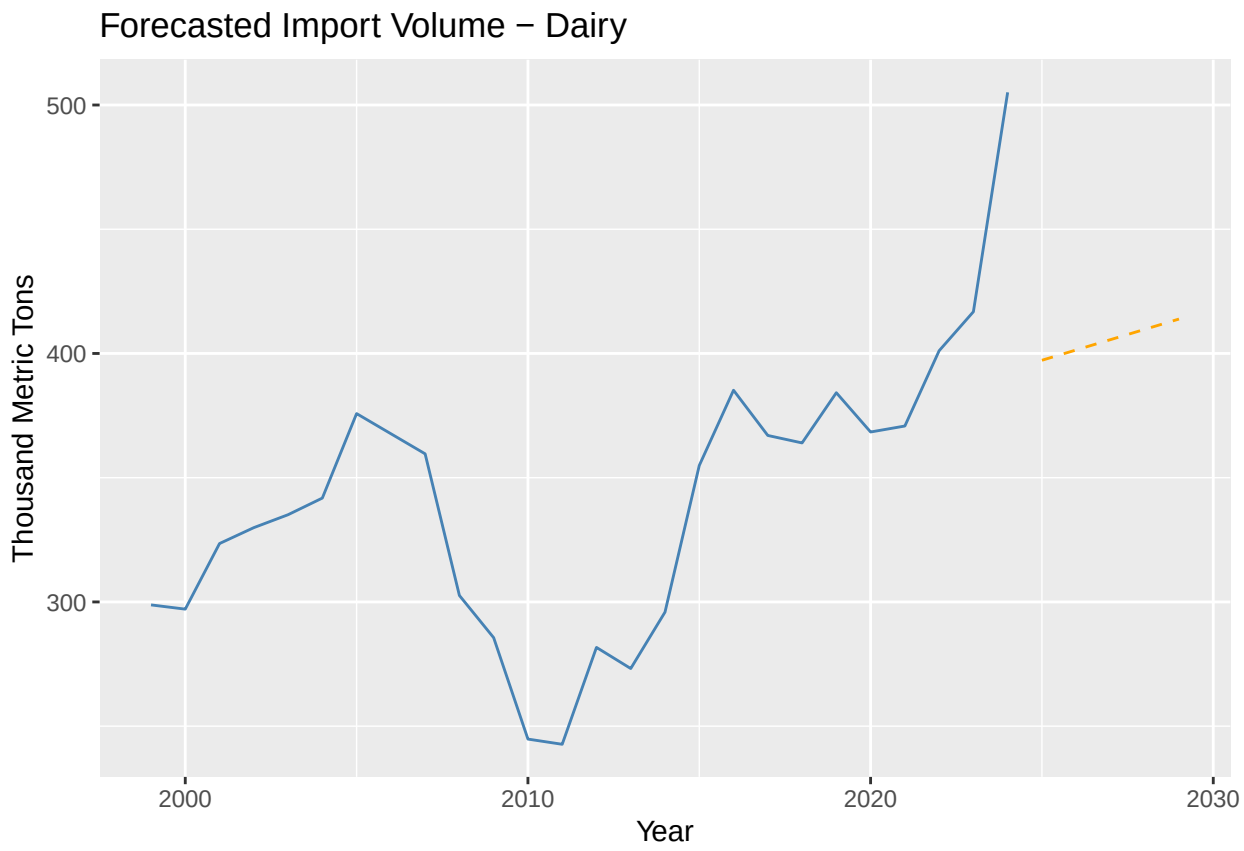
```
## [1] 0.7321432
```

3. Forecast (Linear Regression Only)

```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Dairy_df)
future_yrs <- data.frame(Year = seq(max(Dairy_df$Year) + 1, max(Dairy_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Dairy_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Dairy_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Dairy", y = "Million USD")
```

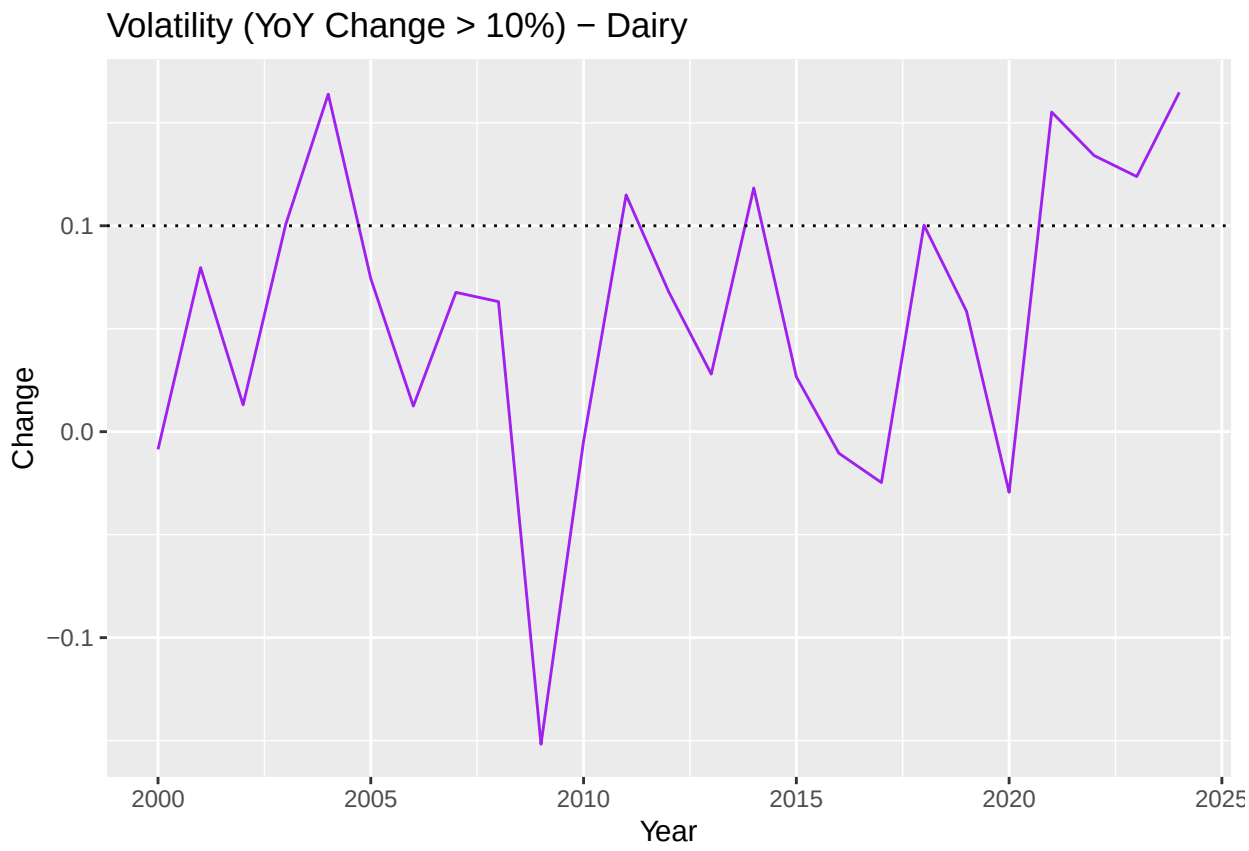



```
ggplot() +
  geom_line(data = Dairy_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Dairy", y = "Thousand Metric Tons")
```



4. Volatility Analysis

```
Dairy_df <- Dairy_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Dairy_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Dairy")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Dairy_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Dairy_df)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.184544 -0.037625  0.008664  0.037440  0.112363
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.4612136  4.7214406  -0.309    0.760
## ImportVolume  0.0003958  0.0003001   1.319    0.201
## Year          0.0006874  0.0023737   0.290    0.775
##
## Residual standard error: 0.07224 on 22 degrees of freedom
## Multiple R-squared:  0.1247, Adjusted R-squared:  0.04508
## F-statistic: 1.566 on 2 and 22 DF,  p-value: 0.2312
```

5. Prescriptive Insight

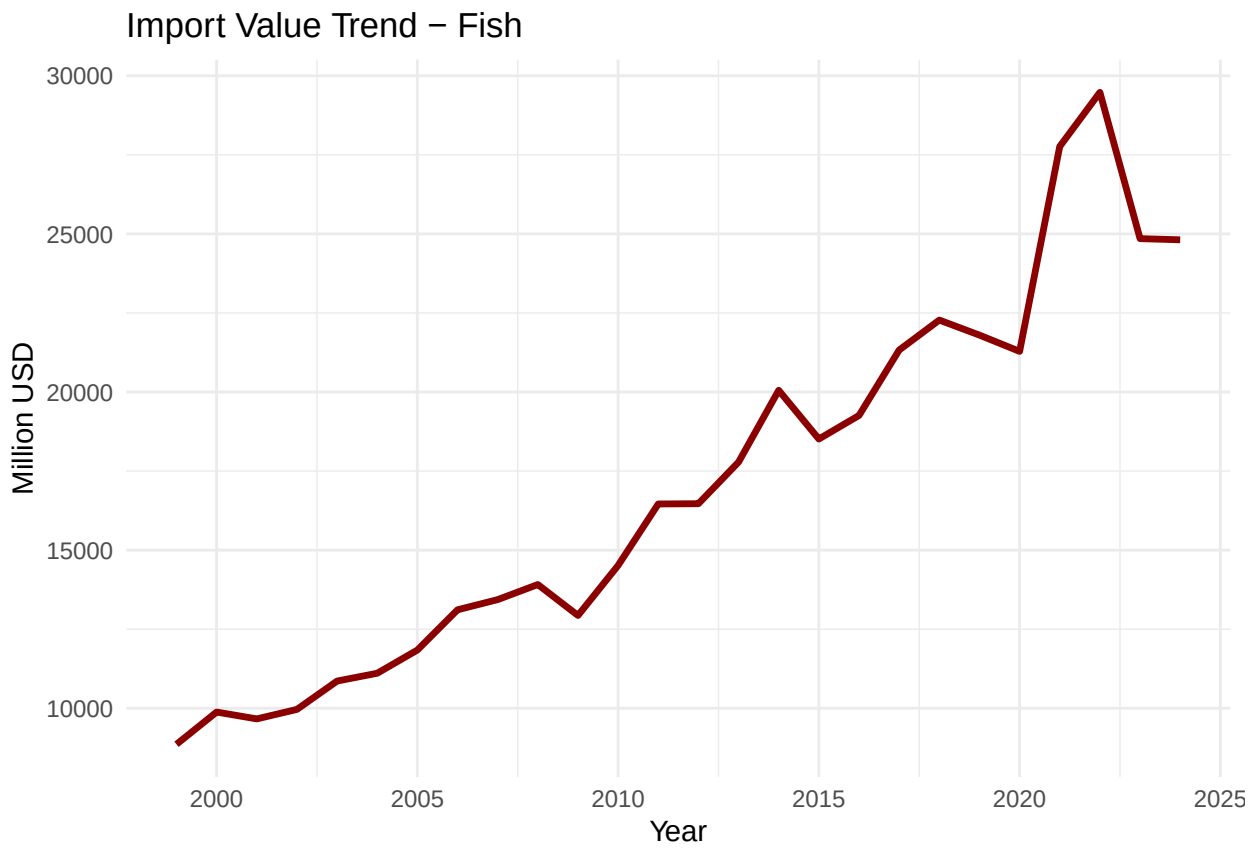
```
cat("Years with >10% import change in Dairy may require diversification, inventory buffering, or trade p
```

```
## Years with >10% import change in Dairy may require diversification, inventory buffering, or trade pol
```

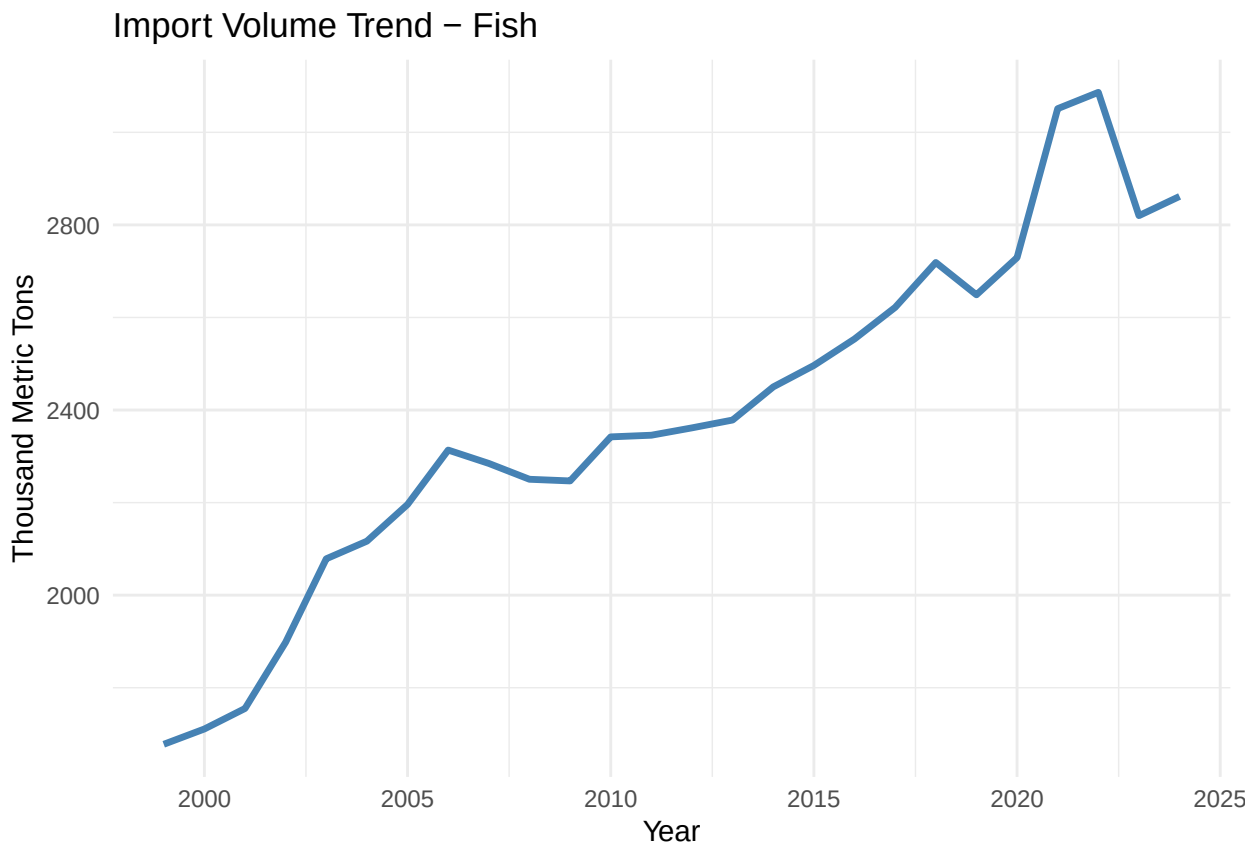
Fish

1. Trend: Value & Volume

```
val <- read_excel("FoodImports_WorldData.xlsx", sheet = "WorldfisheValue") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

vol <- read_excel("FoodImports_WorldData.xlsx", sheet = "WorldfisheVolume") %>%
  select(where(is.numeric)) %>%
  pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
  mutate(Year = as.integer(str_replace(Year, "\\.0", "")))

Fish_df <- left_join(val, vol, by = "Year") %>%
  drop_na()

ggplot(Fish_df, aes(x = Year, y = ImportValue)) +
  geom_line(color = "darkred", size = 1.2) +
  labs(title = "Import Value Trend - Fish", y = "Million USD") +
  theme_minimal()
```

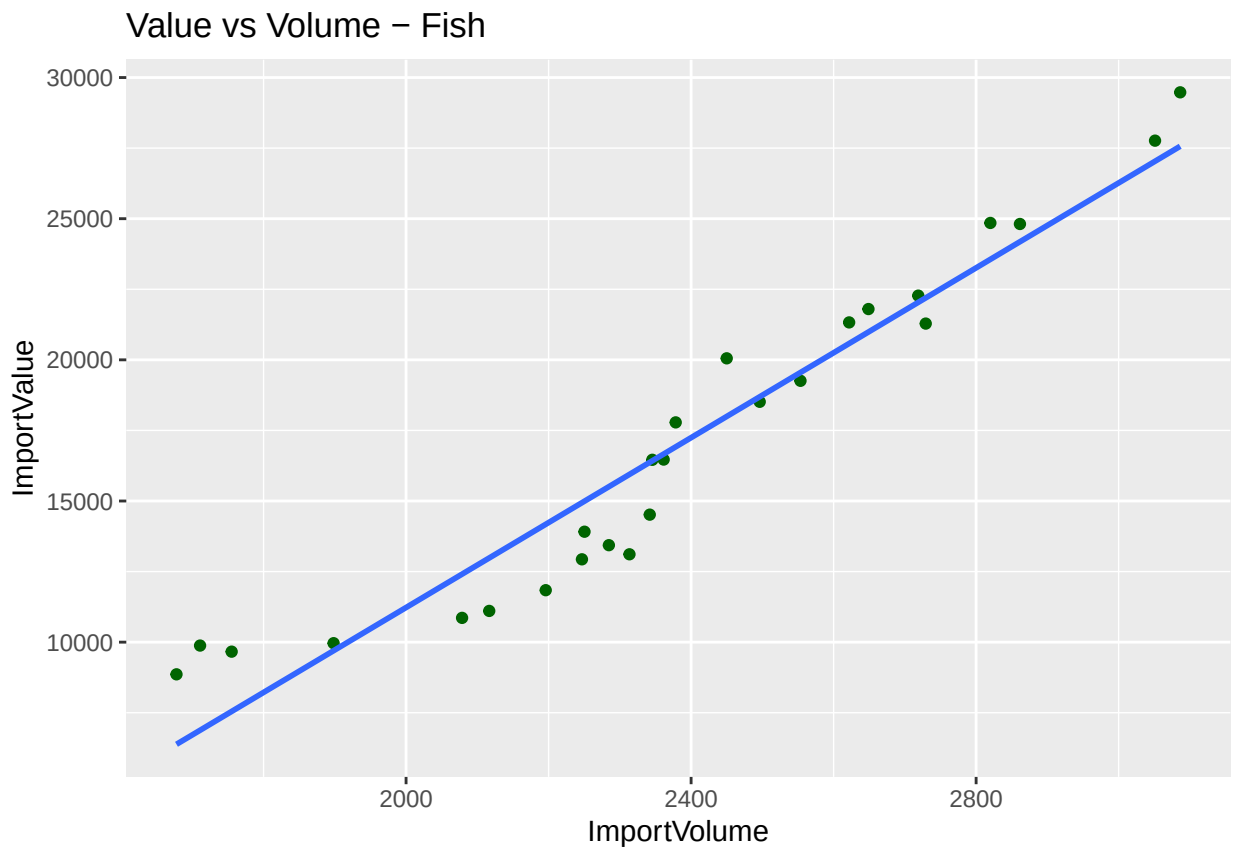



```
ggplot(Fish_df, aes(x = Year, y = ImportVolume)) +
  geom_line(color = "steelblue", size = 1.2) +
  labs(title = "Import Volume Trend - Fish", y = "Thousand Metric Tons") +
  theme_minimal()
```



2. Value vs Volume Correlation

```
ggplot(Fish_df, aes(x = ImportVolume, y = ImportValue)) +
  geom_point(color = "darkgreen") +
  geom_smooth(method = "lm", se = FALSE) +
  labs(title = "Value vs Volume - Fish")
```



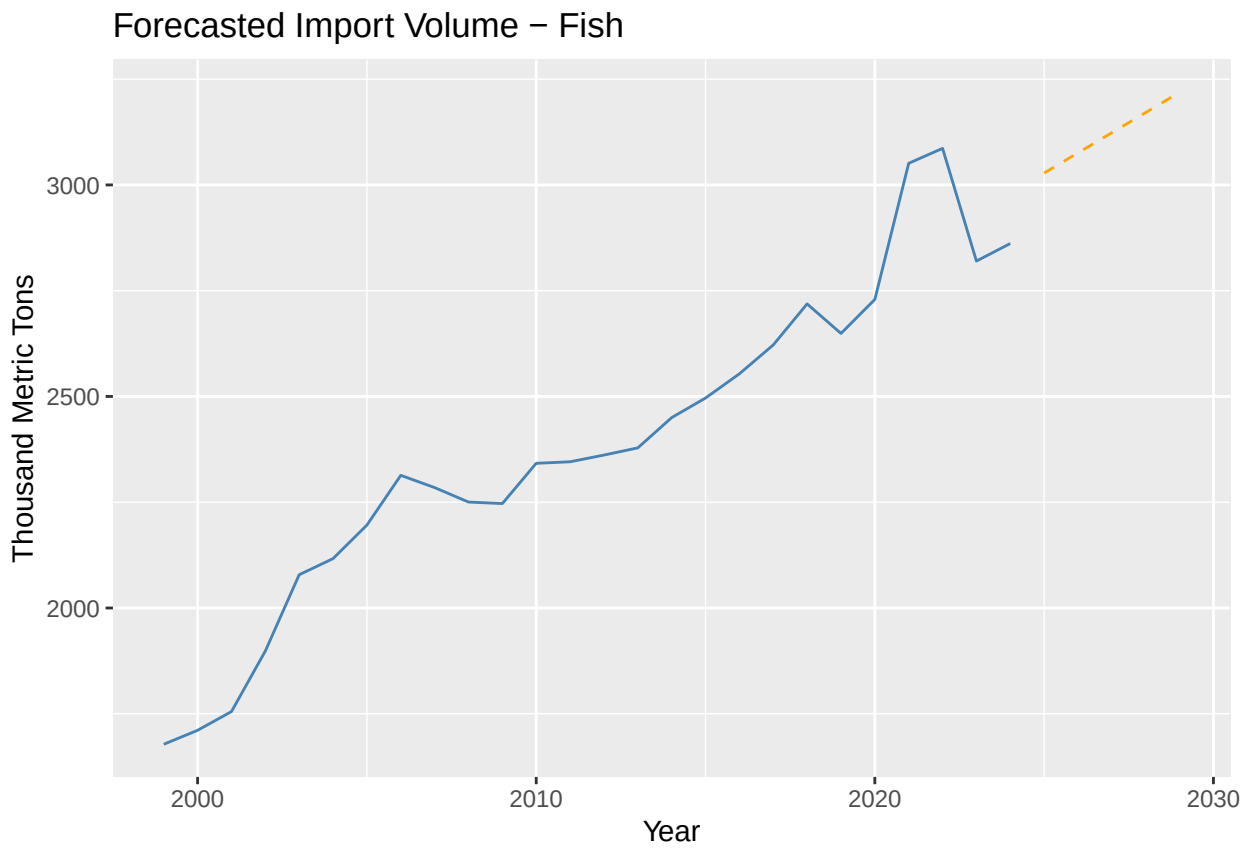

```
cor(Fish_df$ImportVolume, Fish_df$ImportValue, use = "complete.obs")
```

```
## [1] 0.9620446
```

3. Forecast (Linear Regression Only)

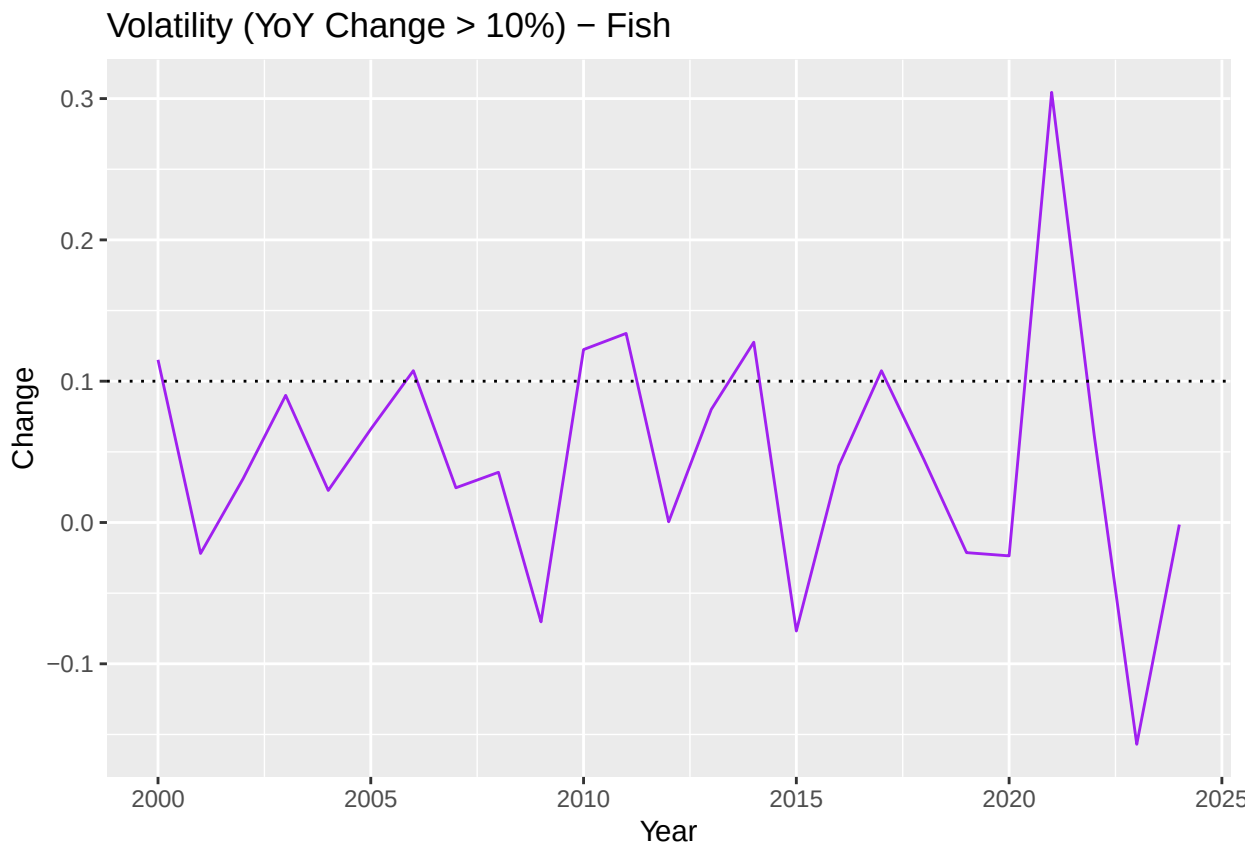
```
# Linear forecast for import value
lm_val <- lm(ImportValue ~ Year, data = Fish_df)
future_yrs <- data.frame(Year = seq(max(Fish_df$Year) + 1, max(Fish_df$Year) + 5))
pred_val <- predict(lm_val, newdata = future_yrs)

# Linear forecast for volume
lm_vol <- lm(ImportVolume ~ Year, data = Fish_df)
pred_vol <- predict(lm_vol, newdata = future_yrs)

# Plot both
ggplot() +
  geom_line(data = Fish_df, aes(x = Year, y = ImportValue), color = "darkred") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_val), color = "green", linetype = "dashed") +
  labs(title = "Forecasted Import Value - Fish", y = "Million USD")
```


```
ggplot() +
  geom_line(data = Fish_df, aes(x = Year, y = ImportVolume), color = "steelblue") +
  geom_line(data = future_yrs, aes(x = Year, y = pred_vol), color = "orange", linetype = "dashed") +
  labs(title = "Forecasted Import Volume - Fish", y = "Thousand Metric Tons")
```



4. Volatility Analysis

```
Fish_df <- Fish_df %>%
  arrange(Year) %>%
  mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
  drop_na()

ggplot(Fish_df, aes(x = Year, y = Change)) +
  geom_line(color = "purple") +
  geom_hline(yintercept = 0.1, linetype = "dotted") +
  labs(title = "Volatility (YoY Change > 10%) - Fish")
```




```
summary(lm(Change ~ ImportVolume + Year, data = Fish_df))
```

```
##
## Call:
## lm(formula = Change ~ ImportVolume + Year, data = Fish_df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14278 -0.03638 -0.01792  0.06429  0.17401
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)  42.5839439 15.0274637   2.834  0.00966 **
## ImportVolume  0.0004381  0.0001572   2.788  0.01073 *
## Year         -0.0216676  0.0076491  -2.833  0.00969 **
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## Residual standard error: 0.07998 on 22 degrees of freedom
## Multiple R-squared:  0.269,  Adjusted R-squared:  0.2025
## F-statistic: 4.047 on 2 and 22 DF,  p-value: 0.03187
```

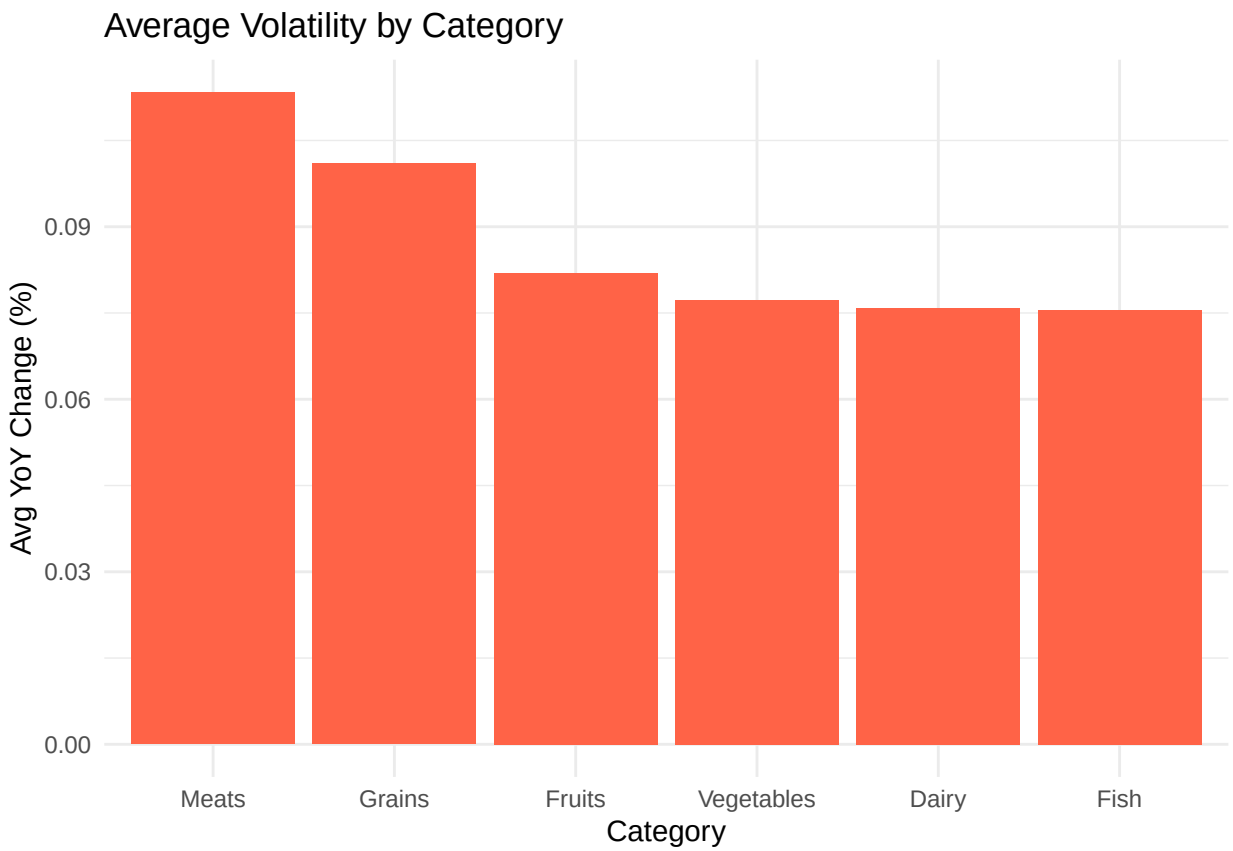
5. Prescriptive Insight

```
cat("Years with >10% import change in Fish may require diversification, inventory buffering, or trade p
```

```
## Years with >10% import change in Fish may require diversification, inventory buffering, or trade poli
```

Cross-Category Volatility Comparison

```
compute_volatility <- function(file, sheet_value, sheet_volume) {
val <- read_excel(file, sheet = sheet_value) %>%
 select(where(is.numeric)) %>%
 pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportValue") %>%
 mutate(Year = as.integer(str_replace(Year, "\\\\.0", "")))

vol <- read_excel(file, sheet = sheet_volume) %>%
 select(where(is.numeric)) %>%
 pivot_longer(cols = everything(), names_to = "Year", values_to = "ImportVolume") %>%
 mutate(Year = as.integer(str_replace(Year, "\\\\.0", "")))

df <- left_join(val, vol, by = "Year") %>%
 arrange(Year) %>%
 mutate(Change = (ImportValue - lag(ImportValue)) / lag(ImportValue)) %>%
 drop_na()

return(mean(abs(df$Change), na.rm = TRUE))
}

categories <- tibble::tibble(
Category = c("Meats", "Fruits", "Vegetables", "Grains", "Dairy", "Fish"),
ValueSheet = c("meatsValueWorld", "fruitsValueWorld", "vegetablesValueWorld", "World grainsValue", "Wor
VolumeSheet = c("meatsVolumeWorld", "fruitsVolumeWorld", "vegetablesVolumeWorld", "worldgrainsVolume",
)

categories <- categories %>%
rowwise() %>%
mutate(AvgVolatility = compute_volatility("FoodImports_WorldData.xlsx", ValueSheet, VolumeSheet)) %>%
ungroup()

ggplot(categories, aes(x = reorder(Category, -AvgVolatility), y = AvgVolatility)) +
geom_col(fill = "tomato") +
labs(title = "Average Volatility by Category", x = "Category", y = "Avg YoY Change (%)") +
theme_minimal()
```


Average Volatility by Category
Avg YoY Change (%)
0.09
0.06
0.03
0.00
Meats
Grains
Fruits
Vegetables
Dairy
Fish
Category