金融危機預測- HW3

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目錄

1 Systemic Sudden Stop(3S)

Systemic Sudden Stop(國際資金集煞車) 指的是一種金融危機，當國際投資者突然停止向一個國家或地區提供資金，並開始撤回他們已投資的資金，從而導致該國或地區的貨幣和金融市場出現崩潰和危機。

國際資金集中煞車通常會對發展中國家產生更大的影響，因為這些國家通常更依賴國際資本流動，其經濟體系較為脆弱。

以下將以實際資料查驗 Systemic Sudden Stop 對經濟體的影響。

2 資料來源

GDP 成長率資料可在 GDP Growth 下載，資料來源取自 World Bank。

實質 GDP 資料可在GDP constant 2015 US dollar 下載，資料來源取自 World Bank。

淨出口資料，可在Net trade in goods and services (BoP, current US$) 下載，資料來源取自 World Bank。

匯率資料，可在 Official exchange rate (LCU per US$, period average) 下載，資料來源取自 World Bank。

注意匯率分母是美元，所以數值增加其實是貶值。

3 資料處理

3.1 讀取資料

```
library(readxl)
real_GDP <- read_excel("real_GDP.xlsx")
GDP_growth <- read_excel("GDP_growth.xlsx")
Exchange_rate <- read_excel("Exchange_rate.xlsx")
Net_exports <- read_excel("Net_exports.xlsx")
```

3.2 寬表轉長表

由於資料原始格式是寬表，為求操作方便，我們先將寬表轉成長表。

`pivot_longer(data, cols, names_to, values_to)`

`data`: 欲轉換的資料框。

`cols`: 指定要轉換的欄位，可以使用欄位名稱、欄位編號或欄位區間。

`names_to`: 指定轉換後欄位名稱的變數名稱，轉換後的值會儲存在這個欄位中。

`values_to`: 指定轉換後的值所儲存在的欄位名稱。

```
library(tidyr)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.1     v dplyr   1.1.0
## v tibble  3.1.8     v stringr 1.5.0
## v readr   2.1.4     v forcats 0.5.2
## v purrr   1.0.1
```

```
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
real_GDP <- real_GDP %>%
  # 將除了第一欄以外的所有欄位變成一個叫做 value 的欄位,
  # 同時將原本的欄位名稱變成一個叫做 year 的欄位。
  pivot_longer(-1, names_to = "year", values_to = "value") %>%
  # 利用 mutate 將 year 欄位轉換成整數格式
  mutate(year = as.integer(year)) %>%
  # 使用 arrange 函數按照 country 和 year 欄位進行升序排序
  # 注意是先依據國家排序
  arrange(country, year)

GDP_growth <- GDP_growth %>%
  pivot_longer(-1, names_to = "year", values_to = "value") %>%
  mutate(year = as.integer(year)) %>%
  arrange(country, year)

Exchange_rate <- Exchange_rate %>%
  pivot_longer(-1, names_to = "year", values_to = "value") %>%
  mutate(year = as.integer(year)) %>%
  arrange(country, year)

Net_exports <- Net_exports %>%
  pivot_longer(-1, names_to = "year", values_to = "value") %>%
  mutate(year = as.integer(year)) %>%
  arrange(country, year)
```

3.3 資料合併

```
merged_data <-
  # 將 real_GDP 和 GDP_growth 這兩個資料框按照 country 和 year
  # 兩個欄位進行合併
  merge(real_GDP, GDP_growth, by = c("country", "year"), all = TRUE) %>%
  # 重新命名變數名稱
  rename("real_GDP" = "value.x", "GDP_growth"="value.y")  %>%
  merge(Exchange_rate, by = c("country", "year"), all = TRUE) %>%
  rename("Exchange_rate" = "value") %>%
```

```
  merge(Net_exports, by = c("country", "year"), all = TRUE) %>%
  rename("Net_exports" = "value") %>%
  # 用 mutate 新增變數
  mutate(exports_gdp_ratio = Net_exports / real_GDP)
```

3.4 標準化事件發生時段

由於各國事件發生時段不一致，我們創建一個函數進行”標準化”。

以下使用 lag()，使用方法如下：

```
library(dplyr)
df <- data.frame(x = c(1, 2, 3, 4, 5))

# 取得前一時間點資料
df$y <- lag(df$x)

# 取得前三時間點資料
df$z <- lag(df$x, n = 3)



df
```

```
##   x  y  z
## 1 1 NA NA
## 2 2  1 NA
## 3 3  2 NA
## 4 4  3  1
## 5 5  4  2
```

```
library(dplyr)

my_function <- function(nation, start_year, end_year){

  nation1 <- merged_data %>%
  # 利用 filter 函數進行 row 的篩選
  filter(country==nation)  %>%
  # 因為還要計算匯率的變化率，所以要多取前一筆資料
  filter(year >= start_year-1 & year <= end_year)
```

```
  nation1 <- nation1 %>%
  # 計算匯率變化率，使用 lag() 幫我們取前一筆資料
  mutate(exchange_change =
           (Exchange_rate - lag(Exchange_rate))/lag(Exchange_rate)) %>%
  # 標準化事件發生的時間點
  mutate(T1=start_year) %>%
  mutate(T2=start_year+1) %>%
  mutate(T3=start_year+2) %>%
  mutate(T4=start_year+3) %>%
  mutate(T5=start_year+4)
  # 重新篩選資料範圍
  nation1 <- nation1 %>%
  filter(year >= start_year & year <= end_year)


  return (tibble(nation1))

}

Argentina1 <- my_function("Argentina",1980,1984)
Argentina2 <- my_function("Argentina",2000,2004)
Brazil <- my_function("Brazil",1981,1985)
Chile <- my_function("Chile",1981,1985)
Cote <- my_function("Cote d'Ivoire",1982,1986)
Ecuador <- my_function("Ecuador",1997,2001)
Salvador <- my_function("El Salvador",1980,1984)
Indonesia <- my_function("Indonesia",1996,2000)
Malaysia <- my_function("Malaysia",1996,2000)
Mexico1 <- my_function("Mexico",1981,1985)
Mexico2 <- my_function("Mexico",1993,1997)
Morocco <- my_function("Morocco", 1993,1997)
Nigeria <- my_function("Nigeria",1982,1986)
Peru <- my_function("Peru",1981,1985)
Russia <- my_function("Russian Federation",1996,2000)
Africa <- my_function("South Africa",1981,1985)
Korea <- my_function("Korea, Rep.",1996,2000)
Thailand <- my_function("Thailand",1996,2000)
Turkey1 <- my_function("Turkiye",1992,1996)
Turkey2 <- my_function("Turkiye",1997,2001)
Uruguay <- my_function("Uruguay",1982,1986)
```

```
Vene <- my_function("Venezuela, RB",1981,1985)
```

3.5 擷取不同時段資料

```
# 將上述資料重新合併
all_data <- rbind(Argentina1, Argentina2, Brazil, Chile, Cote, Ecuador,
                  Salvador, Indonesia, Malaysia, Mexico1, Mexico2,
                  Morocco, Nigeria, Peru,Russia, Africa, Korea,
                  Thailand, Turkey1, Turkey2, Uruguay, Vene)

all_data_T1 <- all_data[all_data$year==all_data$T1,]
all_data_T2 <- all_data[all_data$year==all_data$T2,]
all_data_T3 <- all_data[all_data$year==all_data$T3,]
all_data_T4 <- all_data[all_data$year==all_data$T4,]
all_data_T5 <- all_data[all_data$year==all_data$T5,]
```

3.6 資料分析

```
# 計算不同時段的 mean
GDP_growth_mean <-c(mean(all_data_T1$GDP_growth, na.rm=T),
                    mean(all_data_T2$GDP_growth, na.rm=T),
                    mean(all_data_T3$GDP_growth, na.rm=T),
                    mean(all_data_T4$GDP_growth, na.rm=T),
                    mean(all_data_T5$GDP_growth, na.rm=T))

# 計算不同時段的 sd
GDP_growth_sd <- c(sd(all_data_T1$GDP_growth, na.rm=T),
                   sd(all_data_T2$GDP_growth, na.rm=T),
                   sd(all_data_T3$GDP_growth, na.rm=T),
                   sd(all_data_T4$GDP_growth, na.rm=T),
                   sd(all_data_T5$GDP_growth, na.rm=T))

# 計算 mean plus/minus 一個標準差
growth_mean_plus_sd <- GDP_growth_mean + GDP_growth_sd
growth_mean_minus_sd <- GDP_growth_mean - GDP_growth_sd

# 建立資料框
```

```
growth_df <- data.frame(mean=GDP_growth_mean,
                        mean_plus_sd=growth_mean_plus_sd,
                        mean_minus_sd=growth_mean_minus_sd)
```

```
exchange_change_mean <-c(mean(all_data_T1$exchange_change, na.rm=T),
                         mean(all_data_T2$exchange_change, na.rm=T),
                         mean(all_data_T3$exchange_change, na.rm=T),
                         mean(all_data_T4$exchange_change, na.rm=T),
                         mean(all_data_T5$exchange_change, na.rm=T))

exchange_change_sd <- c(sd(all_data_T1$exchange_change, na.rm=T),
                        sd(all_data_T2$exchange_change, na.rm=T),
                        sd(all_data_T3$exchange_change, na.rm=T),
                        sd(all_data_T4$exchange_change, na.rm=T),
                        sd(all_data_T5$exchange_change, na.rm=T))

# 計算 mean plus/minus 一個標準差
exchange_change_mean_plus_sd <- exchange_change_mean + exchange_change_sd
exchange_change_mean_minus_sd <- exchange_change_mean - exchange_change_sd

# 建立資料框
exchange_change_df <- data.frame(mean=exchange_change_mean,
                        mean_plus_sd=exchange_change_mean_plus_sd,
                        mean_minus_sd=exchange_change_mean_minus_sd)
```

```
ratio_mean <-c(mean(all_data_T1$exports_gdp_ratio, na.rm=T),
               mean(all_data_T2$exports_gdp_ratio, na.rm=T),
               mean(all_data_T3$exports_gdp_ratio, na.rm=T),
               mean(all_data_T4$exports_gdp_ratio, na.rm=T),
               mean(all_data_T5$exports_gdp_ratio, na.rm=T))

ratio_sd <- c(sd(all_data_T1$exports_gdp_ratio, na.rm=T),
              sd(all_data_T2$exports_gdp_ratio, na.rm=T),
              sd(all_data_T3$exports_gdp_ratio, na.rm=T),
              sd(all_data_T4$exports_gdp_ratio, na.rm=T),
              sd(all_data_T5$exports_gdp_ratio, na.rm=T))

# 計算 mean plus/minus 一個標準差
ratio_mean_plus_sd <- ratio_mean + ratio_sd
ratio_mean_minus_sd <- ratio_mean - ratio_sd
```

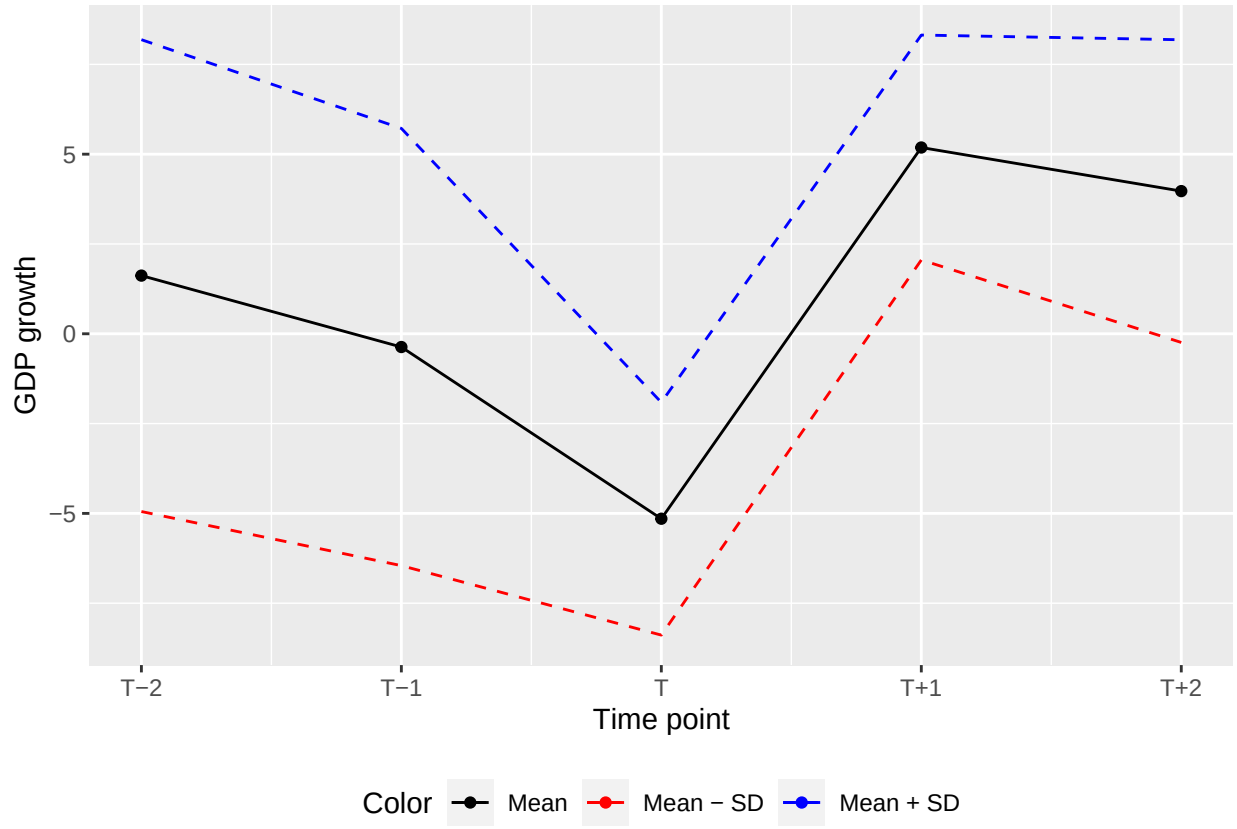
```
# 建立資料框
ratio_df <- data.frame(mean=ratio_mean,
                       mean_plus_sd=ratio_mean_plus_sd,
                       mean_minus_sd=ratio_mean_minus_sd)
```

4 繪圖與解讀

在 ggplot() 的 mapping 參數中，實際上每一維度都有一個對應的預設刻度（scale），即將數據值映射到圖形中的映射方法。如果需要修改刻度對應的變換或者標度方法，可以調用相應的 scale_xxx() 函數。

4.1 GDP 成長率

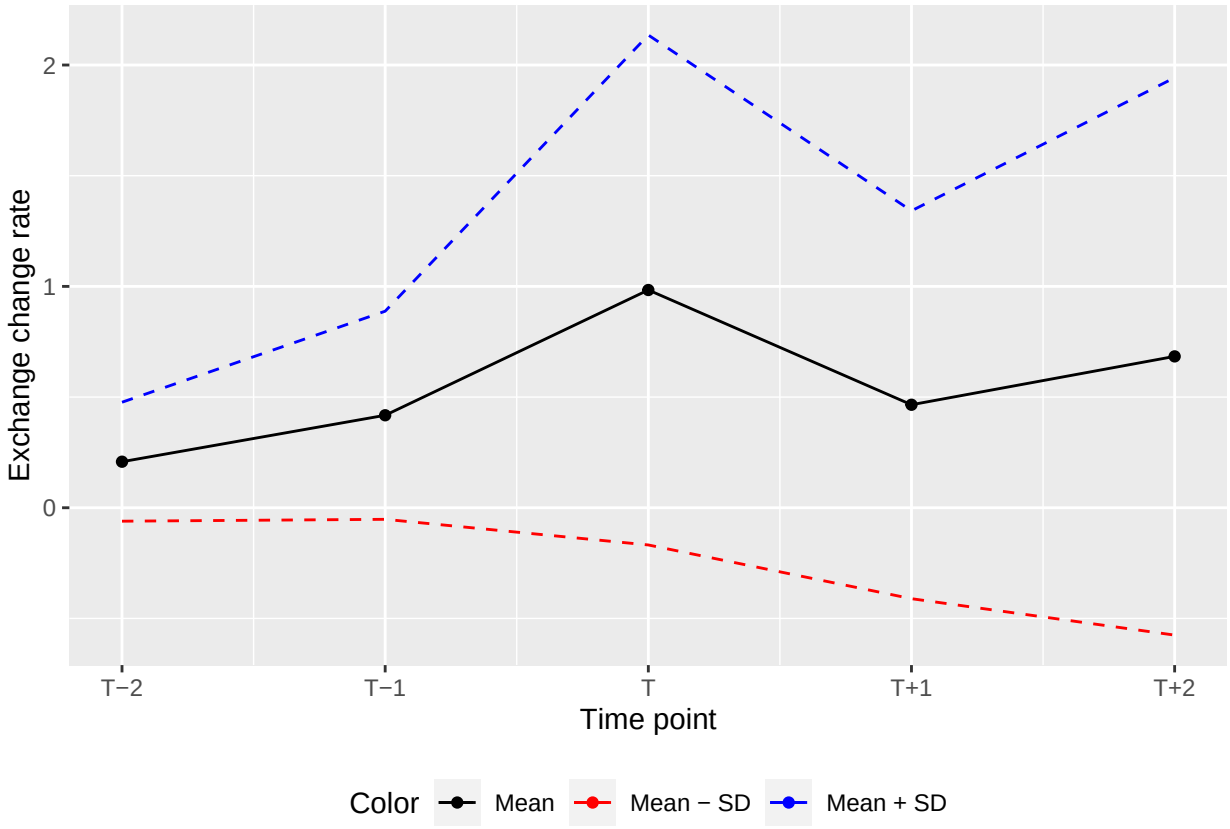
```
library(ggplot2)

ggplot(growth_df, aes(x = c(-2,-1,0,1,2))) +
  geom_line(aes(y = mean, color = "Mean")) +
  geom_point(aes(y = mean, color = "Mean")) +
  geom_line(aes(y = mean_plus_sd, color = "Mean + SD"), linetype = "dashed") +
  geom_line(aes(y = mean_minus_sd, color = "Mean - SD"), linetype = "dashed") +
  labs(x = "Time point", y = "GDP growth", color = "Color") +

  # 設置 x 軸的刻度，breaks 參數用於指定刻度的位置，
  # labels 參數用於指定刻度的標籤。
  scale_x_continuous(breaks = c(-2,-1,0,1,2),
                     labels = c("T-2", "T-1", "T", "T+1", "T+2")) +

  # 設置圖例的顏色，name 參數用於指定圖例的標籤，
  # values 參數用於指定每個類別的顏色。
  scale_color_manual(name = "Color",
                     values = c("Mean" = "black",
                                "Mean + SD" = "blue",
                                "Mean - SD" = "red")) +

  # 圖例位置
  theme(legend.position = "bottom")
```



根據上方圖形，可以明顯發現國際資金急煞車對一經濟體的 GDP 成長率有負面影響，當國際資金流動突然中斷時，國家的經濟活動受到限制，這會導致投資減少、消費減少、生產活動降低等問題，進而對國內生產總值（GDP）產生負面影響。

4.2 匯率成長率 (變動率)

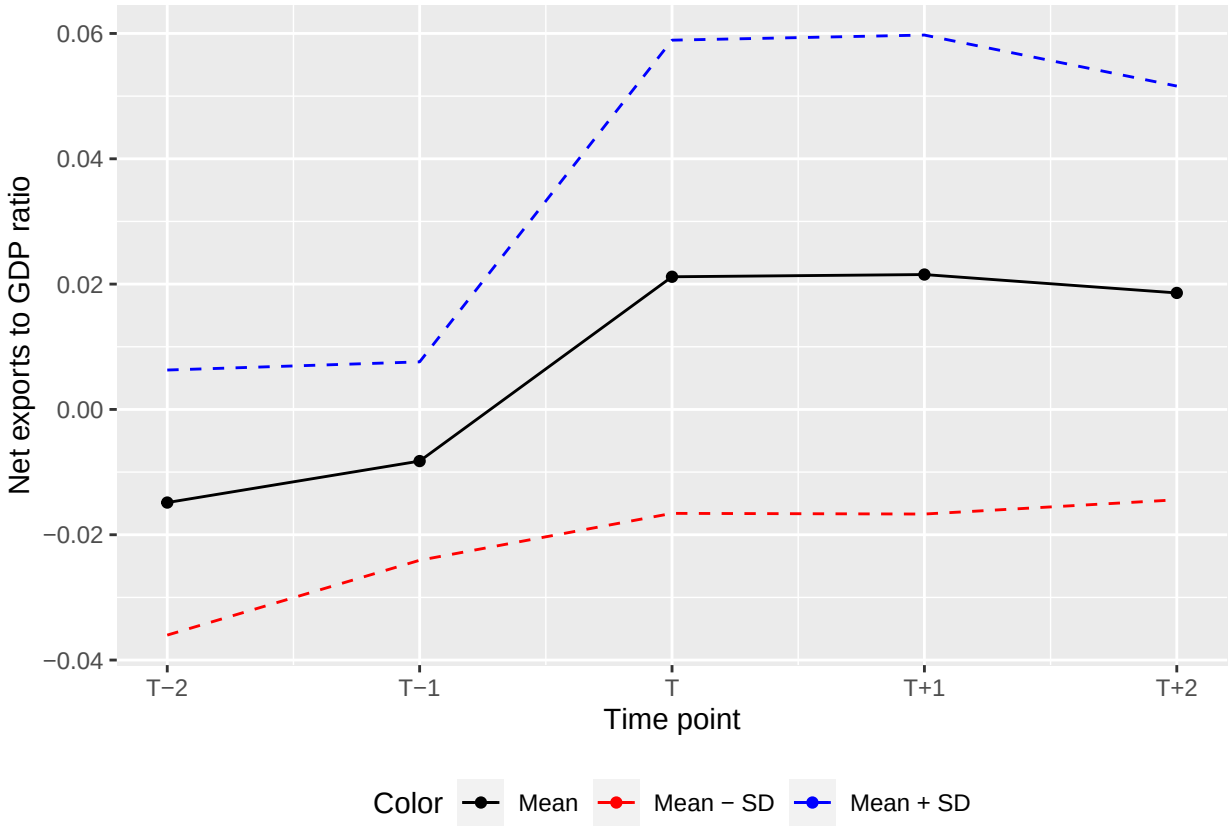
```
ggplot(exchange_change_df, aes(x = c(-2,-1,0,1,2), y = mean)) +
  geom_line(aes(y = mean, color = "Mean")) +
  geom_point(aes(y = mean, color = "Mean")) +
  geom_line(aes(y = mean_plus_sd, color = "Mean + SD"), linetype = "dashed") +
  geom_line(aes(y = mean_minus_sd, color = "Mean - SD"), linetype = "dashed") +
  labs(x = "Time point", y = "Exchange change rate", color = "Color") +
  scale_x_continuous(breaks = c(-2,-1,0,1,2),
                     labels = c("T-2", "T-1", "T", "T+1", "T+2")) +
  scale_color_manual(name = "Color",
                     values = c("Mean" = "black",
                                "Mean + SD" = "blue",
                                "Mean - SD" = "red")) +
  theme(legend.position = "bottom")
```



根據上方圖形，可以明顯發現國際資金急煞車會提升一經濟體的匯率成長率，由於匯率資料分母為單位美元，故匯率成長率上升相當於該國貨幣貶值。當國際資金流動突然中斷時這可能會導致受影響國家的貨幣貶值，進而引發貨幣危機。

4.3 淨出口占實質 GDP 比率

```
ggplot(ratio_df, aes(x = c(-2,-1,0,1,2), y = mean)) +
  geom_line(aes(y = mean, color = "Mean")) +
  geom_point(aes(y = mean, color = "Mean")) +
  geom_line(aes(y = mean_plus_sd, color = "Mean + SD"), linetype = "dashed") +
  geom_line(aes(y = mean_minus_sd, color = "Mean - SD"), linetype = "dashed") +
  labs(x = "Time point", y = "Net exports to GDP ratio", color = "Color") +
  scale_x_continuous(breaks = c(-2,-1,0,1,2),
                     labels = c("T-2", "T-1", "T", "T+1", "T+2")) +
  scale_color_manual(name = "Color",
                     values = c("Mean" = "black",
                                "Mean + SD" = "blue",
                                "Mean - SD" = "red")) +
  theme(legend.position = "bottom")
```



根據上方圖形，可以明顯發現國際資金急煞車對一經濟體的淨出口有影響。當國際資金流動突然中斷時，外國投資者不再投資該國，因此導致原本大規模經常帳赤字的情況出現了急劇的反轉，轉變成較小的赤字或者是小額盈餘，因為國內需求的減少導致進口減少，而出口則可能增加。