SOK-2011 v.2024: Utfordring 1 - kode

89

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Utfordring 1.1

Dette dokumentet inneholder kodene til figurene i utfordring 1, i emnet SOK-2011. Kodene tar utgangspunkt i støtten gitt i oppgaveteksten.

Oppgave C)

```r
# Nullstiller minnet.
rm(list = ls())

# Laster inn pakker.
suppressPackageStartupMessages(library(tidyverse))


# Definerer intervall for kapitalintensiteten.
k <- seq(0, 3000, by = 1)

# Legger intervallet i et dataframe.
df <- data.frame(k)


# Definer akser og parameter til vi skal tegne figurene.
axes_1 <- ggplot(df, aes(k)) +
  labs(x="k", y="sy, nk") +
  theme(axis.title = element_text(size = 10),
        plot.title = element_text(size = 10),
        panel.background = element_blank(),
        axis.line = element_line(colour = "black"),
        axis.title.x = element_text(hjust = 1),
        axis.title.y = element_text(angle = 0, vjust = 1, hjust=1)) +
```

```
  coord_fixed(ratio = 1) +
  scale_x_continuous(limits = c(0, 1200), expand = c(0, 0)) +
  scale_y_continuous(limits = c(0, 45), expand = c(0, 0)) +
  coord_fixed(ratio = (1200 - 0) / (45 - 0))
```

Figur 1.1)

```
# Definerer rammeverk for modellen.
a <- 0.3
s <- 0.1
n <- 0.04
A <- 50
```

```
# Definerer funksjoner for tegning av grafer.
sy <- function(k) (s*A*k^a)
nk <- function(k) (n*k)
```

```
# Finner steady state.
ss_k <- ((s*A/(n))^(1/(1-a)))
ss_nk <- (n*((s*A/(n))^(1/(1-a))))
```

```
# Lager figur 1.1.
figur_1 <- axes_1 +
  stat_function(df, fun=sy, mapping = aes(), color = "#FF8000") +
  stat_function(df, fun=nk, mapping = aes(), color = "#228B22") +
  annotate("text", x = 600, y = 36, label=expression(sy)) +
  annotate("text", x = 600, y = 27, label=expression(nk)) +
  geom_point(x = ss_k, y = ss_nk, color = "#D2042D")+
  geom_segment(aes(x = ss_k, xend = ss_k, y = 0, yend = ss_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 0, xend = ss_k, y = ss_nk, yend = ss_nk),
               linetype = "dashed", color = "#D2042D") +
  annotate("text", x = ss_k + 60, y = 2, label=expression(k^{ss}))
```

```
# Viser figur 1.1.
figur_1
```
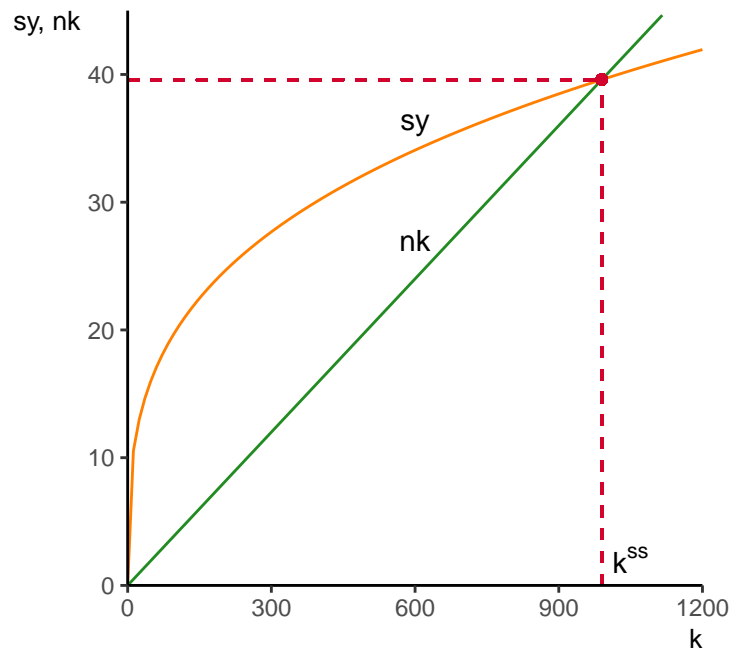
```r
# Viser nivået på ss.
print(ss_k)
```

```
[1] 989.8873
```

```r
print(ss_nk)
```

```
[1] 39.59549
```

Figur 1.2)

```r
# Setter opp nye paramterer for endring i spareraten.
s0 <- 0.07
s1 <- 0.08
n <- 0.04
A <- 50
```

```r
# Setter opp nye funksjoner for endring i spareraten.
s0y <- function(k) (s0*A*k^a)
```

```r
s1y <- function(k) (s1*A*k^a)
nk <- function(k) (n*k)

# Finner steady state.
ss0_k <- ((s0*A/(n))^(1/(1-a)))
ss1_k <- ((s1*A/(n))^(1/(1-a)))
ss0_nk <- (n*((s0*A/(n))^(1/(1-a))))
ss1_nk <- (n*((s1*A/(n))^(1/(1-a))))


# Lager figur 1.2.
figur_2 <- axes_1 +
  stat_function(df, fun=s0y, mapping = aes(), color = "#FF8000") +
  stat_function(df, fun=s1y, mapping = aes(), color = "#2173B8") +
  stat_function(df, fun=nk, mapping = aes(), color = "#228B22") +
  annotate("text", x = 960, y = 25, label=expression(s0*y)) +
  annotate("text", x = 960, y = 30, label=expression(s1*y)) +
  annotate("text", x = 980, y = 37, label=expression(n*k)) +
  geom_point(x = ss0_k, y = ss0_nk, color = "#D2042D") +
  geom_point(x = ss1_k, y = ss1_nk, color = "#D2042D") +
  geom_segment(aes(x = ss0_k, xend = ss0_k, y = 0, yend = ss0_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 0, xend = ss0_k, y = ss0_nk, yend = ss0_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = ss1_k, xend = ss1_k, y = 0, yend = ss1_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 0, xend = ss1_k, y = ss1_nk, yend = ss1_nk),
               linetype = "dashed", color = "#D2042D") +
  annotate("text", x = ss0_k + 60, y = 2, label=expression(k^{ss0})) +
  annotate("text", x = ss1_k + 60, y = 2, label=expression(k^{ss1}))

# Viser figur 1.2.
figur_2
```
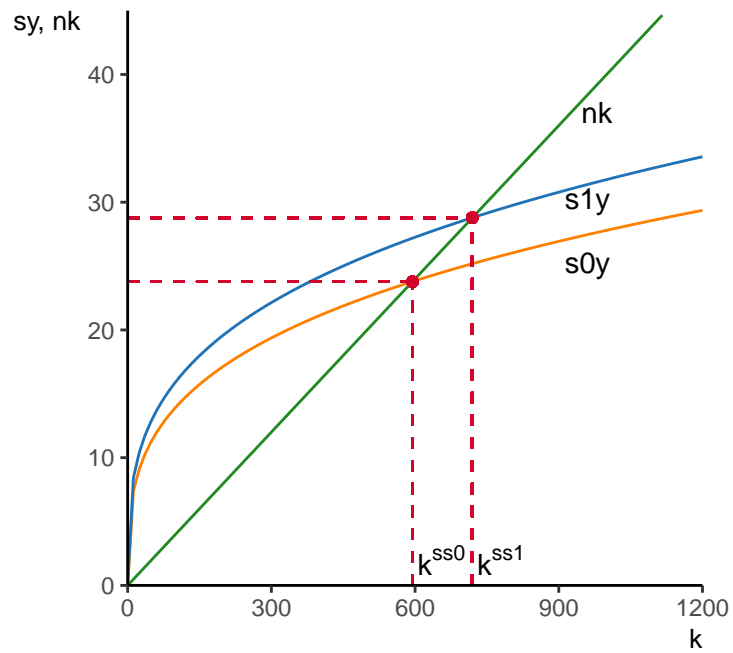
```
# Viser nivået på steady state.
print(ss0_k)
```

[1] 594.699

```
print(ss1_k)
```

[1] 719.6857

```
print(ss0_nk)
```

[1] 23.78796

```
print(ss1_nk)
```

[1] 28.78743

Figur 1.3)

```r
# Setter opp nye paramterer for endring i befolkningsvekstraten.
s <- 0.07
n0 <- 0.04
n1 <- 0.05
A <- 50


# Setter opp nye funksjoner for endring i befolkningsvekstraten.
sy <- function(k) (s*A*k^a)
n0k <- function(k) (n0*k)
n1k <- function(k) (n1*k)

# Finner steady state.
ss0_k <- ((s*A/(n0))^(1/(1-a)))
ss1_k <- ((s*A/(n1))^(1/(1-a)))
ss0_nk <- (n0*((s*A/(n0))^(1/(1-a))))
ss1_nk <- (n1*((s*A/(n1))^(1/(1-a))))


# Lager figur 1.3.
figur_3 <- axes_1+
  stat_function(df, fun=sy, mapping = aes(), color = "#FF8000") +
  stat_function(df, fun=n0k, mapping = aes(), color = "#228B22") +
  stat_function(df, fun=n1k, mapping = aes(), color = "#2173B8") +
  annotate("text", x = 900, y = 25, label=expression(s*y)) +
  annotate("text", x = 800, y = 35, label=expression(n0k)) +
  annotate("text", x = 600, y = 35, label=expression(n1k)) +
  geom_point(x = ss0_k, y = ss0_nk, color = "#D2042D") +
  geom_point(x = ss1_k, y = ss1_nk, color = "#D2042D") +
  geom_segment(aes(x = ss0_k, xend = ss0_k, y = 0, yend = ss0_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 0, xend = ss0_k, y = ss0_nk, yend = ss0_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = ss1_k, xend = ss1_k, y = 0, yend = ss1_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 0, xend = ss1_k, y = ss1_nk, yend = ss1_nk),
               linetype = "dashed", color = "#D2042D") +
  annotate("text", x = ss0_k + 60, y = 2, label=expression(k^{ss0}))+
  annotate("text", x = ss1_k + 60, y = 2, label=expression(k^{ss1}))

# Viser figur 1.3.
figur_3
```
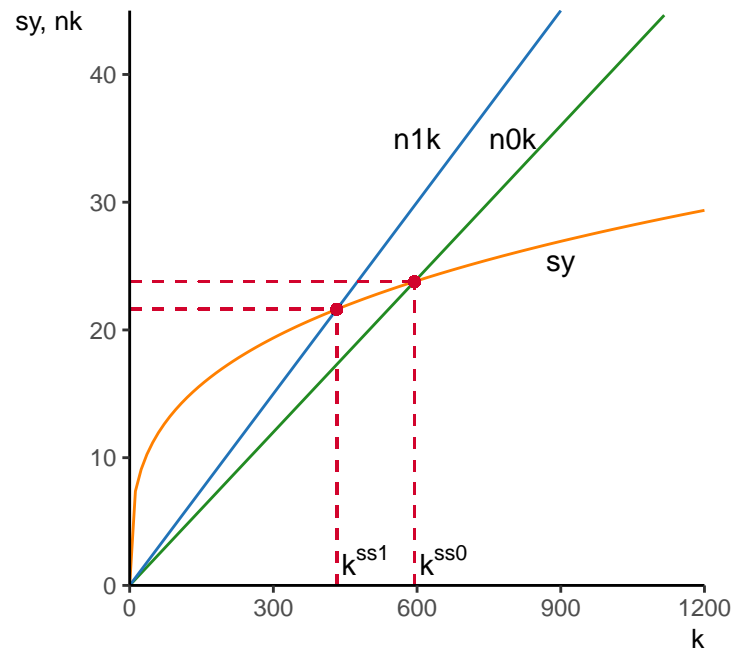
```
# Viser nivået pCå steady state.
print(ss0_k)
```

[1] 594.699

```
print(ss1_k)
```

[1] 432.3688

```
print(ss0_nk)
```

[1] 23.78796

```
print(ss1_nk)
```

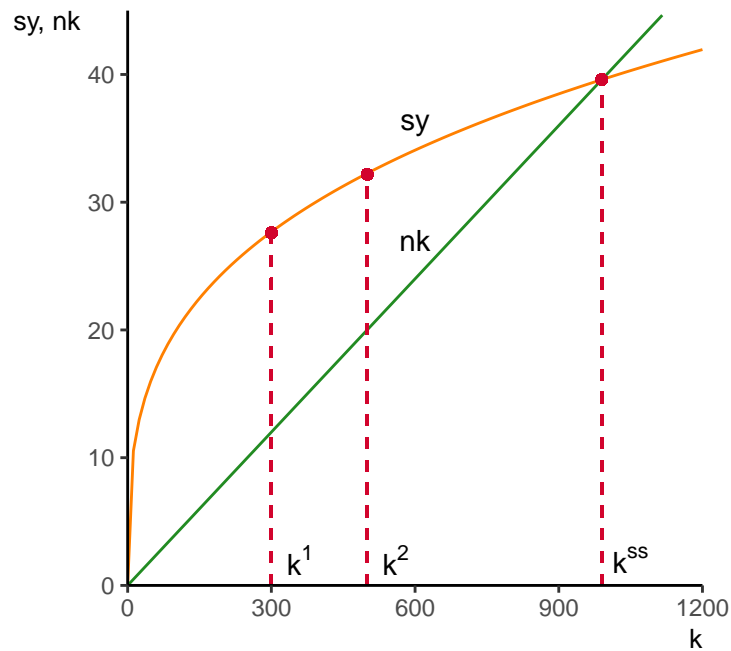[1] 21.61844

Utfordring 1.2

Ubetinget konvergems

```
# Definerer rammeverk for modellen.
a <- 0.3
s <- 0.1
n <- 0.04
A <- 50

# Definerer funksjoner for tegning av grafer.
sy <- function(k) (s*A*k^a)
nk <- function(k) (n*k)

# Lager figur 2.1.
figur_4 <- axes_1 +
  stat_function(df, fun=sy, mapping = aes(), color = "#FF8000") +
  stat_function(df, fun=nk, mapping = aes(), color = "#228B22") +
  annotate("text", x = 600, y = 36, label=expression(sy)) +
  annotate("text", x = 600, y = 27, label=expression(nk)) +
  geom_point(x = ss_k, y = ss_nk, color = "#D2042D") +
  geom_point(x = 500,  y = 32.18, color = "#D2042D") +
  geom_point(x = 300,  y = 27.6,  color = "#D2042D") +
  geom_segment(aes(x = ss_k, xend = ss_k, y = 0, yend = ss_nk),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 500, xend = 500, y = 0, yend = 32.18),
               linetype = "dashed", color = "#D2042D") +
  geom_segment(aes(x = 300, xend = 300, y = 0, yend = 27.6),
               linetype = "dashed", color = "#D2042D") +
  annotate("text", x = ss_k + 60, y = 2, label = expression(k^{ss})) +
  annotate("text", x = 500 + 60,  y = 2, label = expression(k^{2})) +
  annotate("text", x = 300 + 60,  y  =2, label = expression(k^{1}))

# Viser figur 2.1.
figur_4
```

sy, nk

40

sy

30

nk

20

10

k^1 k^2 k^{ss}

0

0   300   600   900   1200

k

Betinget konvergens

```
# Definerer rammeverk for modellen.
a <- 0.3
s0 <- 0.07
s1 <- 0.08
n0 <- 0.04
n1 <- 0.05
A <- 50
```

```
# Definerer funksjoner for tegning av grafer.
s0y <- function(k) (s0*A*k^a)
s1y <- function(k) (s1*A*k^a)
n0k <- function(k) (n0*k)
n1k <- function(k) (n1*k)
```

```
# Lager figur 2.2.
figur_5 <- axes_1 +
  stat_function(df, fun=s0y, mapping = aes(), color = "#FF8000") +
  stat_function(df, fun=s1y, mapping = aes(), color = "#2173B8") +
```

```
stat_function(df, fun=n0k, mapping = aes(), color = "#228B22") +
stat_function(df, fun=n1k, mapping = aes(), color = "#702963") +
annotate("text", x = 1100, y = 27, label=expression(s1y)) +
annotate("text", x = 1100, y = 31, label=expression(s2y)) +
annotate("text", x = 720, y = 40,  label=expression(n1k)) +
annotate("text", x = 920, y = 40,  label=expression(n2k)) +
geom_point(x = 720, y = 28.8, color = "#D2042D") +
geom_point(x = 430, y = 21.5, color = "#D2042D") +
geom_segment(aes(x = 720, xend = 720, y = 0, yend = 28.8),
             linetype = "dashed", color = "#D2042D") +
geom_segment(aes(x = 430, xend = 430, y = 0, yend = 21.5),
             linetype = "dashed", color = "#D2042D") +
annotate("text", x = 720 + 60,  y = 2, label = expression(k^{2})) +
annotate("text", x = 430 + 60,  y =2, label = expression(k^{1}))
```

```
# Viser figur 2.2.
figur_5
```