BEA Fixed Assets - Example

Datasets

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Contents

Preamble

```
rm(list = ls())
pklist <- c("curl", "tidyverse", "rvest")
source("https://fgeerolf.github.io/datasets/load-packages.R")
options(tibble.print_max = 100)
```

Datasets

We now load the National Income and Product Accounts (NIPA) data which may be obtained from the BEA website. We also prepare gdp data, of which we show the first 10 lines below – we see that GDP is expressed in millions as 2016 GDP in the United States is **18.8 trillion**.

```
load("NIPA.fixed.asset.tables.RData")
load("../bea-nipa/nipa.RData")
load("../bea-nipa/nipa.annual.RData")
load("../bea-nipa/nipa.series.RData")

gdp <- nipa.annual %>%
  rename(seriescode = variable) %>%
  full_join(nipa.series, by = "seriescode") %>%
  filter(seriescode == "A001RC") %>%
  select(year, gdp = value) %>%
  arrange(year)

gdp %>%
  tail(10)
```

```
##    year      gdp
## 80 2008 14867453
## 81 2009 14590870
## 82 2010 15187772
## 83 2011 15778960
## 84 2012 16429308
## 85 2013 17015583
## 86 2014 17763425
## 87 2015 18445536
## 88 2016 18922511
## 89 2017 19729061
```

What is capital - an investigation using Table 2.1

Macroeconomists like to represent the economy's production function as follows:

$$F(K, L) = K^{\alpha} L^{1-\alpha}$$

with $\alpha \approx 1/3$.

In this note, we look more in detail at what capital exactly is, and what the elasticity of substitution with labor really is.

1937 and 2015

In particular, it seems quite hard to think about what elasticity between:
1. **Non-Residential structures and labor**: if the wage rate is higher, can a CEO really build more structures to economize on labor?

2. **Residential structures and labor**: is there even any elasticity between residentials structures and labor?

On the other hand, the elasticity between capital and labor is (perhaps) convincing for sometihng like equipment. But equipment is only 32.0% of GDP in 1937 as well as in 2015. (see above)

We now use Table 2.1 and show all lines, to illustrate that most of fixed assets are actually made of the following components:
- Industrial equipment is **ONLY 10.9% of GDP**

For completeness, below are the biggest items. (higher than 20% of GDP)

```
NIPA.fixed.asset.tables %>%
  filter(table_number == "Table 2.1.",
         year %in% c(1937, 2015)) %>%
  select(year, value, line, description) %>%
  merge(gdp, by = "year") %>%
  arrange(line, year) %>%
  mutate(value = round(value * 1000*100/gdp, digits = 1)) %>%
  select(-gdp) %>%
  spread(year, value) %>%
  filter(`2015` >= 20) %>%
  as.tibble
```

```
## # A tibble: 11 x 4
##     line description                `1937` `2015`
```

```
##    <int> <chr>                       <dbl>  <dbl>
##  1     1 Private fixed assets        248.   223
##  2     2 Equipment                    32.5   33.9
##  3     3 Nonresidential equipment     32     33.7
##  4    35 Structures                  212.   175.
##  5    36 Nonresidential structures    99.4   71.5
##  6    37 Commercial and health care   17.3   26.3
##  7    67 Residential structures      112.   103.
##  8    68 Housing units               102.    78.3
##  9    69 Permanent site              102.    77
## 10    70 1-to-4-unit                  92     66.1
## 11    74 Improvements                  9.1   23.1
```

And below are all items.

```
NIPA.fixed.asset.tables %>%
  filter(table_number == "Table 2.1.",
         year %in% c(1937, 2015)) %>%
  select(year, value, line, description) %>%
  merge(gdp, by = "year") %>%
  arrange(line, year) %>%
  mutate(value = round(value * 1000*100/gdp, digits = 1)) %>%
  select(-gdp) %>%
  spread(year, value) %>%
  as.tibble
```

```
## # A tibble: 103 x 4
##     line description                          `1937` `2015`
##    <int> <chr>                                <dbl>  <dbl>
##  1     1 Private fixed assets                 248.   223
##  2     2 Equipment                             32.5   33.9
##  3     3 Nonresidential equipment              32     33.7
##  4     4 Information processing equipment       1.6    7.4
##  5     5 Computers and peripheral equipment     0      1
##  6     6 Communication equipment                0.9    2.8
##  7     7 Medical equipment and instruments      0.1    2.3
##  8     8 Nonmedical instruments                 0.2    1.1
##  9     9 Photocopy and related equipment        0.1    0.2
## 10    10 Office and accounting equipment        0.4    0.1
## # ... with 93 more rows
```

Finally, here are all items but ranked:

```
NIPA.fixed.asset.tables %>%
  filter(table_number == "Table 2.1.",
         year %in% c(1937, 2015)) %>%
  select(year, value, line, description) %>%
  merge(gdp, by = "year") %>%
  arrange(line, year) %>%
  mutate(value = round(value * 1000*100/gdp, digits = 1)) %>%
  select(-gdp) %>%
  spread(year, value) %>%
  arrange(-`2015`) %>%
  as.tibble
```

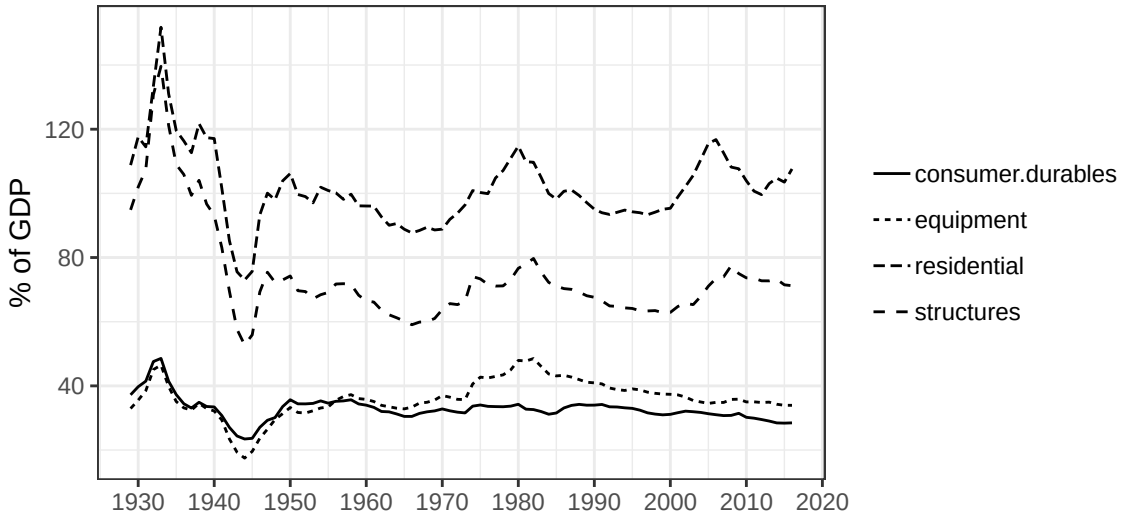
```
## # A tibble: 103 x 4
##     line description                  `1937` `2015`
```

```
##    <int> <chr>                       <dbl>  <dbl>
##  1     1 Private fixed assets        248.   223
##  2    35 Structures                  212.   175.
##  3    67 Residential structures      112.   103.
##  4    68 Housing units               102.    78.3
##  5    69 Permanent site              102.    77
##  6    36 Nonresidential structures    99.4   71.5
##  7    70 1-to-4-unit                  92     66.1
##  8     2 Equipment                    32.5   33.9
##  9     3 Nonresidential equipment     32     33.7
## 10    37 Commercial and health care   17.3   26.3
## # ... with 93 more rows
```

Time series

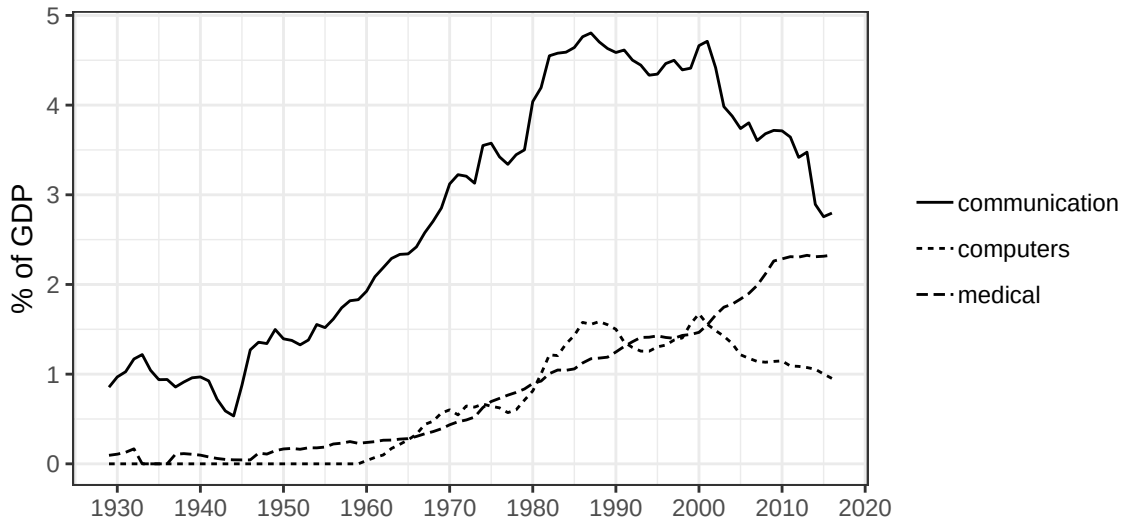
Decomposing in big items

```
matrix(c("Table 1.1.", 6, "structures",
         "Table 1.1.", 8, "residential",
         "Table 1.1.", 15, "consumer.durables",
         "Table 2.1.", 2, "equipment"),
       byrow = TRUE, ncol = 3) %>%
  as.data.frame %>%
  mutate(V2 = V2 %>% paste %>% as.numeric) %>%
  rename(table_number = V1, line = V2, variable = V3) %>%
  left_join(NIPA.fixed.asset.tables,
            by = c("table_number", "line")) %>%
  select(variable, year, value) %>%
  merge(gdp, by = "year") %>%
  mutate(value = value * 1000*100/gdp) %>%
  arrange(value) %>%
  ggplot(data = ., aes(x = year, y = value, linetype = variable)) +
  geom_line() + ylab("% of GDP") + xlab("") +
  scale_x_continuous(breaks = seq(1920, 2025, 10)) +
  theme_bw() + theme(legend.title = element_blank())
```



Decomposing Equipment: computers, communication, medical

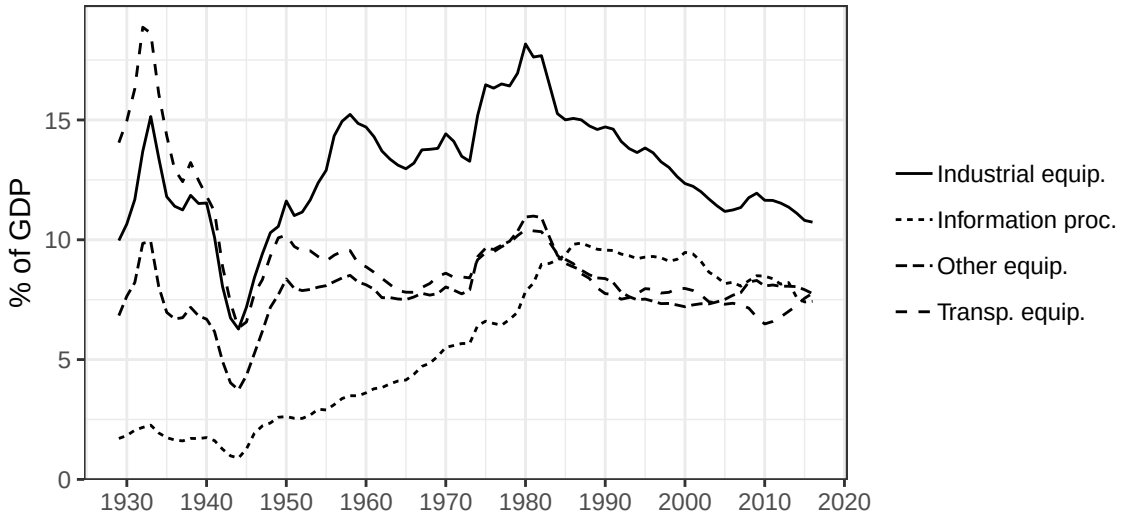
```
matrix(c("Table 2.1.", 5, "computers",
         "Table 2.1.", 6, "communication",
         "Table 2.1.", 7, "medical"), byrow = TRUE, ncol = 3) %>%
  as.data.frame %>%
  mutate(V2 = as.numeric(paste(V2))) %>%
  rename(table_number = V1, line = V2, variable = V3) %>%
  as.data.frame %>%
  left_join(NIPA.fixed.asset.tables, by = c("table_number", "line")) %>%
  select(variable, year, value) %>%
  merge(gdp, by = "year") %>%
  mutate(value = value * 1000*100/gdp) %>%
  ggplot(data = ., aes(x = year, y = value, linetype = variable)) +
  geom_line() + ylab("% of GDP") + xlab("") +
  scale_x_continuous(breaks = seq(1920, 2025, 10)) +
  theme_bw() + theme(legend.title = element_blank())
```



Information proc., Industrual equip., Transp .equip., Other equip.

```
matrix(c("Table 2.1.", 4, "Information proc.",
         "Table 2.1.", 11, "Industrial equip.",
         "Table 2.1.", 18, "Transp. equip.",
         "Table 2.1.", 26, "Other equip."),
       byrow = TRUE, ncol = 3) %>%
  as.data.frame %>%
  mutate(V2 = as.numeric(paste(V2))) %>%
  rename(table_number = V1, line = V2, variable = V3) %>%
  left_join(NIPA.fixed.asset.tables, by = c("table_number", "line")) %>%
  select(variable, year, value) %>%
  arrange(variable, year) %>%
  merge(gdp, by = "year") %>%
  mutate(value = value * 1000*100/gdp) %>%
  ggplot(data = ., aes(x = year, y = value, linetype = variable)) +
  geom_line() + ylab("% of GDP") + xlab("") +
```

```
  scale_x_continuous(breaks = seq(1920, 2025, 10)) +
  theme_bw() + theme(legend.title = element_blank())
```



What is investment in practice - an investigation using Table 2.7

In mainstream macroeconomic models, there is **a lot** of capital-labor substitution: with a Cobb-Douglas elasticity, the elasticity of substitution between capital and labor is equal to 1.

Example in 1937 and 2015

Finally, here are all items but ranked:

```
NIPA.fixed.asset.tables %>%
  filter(table_number == "Table 2.7.", year %in% c(1937, 2015)) %>%
  select(year, value, line, description) %>%
  merge(gdp, by = "year") %>%
  arrange(line, year) %>%
  mutate(value = round(value * 1000*100/gdp, digits = 1)) %>%
  select(-gdp) %>%
  spread(year, value) %>%
  arrange(-`2015`) %>%
  as.tibble
```

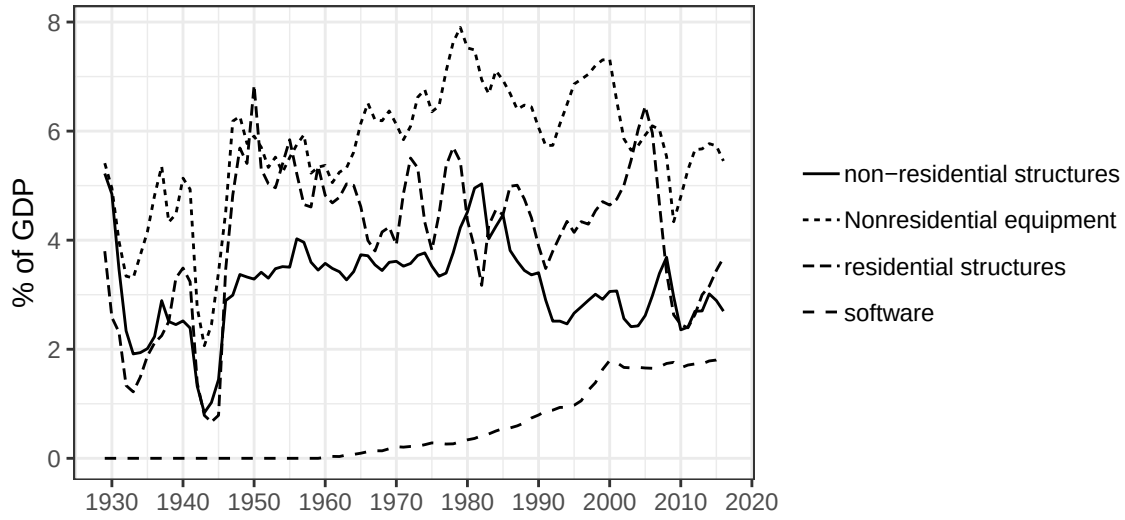
```
## # A tibble: 103 x 4
##     line description                                      `1937` `2015`
##    <int> <chr>                                           <dbl>  <dbl>
##  1     1 Private fixed assets                             11.4   16
##  2    35 Structures                                        5.1    6.3
##  3     2 Equipment                                         5.5    5.8
##  4     3 Nonresidential equipment                          5.4    5.7
##  5    76 Intellectual property products                    0.7    3.9
##  6    77 Nonresidential intellectual property products     0.7    3.9
##  7    67 Residential structures                            2.2    3.4
##  8    36 Nonresidential structures                         2.9    2.9
##  9    78 Software                                          0      1.8
```

```
## 10    82 "Research and development \\8,9\\"              0.3    1.7
## # ... with 93 more rows
```

Time series

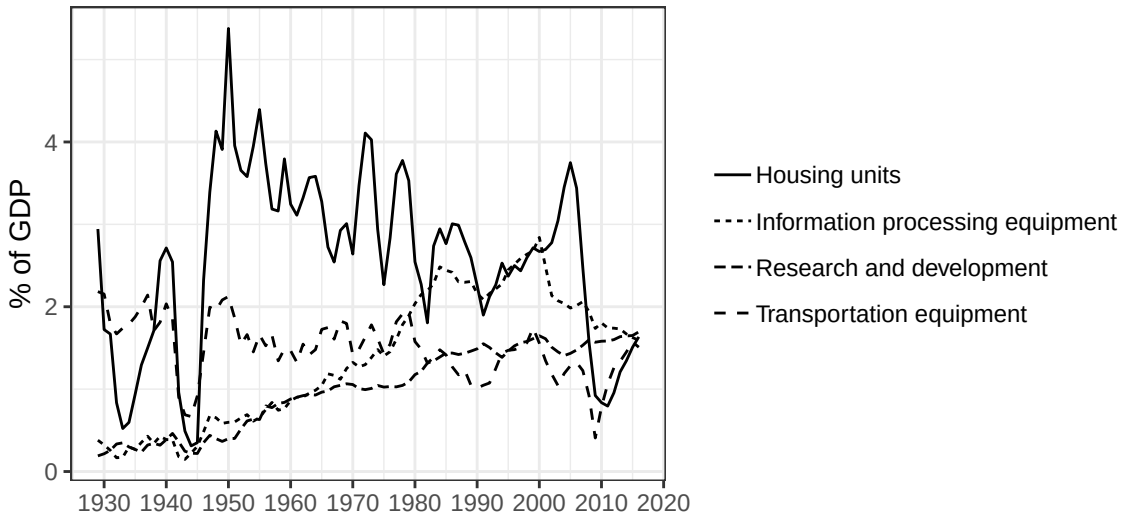
Decomposing in big items

```
matrix(c("Table 2.7.", 67, "residential structures",
         "Table 2.7.", 36, "non-residential structures",
         "Table 2.7.", 78, "software",
         "Table 2.7.", 3,  "Nonresidential equipment"),
       byrow = TRUE, ncol = 3) %>%
  as.data.frame %>%
  mutate(V2 = as.numeric(paste(V2))) %>%
  rename(table_number = V1, line = V2, variable = V3) %>%
  left_join(NIPA.fixed.asset.tables, by = c("table_number", "line")) %>%
  select(variable, year, value) %>%
  merge(gdp, by = "year") %>%
  mutate(value = value * 1000*100/gdp) %>%
  arrange(value) %>%
  ggplot(data = ., aes(x = year, y = value, linetype = variable)) +
  geom_line() + ylab("% of GDP") + xlab("") +
  scale_x_continuous(breaks = seq(1920, 2025, 10)) +
  theme_bw() +
  theme(legend.title = element_blank())
```




```
matrix(c("Table 2.7.", 82, "Research and development",
         "Table 2.7.", 4, "Information processing equipment",
         "Table 2.7.", 18, "Transportation equipment",
         "Table 2.7.", 68,  "Housing units"),
       byrow = TRUE, ncol = 3) %>%
  as.data.frame %>%
  mutate(V2 = as.numeric(paste(V2))) %>%
  rename(table_number = V1, line = V2, variable = V3) %>%
  left_join(NIPA.fixed.asset.tables, by = c("table_number", "line")) %>%
  select(variable, year, value) %>%
```

```
  merge(gdp, by = "year") %>%
  mutate(value = value * 1000*100/gdp) %>%
  arrange(value) %>%
  ggplot(data = ., aes(x = year, y = value, linetype = variable)) +
  geom_line() + ylab("% of GDP") + xlab("") +
  scale_x_continuous(breaks = seq(1920, 2025, 10)) +
  theme_bw() +
  theme(legend.title = element_blank())
```



Computing Environment

```
Sys.time()
```

```
## [1] "2018-09-24 19:47:34 PDT"
```

```
sessionInfo()
```

```
## R version 3.5.1 (2018-07-02)
## Platform: x86_64-apple-darwin15.6.0 (64-bit)
## Running under: macOS High Sierra 10.13.6
##
## Matrix products: default
## BLAS: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/3.5/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] bindrcpp_0.2.2  rvest_0.3.2     xml2_1.2.0      forcats_0.3.0
##  [5] stringr_1.3.1   dplyr_0.7.6     purrr_0.2.5     readr_1.1.1
##  [9] tidyr_0.8.1     tibble_1.4.2    ggplot2_3.0.0   tidyverse_1.2.1
## [13] curl_3.2
```

```
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_0.12.18     cellranger_1.1.0 pillar_1.3.0     compiler_3.5.1
##  [5] plyr_1.8.4       bindr_0.1.1      tools_3.5.1      digest_0.6.15
##  [9] lubridate_1.7.4  jsonlite_1.5     evaluate_0.11    nlme_3.1-137
## [13] gtable_0.2.0     lattice_0.20-35  pkgconfig_2.0.2  rlang_0.2.2
## [17] cli_1.0.0        rstudioapi_0.7   yaml_2.2.0       haven_1.1.2
## [21] withr_2.1.2      httr_1.3.1       knitr_1.20       hms_0.4.2
## [25] rprojroot_1.3-2  grid_3.5.1       tidyselect_0.2.4 glue_1.3.0
## [29] R6_2.2.2         fansi_0.3.0      readxl_1.1.0     rmarkdown_1.10
## [33] modelr_0.1.2     magrittr_1.5     backports_1.1.2  scales_1.0.0
## [37] htmltools_0.3.6  assertthat_0.2.0 colorspace_1.3-2 labeling_0.3
## [41] utf8_1.1.4       stringi_1.2.4    lazyeval_0.2.1   munsell_0.5.0
## [45] broom_0.5.0      crayon_1.3.4
```