ATM Cost Analysis

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This paper outlines the variance in ATM costs worldwide. Absent primary data on the cost to maintain ATM fleets in a number of countries, we estimate from secondary sources. The key data sources present in this report are:

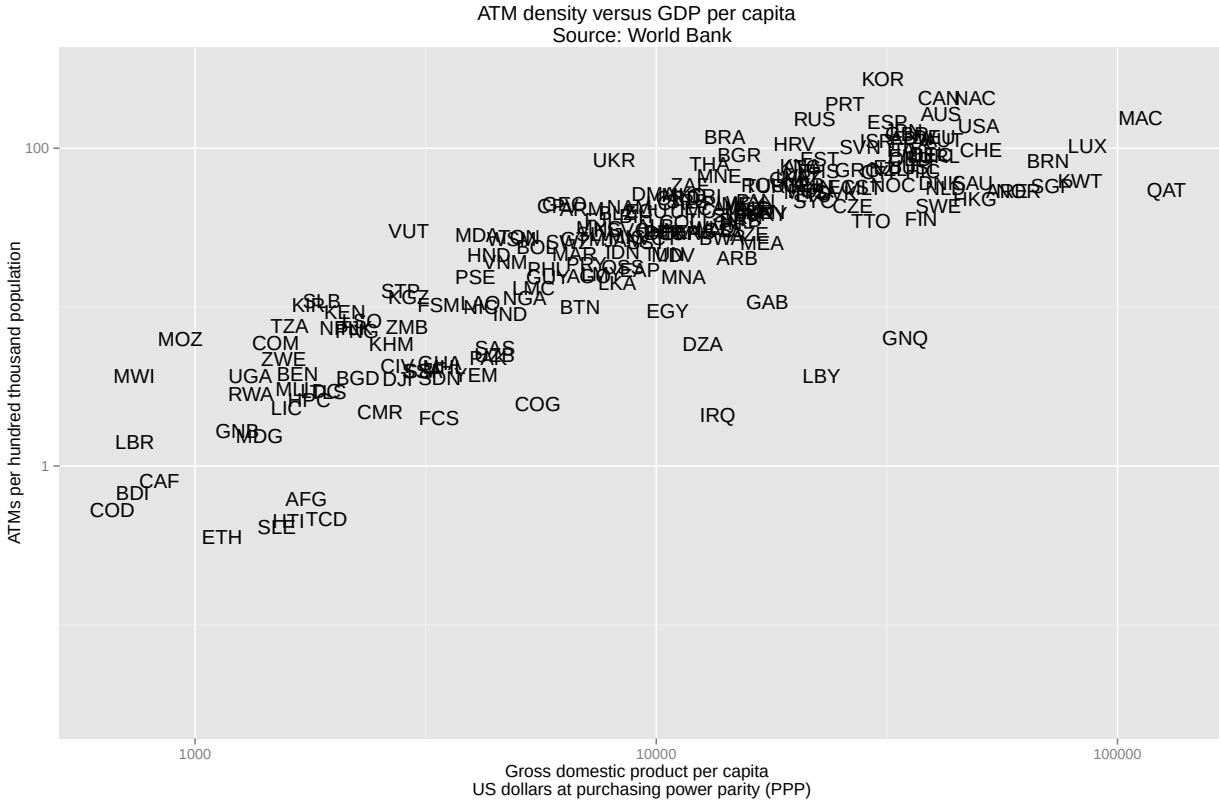
- Number of ATMs in each country.
- Maintenance cost of an ATM.
- Cost of funds in the ATM.
- Capital expense for the ATM itself.

The following sections treat each cost in turn; followed by an explicit model for how the costs were calculated.

Contents

ATM count

The World Bank estimates ATMs per capita, population and GDP per capita.




```
## Generate estimates of ATMs in each country from ATM density.

##      Country.Code Country.Name ATMper100k population     ATMs
##   1:          ABW        Aruba   115.8796     102048   118.25
##   2:          AFG  Afghanistan     0.6198   29117538   180.48
##   3:          AGO       Angola    15.7307   20189681  3175.98
##   4:          ALB      Albania    32.5179    2829123   919.97
##   5:          AND      Andorra        NaN      78402      NaN
##  ---
## 254:          WSM        Samoa    26.9822     187485    50.59
## 255:          YEM  Yemen, Rep.     3.7464   23311326   873.34
## 256:          ZAF South Africa    58.6913   51591046 30279.46
## 257:          ZMB       Zambia     7.5777   13657910  1034.96
## 258:          ZWE     Zimbabwe     4.7241   13439720   634.90

## Join a column for GDP per capita (Source: World Bank).

## Here is a summary of population and estimated ATM counts.
##  The USA numbers verify we are plausibly accurate.

##   Country.Code         Country.Name   ATMper100k       population
##  ABW    :  1   Afghanistan   :  1   Min.   :  0.03   Min.   :9.84e+03
##  AFG    :  1   Albania       :  1   1st Qu.:  9.37   1st Qu.:1.33e+06
##  AGO    :  1   Algeria       :  1   Median : 30.85   Median :8.41e+06
##  ALB    :  1   American Samoa:  1   Mean   : 42.84   Mean   :1.95e+08
##  AND    :  1   Andean Region :  1   3rd Qu.: 58.34   3rd Qu.:3.81e+07
```

```
##  ANR    :  1   Andorra       :  1   Max.   :274.54   Max.   :6.96e+09
##  (Other):252   (Other)       :252   NA's   :49       NA's   :11
##       ATMs             GDPcap
##  Min.   :      2   Min.   :   662
##  1st Qu.:    414   1st Qu.:  3440
##  Median :   2112   Median : 10669
##  Mean   :  75461   Mean   : 16924
##  3rd Qu.:  17034   3rd Qu.: 22274
##  Max.   :2199554   Max.   :127698
##  NA's   :49        NA's   :35

##    Country.Code  Country.Name ATMper100k population   ATMs GDPcap
## 1:          USA United States      137.7  311536582 428830  50022
```

Maintenance cost

Cost of maintenance is assumed proportional to the PPP price level ratio.

```
## Data live in data.table ppplevel
##      Create a new variable named c_maint
##      Merge on "Country.Code"
setkey(ATMcost, "Country.Code"); setkey(ppplevel, "Country.Code")

# ATMcostvars <- names(ATMcost)
# rm(ATMcostvars)
# tables()
ATMcost <- ATMcost[ppplevel[,.SD, .SDcols=c("Country.Code","estimate")],]
setnames(ATMcost, "estimate", "c_maint")

##        Now c_maint gives the PPP level ratio of each country relative to the USA.

# tables()

# ##      Check USA is the numeraire
# ATMcost["United States",]
summary(ATMcost)
```

```
##   Country.Code         Country.Name   ATMper100k       population
##  ABW    :  1   Afghanistan   :  1   Min.   :  0.03   Min.   :      9843
##  AFG    :  1   Albania       :  1   1st Qu.:  9.37   1st Qu.:   1330534
##  AGO    :  1   Algeria       :  1   Median : 30.85   Median :   8413002
##  ALB    :  1   American Samoa:  1   Mean   : 42.84   Mean   : 195243017
##  AND    :  1   Andean Region :  1   3rd Qu.: 58.34   3rd Qu.:  38083502
##  ANR    :  1   Andorra       :  1   Max.   :274.54   Max.   :6963908391
##  (Other):252   (Other)       :252   NA's   :49       NA's   :11
##       ATMs             GDPcap          c_maint
##  Min.   :      2   Min.   :   662   Min.   :0.27
##  1st Qu.:    414   1st Qu.:  3440   1st Qu.:0.43
##  Median :   2112   Median : 10669   Median :0.53
##  Mean   :  75461   Mean   : 16924   Mean   :0.62
##  3rd Qu.:  17034   3rd Qu.: 22274   3rd Qu.:0.70
##  Max.   :2199554   Max.   :127698   Max.   :1.59
##  NA's   :49        NA's   :35       NA's   :68
```

Cost of funds

The cost of funds is calculated on a per-machine basis. The per-machine cost is a simple ratio of the cost of funds in the United States to the cost of funds in country i.

```
## [1] "Country.Name"  "deposit"       "discount"      "lending"
## [5] "moneymarket"   "ratiodiscount" "ratiolending"  "ratiomoney"
## [9] "estimate"
```

```
## Loading required package: countrycode
```

```
##                                       Country.Name deposit discount
##   1:                 Afghanistan, Islamic Republic of      NA       NA
##   2:                                          Albania  5.1503       NA
##   3:                                          Algeria  1.7500     4.00
##   4:                                           Angola  4.3526    20.56
##   5:                                         Anguilla  3.8407     6.50
##  ---
## 177:                                          Vietnam 10.5457       NA
## 178: West African Economic and Monetary Union (WAEMU)  3.5000       NA
## 179:                              West Bank and Gaza  0.4933       NA
## 180:                              Yemen, Republic of 18.2500       NA
## 181:                                           Zambia  6.8381    10.74
##      lending moneymarket ratiodiscount ratiolending ratiomoney estimate
##   1:  15.075       0.200            NA        4.638      1.718   15.186
##   2:  11.046          NA            NA        3.399         NA   11.128
##   3:   8.000       1.394         5.333        2.462     11.976    5.333
##   4:  17.074       7.635        27.407        5.254     65.597   27.407
##   5:   9.250       5.718         8.667        2.846     49.130    8.667
##  ---
## 177:  13.600          NA            NA        4.185         NA   13.700
## 178:      NA          NA            NA           NA         NA       NA
## 179:   6.877          NA            NA        2.116         NA    6.928
## 180:  23.861          NA            NA        7.342         NA   24.037
## 181:  13.502          NA        14.315        4.155         NA   14.315
##      Country.Code
##   1:          AFG
##   2:          ALB
##   3:          DZA
##   4:          AGO
##   5:          AIA
##  ---
## 177:          VNM
## 178:          ZAF
## 179:          WBG
## 180:          YEM
## 181:          ZMB
```

```
##                                       Country.Name deposit discount
##   1:                 Afghanistan, Islamic Republic of      NA       NA
##   2:                                          Albania  5.1503       NA
##   3:                                          Algeria  1.7500     4.00
##   4:                                           Angola  4.3526    20.56
```

```
##   5:                                        Anguilla  3.8407     6.50
##  ---
## 177:                                         Vietnam 10.5457       NA
## 178: West African Economic and Monetary Union (WAEMU)  3.5000       NA
## 179:                             West Bank and Gaza  0.4933       NA
## 180:                             Yemen, Republic of 18.2500       NA
## 181:                                          Zambia  6.8381    10.74
##      lending moneymarket ratiodiscount ratiolending ratiomoney estimate
##   1:  15.075       0.200            NA        4.638      1.718   15.186
##   2:  11.046          NA            NA        3.399         NA   11.128
##   3:   8.000       1.394         5.333        2.462     11.976    5.333
##   4:  17.074       7.635        27.407        5.254     65.597   27.407
##   5:   9.250       5.718         8.667        2.846     49.130    8.667
##  ---
## 177:  13.600          NA            NA        4.185         NA   13.700
## 178:      NA          NA            NA           NA         NA       NA
## 179:   6.877          NA            NA        2.116         NA    6.928
## 180:  23.861          NA            NA        7.342         NA   24.037
## 181:  13.502          NA        14.315        4.155         NA   14.315
##      Country.Code
##   1:          AFG
##   2:          ALB
##   3:          DZA
##   4:          AGO
##   5:          AIA
##  ---
## 177:          VNM
## 178:          ZAF
## 179:          WBG
## 180:          YEM
## 181:          ZMB

## [1] 180  10

## [1] "Country.Code" "Country.Name" "ATMper100k"   "population"
## [5] "ATMs"         "GDPcap"       "c_maint"      "estimate"

##  [1] "Country.Name"  "deposit"       "discount"      "lending"
##  [5] "moneymarket"   "ratiodiscount" "ratiolending"  "ratiomoney"
##  [9] "estimate"      "Country.Code"

##   Country.Code              Country.Name   ATMper100k
##  ABW    :  1   Afghanistan        :  1   Min.   :  0.03
##  AFG    :  1   Albania            :  1   1st Qu.:  9.41
##  AGO    :  1   Algeria            :  1   Median : 33.39
##  ALB    :  1   Angola             :  1   Mean   : 43.08
##  ARG    :  1   Antigua and Barbuda:  1   3rd Qu.: 56.76
##  (Other):166   (Other)            :166   Max.   :274.54
##  NA's   :  9   NA's               :  9   NA's   :18
##    population              ATMs            GDPcap          c_maint
##  Min.   :     31060   Min.   :    11   Min.   :   733   Min.   :0.266
##  1st Qu.:   2008713   1st Qu.:   308   1st Qu.:  3733   1st Qu.:0.430
##  Median :   7241879   Median :  1410   Median : 10411   Median :0.527
```

```
##  Mean   :  40942790   Mean   : 19628   Mean   : 16919   Mean   :0.602
##  3rd Qu.:  28271523   3rd Qu.:  6600   3rd Qu.: 22011   3rd Qu.:0.685
##  Max.   :1344234000   Max.   :428830   Max.   :127698   Max.   :1.518
##  NA's   :9            NA's   :18       NA's   :13       NA's   :14
##      c_int
##  Min.   : 0.40
##  1st Qu.: 5.00
##  Median : 8.67
##  Mean   :10.31
##  3rd Qu.:13.69
##  Max.   :57.92
##  NA's   :9
```

Capital expense

Most market research on national ATM fleets is proprietary. RBR London reports on sales, features, and cost. Those numbers are not useful for this benchmarking exercise unless we can reach an agreement with them to share our models and theirs.

We treat all fleets as equally expensive on a capital expenditure basis.

Modeled cost

Using the model below, we calculate per-machine maintenance costs worldwide. The basic inputs to the model are USA costs per machine for maintenance, funds, and capital expense. The output is a per-machine cost worldwide; from which we calculate the national cost worldwide.

```
ATMusa <- data.table("United States", 1290.05, 971.41, 81.27, 237.37)
names(ATMusa) <- c("Country.Name", "cost_permo", "cost_maint", "cost_funds", "cost_capex")
```

```
## Warning: The names(x)<-value syntax copies the whole table. This is due to
## <- in R itself. Please change to setnames(x,old,new) which does not copy
## and is faster. See help('setnames'). You can safely ignore this warning if
## it is inconvenient to change right now. Setting options(warn=2) turns this
## warning into an error, so you can then use traceback() to find and change
## your names<- calls.
```

```
attr(ATMusa, "table.label") <- "Cost of a single ATM in the United States in 2012, based on US GDP defla
str(ATMusa)
```

```
## Classes 'data.table' and 'data.frame':   1 obs. of  5 variables:
##  $ Country.Name: chr "United States"
##  $ cost_permo  : num 1290
##  $ cost_maint  : num 971
##  $ cost_funds  : num 81.3
##  $ cost_capex  : num 237
##  - attr(*, ".internal.selfref")=<externalptr>
##  - attr(*, "table.label")= chr "Cost of a single ATM in the United States in 2012, based on US GDP de
```

```
names(ATMcost)
```

```
## [1] "Country.Code" "Country.Name" "ATMper100k"   "population"
## [5] "ATMs"         "GDPcap"       "c_maint"      "c_int"
```

```
##    Calculate worldwide per-machine costs of ATM operations
ATMcost[,gamma_maint := c_maint * ATMusa$cost_maint]
```

```
##      Country.Code Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA           NA         NA         NA       NA     NA
##   2:          ABW        Aruba   115.8796     102048   118.25  36016
##   3:          AFG  Afghanistan     0.6198   29117538   180.48   1743
##   4:          AGO       Angola    15.7307   20189681  3175.98   7145
##   5:           NA           NA         NA         NA       NA     NA
##  ---
## 176:          WSM        Samoa    26.9822     187485    50.59   4866
## 177:          YEM  Yemen, Rep.     3.7464   23311326   873.34   4070
## 178:          ZAF South Africa    58.6913   51591046 30279.46  11837
## 179:           NA           NA         NA         NA       NA     NA
## 180:          ZMB       Zambia     7.5777   13657910  1034.96   2881
##      c_maint  c_int gamma_maint
##   1:      NA  5.000          NA
##   2:  0.7040  1.333       683.9
##   3:  0.3420 15.186       332.2
##   4:  0.6854 27.407       665.8
##   5:      NA  8.667          NA
##  ---
## 176:  0.6739 10.082       654.6
## 177:  0.3313 24.037       321.9
## 178:  0.5844  8.814       567.7
## 179:      NA 13.667          NA
## 180:  0.4582 14.315       445.1
```

```
ATMcost[,gamma_int := c_int * ATMusa$cost_funds]
```

```
##      Country.Code Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA           NA         NA         NA       NA     NA
##   2:          ABW        Aruba   115.8796     102048   118.25  36016
##   3:          AFG  Afghanistan     0.6198   29117538   180.48   1743
##   4:          AGO       Angola    15.7307   20189681  3175.98   7145
##   5:           NA           NA         NA         NA       NA     NA
##  ---
## 176:          WSM        Samoa    26.9822     187485    50.59   4866
## 177:          YEM  Yemen, Rep.     3.7464   23311326   873.34   4070
## 178:          ZAF South Africa    58.6913   51591046 30279.46  11837
## 179:           NA           NA         NA         NA       NA     NA
## 180:          ZMB       Zambia     7.5777   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int
##   1:      NA  5.000          NA     406.3
##   2:  0.7040  1.333       683.9     108.4
##   3:  0.3420 15.186       332.2    1234.2
##   4:  0.6854 27.407       665.8    2227.4
```

```
##   5:      NA  8.667          NA     704.3
##  ---
## 176:  0.6739 10.082       654.6     819.3
## 177:  0.3313 24.037       321.9    1953.5
## 178:  0.5844  8.814       567.7     716.4
## 179:      NA 13.667          NA    1110.7
## 180:  0.4582 14.315       445.1    1163.4
```

```
ATMcost[,gamma_capex := ATMusa$cost_capex]
```

```
##      Country.Code Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA           NA         NA         NA       NA     NA
##   2:          ABW        Aruba   115.8796     102048   118.25  36016
##   3:          AFG  Afghanistan     0.6198   29117538   180.48   1743
##   4:          AGO       Angola    15.7307   20189681  3175.98   7145
##   5:           NA           NA         NA         NA       NA     NA
##  ---
## 176:          WSM        Samoa    26.9822     187485    50.59   4866
## 177:          YEM  Yemen, Rep.     3.7464   23311326   873.34   4070
## 178:          ZAF South Africa    58.6913   51591046 30279.46  11837
## 179:           NA           NA         NA         NA       NA     NA
## 180:          ZMB       Zambia     7.5777   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int gamma_capex
##   1:      NA  5.000          NA     406.3       237.4
##   2:  0.7040  1.333       683.9     108.4       237.4
##   3:  0.3420 15.186       332.2    1234.2       237.4
##   4:  0.6854 27.407       665.8    2227.4       237.4
##   5:      NA  8.667          NA     704.3       237.4
##  ---
## 176:  0.6739 10.082       654.6     819.3       237.4
## 177:  0.3313 24.037       321.9    1953.5       237.4
## 178:  0.5844  8.814       567.7     716.4       237.4
## 179:      NA 13.667          NA    1110.7       237.4
## 180:  0.4582 14.315       445.1    1163.4       237.4
```

```
##    Calculate worldwide per-machine cost
ATMcost[,gamma_sum := gamma_maint + gamma_int + gamma_capex]
```

```
##      Country.Code Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA           NA         NA         NA       NA     NA
##   2:          ABW        Aruba   115.8796     102048   118.25  36016
##   3:          AFG  Afghanistan     0.6198   29117538   180.48   1743
##   4:          AGO       Angola    15.7307   20189681  3175.98   7145
##   5:           NA           NA         NA         NA       NA     NA
##  ---
## 176:          WSM        Samoa    26.9822     187485    50.59   4866
## 177:          YEM  Yemen, Rep.     3.7464   23311326   873.34   4070
## 178:          ZAF South Africa    58.6913   51591046 30279.46  11837
## 179:           NA           NA         NA         NA       NA     NA
## 180:          ZMB       Zambia     7.5777   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int gamma_capex gamma_sum
##   1:      NA  5.000          NA     406.3       237.4        NA
##   2:  0.7040  1.333       683.9     108.4       237.4      1030
```

```
##   3:  0.3420 15.186       332.2    1234.2       237.4      1804
##   4:  0.6854 27.407       665.8    2227.4       237.4      3131
##   5:      NA  8.667          NA     704.3       237.4        NA
##  ---
## 176:  0.6739 10.082       654.6     819.3       237.4      1711
## 177:  0.3313 24.037       321.9    1953.5       237.4      2513
## 178:  0.5844  8.814       567.7     716.4       237.4      1521
## 179:      NA 13.667          NA    1110.7       237.4        NA
## 180:  0.4582 14.315       445.1    1163.4       237.4      1846
```

```
summary(ATMcost)
```

```
##   Country.Code              Country.Name   ATMper100k
##  ABW    :  1   Afghanistan        :  1   Min.   :  0.03
##  AFG    :  1   Albania            :  1   1st Qu.:  9.41
##  AGO    :  1   Algeria            :  1   Median : 33.39
##  ALB    :  1   Angola             :  1   Mean   : 43.08
##  ARG    :  1   Antigua and Barbuda:  1   3rd Qu.: 56.76
##  (Other):166   (Other)            :166   Max.   :274.54
##  NA's   :  9   NA's               :  9   NA's   :18
##    population              ATMs            GDPcap          c_maint
##  Min.   :     31060   Min.   :    11   Min.   :   733   Min.   :0.266
##  1st Qu.:   2008713   1st Qu.:   308   1st Qu.:  3733   1st Qu.:0.430
##  Median :   7241879   Median :  1410   Median : 10411   Median :0.527
##  Mean   :  40942790   Mean   : 19628   Mean   : 16919   Mean   :0.602
##  3rd Qu.:  28271523   3rd Qu.:  6600   3rd Qu.: 22011   3rd Qu.:0.685
##  Max.   :1344234000   Max.   :428830   Max.   :127698   Max.   :1.518
##  NA's   :9            NA's   :18       NA's   :13       NA's   :14
##      c_int        gamma_maint     gamma_int     gamma_capex
##  Min.   : 0.40   Min.   : 259   Min.   :  33   Min.   :237
##  1st Qu.: 5.00   1st Qu.: 417   1st Qu.: 406   1st Qu.:237
##  Median : 8.67   Median : 512   Median : 704   Median :237
##  Mean   :10.31   Mean   : 585   Mean   : 838   Mean   :237
##  3rd Qu.:13.69   3rd Qu.: 665   3rd Qu.:1113   3rd Qu.:237
##  Max.   :57.92   Max.   :1474   Max.   :4707   Max.   :237
##  NA's   :9       NA's   :14     NA's   :9
##    gamma_sum
##  Min.   : 680
##  1st Qu.:1312
##  Median :1569
##  Mean   :1669
##  3rd Qu.:1888
##  Max.   :5254
##  NA's   :21
```

```
##    Calculate national fleet costs
ATMcost[,national := gamma_sum * ATMs]
```

```
##      Country.Code Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA           NA         NA         NA       NA     NA
##   2:          ABW        Aruba   115.8796     102048   118.25  36016
##   3:          AFG  Afghanistan     0.6198   29117538   180.48   1743
##   4:          AGO       Angola    15.7307   20189681  3175.98   7145
```

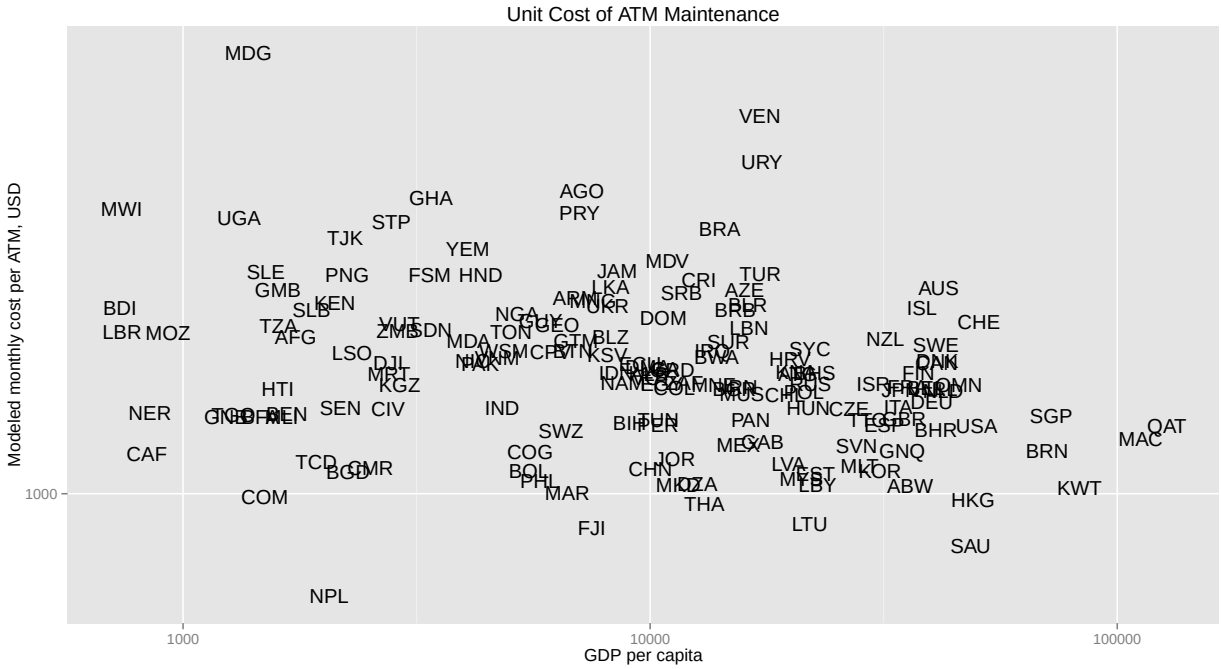
```
##   5:           NA           NA         NA         NA       NA     NA
##  ---
## 176:          WSM        Samoa    26.9822     187485    50.59   4866
## 177:          YEM  Yemen, Rep.     3.7464   23311326   873.34   4070
## 178:          ZAF South Africa    58.6913   51591046 30279.46  11837
## 179:           NA           NA         NA         NA       NA     NA
## 180:          ZMB       Zambia     7.5777   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int gamma_capex gamma_sum national
##   1:      NA  5.000          NA     406.3       237.4        NA       NA
##   2:  0.7040  1.333       683.9     108.4       237.4      1030   121751
##   3:  0.3420 15.186       332.2    1234.2       237.4      1804   325546
##   4:  0.6854 27.407       665.8    2227.4       237.4      3131  9942677
##   5:      NA  8.667          NA     704.3       237.4        NA       NA
##  ---
## 176:  0.6739 10.082       654.6     819.3       237.4      1711    86572
## 177:  0.3313 24.037       321.9    1953.5       237.4      2513  2194458
## 178:  0.5844  8.814       567.7     716.4       237.4      1521 46066382
## 179:      NA 13.667          NA    1110.7       237.4        NA       NA
## 180:  0.4582 14.315       445.1    1163.4       237.4      1846  1910388
```

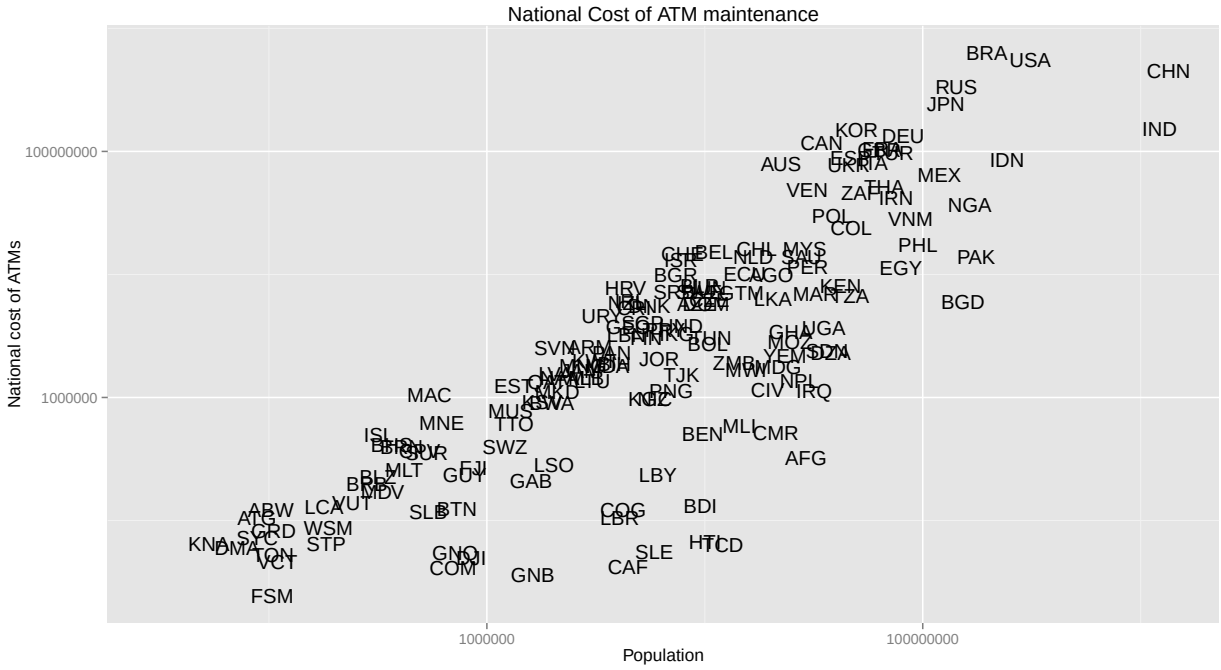
```
summary(ATMcost)
```

```
##   Country.Code              Country.Name   ATMper100k
##  ABW    :  1   Afghanistan        :  1   Min.   :  0.03
##  AFG    :  1   Albania            :  1   1st Qu.:  9.41
##  AGO    :  1   Algeria            :  1   Median : 33.39
##  ALB    :  1   Angola             :  1   Mean   : 43.08
##  ARG    :  1   Antigua and Barbuda:  1   3rd Qu.: 56.76
##  (Other):166   (Other)            :166   Max.   :274.54
##  NA's   :  9   NA's               :  9   NA's   :18
##    population              ATMs            GDPcap          c_maint
##  Min.   :     31060   Min.   :    11   Min.   :   733   Min.   :0.266
##  1st Qu.:   2008713   1st Qu.:   308   1st Qu.:  3733   1st Qu.:0.430
##  Median :   7241879   Median :  1410   Median : 10411   Median :0.527
##  Mean   :  40942790   Mean   : 19628   Mean   : 16919   Mean   :0.602
##  3rd Qu.:  28271523   3rd Qu.:  6600   3rd Qu.: 22011   3rd Qu.:0.685
##  Max.   :1344234000   Max.   :428830   Max.   :127698   Max.   :1.518
##  NA's   :9            NA's   :18       NA's   :13       NA's   :14
##      c_int        gamma_maint     gamma_int     gamma_capex
##  Min.   : 0.40   Min.   : 259   Min.   :  33   Min.   :237
##  1st Qu.: 5.00   1st Qu.: 417   1st Qu.: 406   1st Qu.:237
##  Median : 8.67   Median : 512   Median : 704   Median :237
##  Mean   :10.31   Mean   : 585   Mean   : 838   Mean   :237
##  3rd Qu.:13.69   3rd Qu.: 665   3rd Qu.:1113   3rd Qu.:237
##  Max.   :57.92   Max.   :1474   Max.   :4707   Max.   :237
##  NA's   :9       NA's   :14     NA's   :9
##    gamma_sum       national
##  Min.   : 680   Min.   :    24394
##  1st Qu.:1312   1st Qu.:   380615
##  Median :1569   Median :  2314015
##  Mean   :1669   Mean   : 28343098
##  3rd Qu.:1888   3rd Qu.: 10031816
##  Max.   :5254   Max.   :631777659
##  NA's   :21     NA's   :29
```

Findings

These are scatterplots of the national unit costs and national fleet costs of ATM.





And here are the rank orderings by cost. See Tables 1, 2, 3, 4, 5, and 6.

Table 1: Highest Unit Operating Costs

	Country.Name	GDPcap	gamma_sum
1	Costa Rica	12,717	2,235
2	Micronesia, Fed. Sts.	3,375	2,281
3	Papua New Guinea	2,246	2,285
4	Honduras	4,339	2,285
5	Turkey	17,214	2,285
6	Sierra Leone	1,504	2,305
7	Jamaica	8,503	2,317
8	Maldives	10,884	2,403
9	Yemen, Rep.	4,070	2,513
10	Tajikistan	2,224	2,617
11	Brazil	14,090	2,707
12	Sao Tome and Principe	2,793	2,781
13	Uganda	1,319	2,824
14	Paraguay	7,062	2,882
15	Malawi	739	2,926
16	Ghana	3,395	3,048
17	Angola	7,145	3,131
18	Uruguay	17,351	3,493
19	Venezuela, RB	17,170	4,146
20	Madagascar	1,380	5,254

Table 2: Lowest Unit Operating Costs

	Country.Name	GDPcap	gamma_sum
1	Nepal	2,055	680
2	Saudi Arabia	48,538	822
3	Fiji	7,497	881
4	Lithuania	21,965	892
5	Thailand	13,057	964
6	Hong Kong SAR, China	49,126	976
7	Comoros	1,495	988
8	Morocco	6,651	1,004
9	Kuwait	83,009	1,022
10	Aruba	36,016	1,030
11	Libya	22,830	1,033
12	Macedonia, FYR	11,490	1,036
13	Algeria	12,614	1,040
14	Philippines	5,801	1,051
15	Malaysia	21,073	1,060
16	Estonia	22,609	1,079
17	Bangladesh	2,256	1,086
18	Bolivia	5,502	1,089
19	Korea, Rep.	31,038	1,091
20	China	10,016	1,099

Table 3: Highest Fleet Operating Costs

	Country.Name	GDPcap	national
1	Venezuela, RB	17,170	48,791,735
2	Thailand	13,057	51,433,693
3	Mexico	15,442	64,571,833
4	Ukraine	8,109	78,238,971
5	Australia	41,466	79,805,923
6	Italy	33,969	80,926,719
7	Indonesia	8,460	85,161,948
8	Spain	31,719	88,508,931
9	Turkey	17,214	97,094,724
10	United Kingdom	34,971	103,701,131
11	France	35,598	105,411,321
12	Canada	41,044	117,966,537
13	Germany	40,089	135,269,373
14	Korea, Rep.	31,038	148,892,052
15	India	4,822	153,766,260
16	Japan	34,371	244,108,114
17	Russian Federation	22,044	333,053,847
18	China	10,016	455,728,900
19	United States	50,022	553,212,278
20	Brazil	14,090	631,777,659

Table 4: Lowest Fleet Operating Costs

	Country.Name	GDPcap	national
1	Micronesia, Fed. Sts.	3,375	24,394
2	Guinea-Bissau	1,236	36,034
3	Comoros	1,495	41,353
4	Central African Republic	837	41,889
5	St. Vincent and the Grenadines	10,089	46,125
6	Djibouti	2,749	49,374
7	Tonga	5,041	52,903
8	Equatorial Guinea	34,669	54,186
9	Sierra Leone	1,504	55,686
10	Dominica	9,882	59,652
11	Chad	1,930	63,241
12	Sao Tome and Principe	2,793	64,162
13	St. Kitts and Nevis	20,557	64,912
14	Haiti	1,596	67,044
15	Seychelles	21,977	71,863
16	Grenada	11,154	81,981
17	Samoa	4,866	86,572
18	Antigua and Barbuda	20,703	105,689
19	Liberia	740	105,742
20	Solomon Islands	1,884	118,185

Countries studied

A bit of housekeeping. These are the countries we studied. And I'm adding two variables to convert population and national ATM cost to "millions".

```
setkey(ATMcost, Country.Name)
ATMcost[complete.cases(ATMcost), Country.Name]
```

```
##   [1] Afghanistan                 Albania
##   [3] Algeria                     Angola
##   [5] Antigua and Barbuda         Armenia
##   [7] Aruba                       Australia
##   [9] Azerbaijan                  Bahamas, The
##  [11] Bangladesh                  Barbados
##  [13] Belarus                     Belgium
##  [15] Belize                      Benin
##  [17] Bhutan                      Bolivia
##  [19] Bosnia and Herzegovina      Botswana
##  [21] Brazil                      Brunei Darussalam
##  [23] Bulgaria                    Burundi
##  [25] Cabo Verde                  Cameroon
##  [27] Canada                      Central African Republic
##  [29] Chad                        Chile
##  [31] China                       Colombia
##  [33] Comoros                     Congo, Rep.
##  [35] Costa Rica                  Cote d'Ivoire
##  [37] Croatia                     Czech Republic
##  [39] Denmark                     Djibouti
##  [41] Dominica                    Dominican Republic
##  [43] Ecuador                     Egypt, Arab Rep.
##  [45] Equatorial Guinea           Estonia
##  [47] Fiji                        Finland
##  [49] France                      Gabon
##  [51] Georgia                     Germany
##  [53] Ghana                       Grenada
##  [55] Guatemala                   Guinea-Bissau
##  [57] Guyana                      Haiti
##  [59] Honduras                    Hong Kong SAR, China
##  [61] Hungary                     Iceland
##  [63] India                       Indonesia
##  [65] Iran, Islamic Rep.          Iraq
##  [67] Ireland                     Israel
##  [69] Italy                       Jamaica
##  [71] Japan                       Jordan
##  [73] Kenya                       Korea, Rep.
##  [75] Kosovo                      Kuwait
##  [77] Kyrgyz Republic             Latvia
##  [79] Lebanon                     Lesotho
##  [81] Liberia                     Libya
##  [83] Lithuania                   Macao SAR, China
##  [85] Macedonia, FYR              Madagascar
##  [87] Malawi                      Malaysia
##  [89] Maldives                    Mali
##  [91] Malta                       Mauritius
```

```
##  [93] Mexico                           Micronesia, Fed. Sts.
##  [95] Moldova                          Mongolia
##  [97] Montenegro                       Morocco
##  [99] Mozambique                       Namibia
## [101] Nepal                            Netherlands
## [103] New Zealand                      Nicaragua
## [105] Nigeria                          Pakistan
## [107] Panama                           Papua New Guinea
## [109] Paraguay                         Peru
## [111] Philippines                      Poland
## [113] Qatar                            Russian Federation
## [115] Samoa                            Sao Tome and Principe
## [117] Saudi Arabia                     Serbia
## [119] Seychelles                       Sierra Leone
## [121] Singapore                        Slovenia
## [123] Solomon Islands                  South Africa
## [125] Spain                            Sri Lanka
## [127] St. Kitts and Nevis              St. Lucia
## [129] St. Vincent and the Grenadines   Sudan
## [131] Suriname                         Swaziland
## [133] Sweden                           Switzerland
## [135] Tajikistan                       Tanzania
## [137] Thailand                         Tonga
## [139] Trinidad and Tobago              Tunisia
## [141] Turkey                           Uganda
## [143] Ukraine                          United Kingdom
## [145] United States                    Uruguay
## [147] Vanuatu                          Venezuela, RB
## [149] Vietnam                          Yemen, Rep.
## [151] Zambia
## 258 Levels: Afghanistan Albania Algeria American Samoa ... Zimbabwe
```

```
# Convert population to millions
ATMcost[,pop_MM := population/10^6]
```

```
##      Country.Code  Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA            NA         NA         NA       NA     NA
##   2:           NA            NA         NA         NA       NA     NA
##   3:           NA            NA         NA         NA       NA     NA
##   4:           NA            NA         NA         NA       NA     NA
##   5:           NA            NA         NA         NA       NA     NA
##  ---
## 176:          VUT       Vanuatu     30.221     241787    73.07   2907
## 177:          VEN Venezuela, RB     39.892   29497387 11767.04  17170
## 178:          VNM       Vietnam     19.388   87855860 17033.86   4707
## 179:          YEM   Yemen, Rep.      3.746   23311326   873.34   4070
## 180:          ZMB        Zambia      7.578   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int gamma_capex gamma_sum national
##   1:      NA  5.000          NA     406.3       237.4        NA       NA
##   2:      NA  8.667          NA     704.3       237.4        NA       NA
##   3:      NA     NA          NA        NA       237.4        NA       NA
##   4:      NA  8.667          NA     704.3       237.4        NA       NA
##   5:      NA  8.667          NA     704.3       237.4        NA       NA
##  ---
```

```
## 176:  1.0547  7.778      1024.6     632.1       237.4      1894   138399
## 177:  0.7335 39.333       712.5    3196.6       237.4      4146 48791735
## 178:  0.3282 13.700       318.8    1113.4       237.4      1670 28439270
## 179:  0.3313 24.037       321.9    1953.5       237.4      2513  2194458
## 180:  0.4582 14.315       445.1    1163.4       237.4      1846  1910388
##       pop_MM
##   1:      NA
##   2:      NA
##   3:      NA
##   4:      NA
##   5:      NA
##  ---
## 176:  0.2418
## 177: 29.4974
## 178: 87.8559
## 179: 23.3113
## 180: 13.6579
```

```
# Convert national cost to millions
ATMcost[,ATM_MM := national/10^6]
```

```
##      Country.Code  Country.Name ATMper100k population     ATMs GDPcap
##   1:           NA            NA         NA         NA       NA     NA
##   2:           NA            NA         NA         NA       NA     NA
##   3:           NA            NA         NA         NA       NA     NA
##   4:           NA            NA         NA         NA       NA     NA
##   5:           NA            NA         NA         NA       NA     NA
##  ---
## 176:          VUT       Vanuatu     30.221     241787    73.07   2907
## 177:          VEN Venezuela, RB     39.892   29497387 11767.04  17170
## 178:          VNM       Vietnam     19.388   87855860 17033.86   4707
## 179:          YEM   Yemen, Rep.      3.746   23311326   873.34   4070
## 180:          ZMB        Zambia      7.578   13657910  1034.96   2881
##      c_maint  c_int gamma_maint gamma_int gamma_capex gamma_sum national
##   1:      NA  5.000          NA     406.3       237.4        NA       NA
##   2:      NA  8.667          NA     704.3       237.4        NA       NA
##   3:      NA     NA          NA        NA       237.4        NA       NA
##   4:      NA  8.667          NA     704.3       237.4        NA       NA
##   5:      NA  8.667          NA     704.3       237.4        NA       NA
##  ---
## 176:  1.0547  7.778      1024.6     632.1       237.4      1894   138399
## 177:  0.7335 39.333       712.5    3196.6       237.4      4146 48791735
## 178:  0.3282 13.700       318.8    1113.4       237.4      1670 28439270
## 179:  0.3313 24.037       321.9    1953.5       237.4      2513  2194458
## 180:  0.4582 14.315       445.1    1163.4       237.4      1846  1910388
##       pop_MM  ATM_MM
##   1:      NA      NA
##   2:      NA      NA
##   3:      NA      NA
##   4:      NA      NA
##   5:      NA      NA
##  ---
## 176:  0.2418  0.1384
## 177: 29.4974 48.7917
```

```
## 178: 87.8559 28.4393
## 179: 23.3113  2.1945
## 180: 13.6579  1.9104
```

And the full list of country estimates is here.

% latex table generated in R 3.1.1 by xtable 1.7-3 package % Tue Sep 30 12:19:25 2014

	Country.Name	Country.Code	gamma_sum
1	Nepal	NPL	680.49
2	Saudi Arabia	SAU	822.12
3	Fiji	FJI	880.59
4	Lithuania	LTU	891.97
5	Thailand	THA	963.71
6	Hong Kong SAR, China	HKG	976.06
7	Comoros	COM	987.89
8	Morocco	MAR	1004.26
9	Kuwait	KWT	1021.72
10	Aruba	ABW	1029.58
11	Libya	LBY	1033.29
12	Macedonia, FYR	MKD	1036.13
13	Algeria	DZA	1040.19
14	Philippines	PHL	1051.42
15	Malaysia	MYS	1059.95
16	Estonia	EST	1078.96
17	Bangladesh	BGD	1086.46
18	Bolivia	BOL	1089.43
19	Korea, Rep.	KOR	1090.77
20	China	CHN	1098.85
21	Cameroon	CMR	1100.80
22	Malta	MLT	1112.01
23	Latvia	LVA	1119.15
24	Chad	TCD	1127.47
25	Jordan	JOR	1140.70
26	Central African Republic	CAF	1163.06
27	Congo, Rep.	COG	1171.31
28	Brunei Darussalam	BRN	1177.07
29	Equatorial Guinea	GNQ	1177.83
30	Slovenia	SVN	1198.65
31	Mexico	MEX	1200.74
32	Gabon	GAB	1216.94
33	Macao SAR, China	MAC	1230.02
34	Swaziland	SWZ	1269.99
35	Bahrain	BHR	1270.47
36	United States	USA	1290.05
37	Qatar	QAT	1292.75
38	Peru	PER	1297.36
39	Spain	ESP	1298.27
40	Bosnia and Herzegovina	BIH	1305.06
41	Trinidad and Tobago	TTO	1318.81
42	Panama	PAN	1323.53
43	Tunisia	TUN	1323.69
44	United Kingdom	GBR	1327.91
45	Burkina Faso	BFA	1334.44
46	Mali	MLI	1335.00

47	Guinea-Bissau	GNB	1336.79
48	Singapore	SGP	1340.29
49	Togo	TGO	1345.99
50	Benin	BEN	1350.09
51	Niger	NER	1355.39
52	Cote d'Ivoire	CIV	1374.90
53	Czech Republic	CZE	1376.09
54	India	IND	1381.63
55	Senegal	SEN	1383.36
56	Hungary	HUN	1384.56
57	Italy	ITA	1387.63
58	Germany	DEU	1414.46
59	Chile	CHL	1449.56
60	Mauritius	MUS	1458.72
61	Poland	POL	1468.41
62	Netherlands	NLD	1474.57
63	Japan	JPN	1480.16
64	Ireland	IRL	1482.31
65	Bulgaria	BGR	1483.37
66	Haiti	HTI	1484.55
67	Colombia	COL	1488.99
68	Belgium	BEL	1489.58
69	France	FRA	1494.08
70	Iran, Islamic Rep.	IRN	1497.33
71	Montenegro	MNE	1504.76
72	Kyrgyz Republic	KGZ	1506.22
73	Oman	OMN	1508.76
74	Egypt, Arab Rep.	EGY	1510.65
75	Russian Federation	RUS	1510.93
76	Israel	ISR	1511.80
77	Namibia	NAM	1518.56
78	South Africa	ZAF	1521.37
79	St. Vincent and the Grenadines	VCT	1550.08
80	Antigua and Barbuda	ATG	1569.08
81	Mauritania	MRT	1569.40
82	Albania	ALB	1570.46
83	Finland	FIN	1574.87
84	Indonesia	IDN	1575.18
85	Bahamas, The	BHS	1577.65
86	St. Kitts and Nevis	KNA	1584.78
87	Grenada	GRD	1597.41
88	St. Lucia	LCA	1601.19
89	Dominica	DMA	1615.76
90	Ecuador	ECU	1629.91
91	Pakistan	PAK	1633.94
92	Djibouti	DJI	1637.24
93	Canada	CAN	1637.81
94	Nicaragua	NIC	1647.37
95	Denmark	DNK	1647.67
96	Croatia	HRV	1664.22
97	Vietnam	VNM	1669.57
98	Botswana	BWA	1676.19
99	Kosovo	KSV	1688.73
100	Lesotho	LSO	1697.34

101	Cabo Verde	CPV	1705.43
102	Bhutan	BTN	1710.87
103	Samoa	WSM	1711.32
104	Iraq	IRQ	1713.13
105	Seychelles	SYC	1727.00
106	Sweden	SWE	1751.04
107	Suriname	SUR	1774.33
108	Moldova	MDA	1778.09
109	Guatemala	GTM	1780.02
110	New Zealand	NZL	1794.77
111	Afghanistan	AFG	1803.79
112	Belize	BLZ	1809.10
113	Mozambique	MOZ	1830.01
114	Tonga	TON	1836.89
115	Liberia	LBR	1839.90
116	Zambia	ZMB	1845.86
117	Sudan	SDN	1856.05
118	Lebanon	LBN	1867.95
119	Tanzania	TZA	1883.76
120	Georgia	GEO	1892.38
121	Vanuatu	VUT	1894.02
122	Switzerland	CHE	1910.32
123	Guyana	GUY	1914.55
124	Dominican Republic	DOM	1943.26
125	Nigeria	NGA	1968.68
126	Barbados	BRB	1997.20
127	Solomon Islands	SLB	2000.10
128	Iceland	ISL	2014.20
129	Burundi	BDI	2016.30
130	Ukraine	UKR	2030.51
131	Belarus	BLR	2039.88
132	Kenya	KEN	2053.91
133	Mongolia	MNG	2065.85
134	Armenia	ARM	2088.59
135	Serbia	SRB	2131.80
136	Azerbaijan	AZE	2156.26
137	Gambia, The	GMB	2157.03
138	Australia	AUS	2167.98
139	Sri Lanka	LKA	2180.19
140	Costa Rica	CRI	2234.78
141	Micronesia, Fed. Sts.	FSM	2281.01
142	Papua New Guinea	PNG	2284.67
143	Honduras	HND	2284.71
144	Turkey	TUR	2285.18
145	Sierra Leone	SLE	2304.97
146	Jamaica	JAM	2317.49
147	Maldives	MDV	2402.71
148	Yemen, Rep.	YEM	2512.73
149	Tajikistan	TJK	2616.65
150	Brazil	BRA	2706.83
151	Sao Tome and Principe	STP	2781.41
152	Uganda	UGA	2824.35
153	Paraguay	PRY	2882.24
154	Malawi	MWI	2926.49

155	Ghana	GHA	3048.46
156	Angola	AGO	3130.59
157	Uruguay	URY	3493.43
158	Venezuela, RB	VEN	4146.48
159	Madagascar	MDG	5254.38

Table 5: Unit cost of ATM Operations

% latex table generated in R 3.1.1 by xtable 1.7-3 package % Tue Sep 30 12:19:25 2014

	Country.Name	Country.Code	national
1	Micronesia, Fed. Sts.	FSM	24393.90
2	Guinea-Bissau	GNB	36034.44
3	Comoros	COM	41352.59
4	Central African Republic	CAF	41888.83
5	St. Vincent and the Grenadines	VCT	46125.28
6	Djibouti	DJI	49373.85
7	Tonga	TON	52902.53
8	Equatorial Guinea	GNQ	54186.25
9	Sierra Leone	SLE	55686.30
10	Dominica	DMA	59652.23
11	Chad	TCD	63241.44
12	Sao Tome and Principe	STP	64161.51
13	St. Kitts and Nevis	KNA	64911.62
14	Haiti	HTI	67043.68
15	Seychelles	SYC	71862.99
16	Grenada	GRD	81980.59
17	Samoa	WSM	86571.64
18	Antigua and Barbuda	ATG	105689.03
19	Liberia	LBR	105742.05
20	Solomon Islands	SLB	118185.38
21	Aruba	ABW	121751.24
22	Congo, Rep.	COG	122657.13
23	Bhutan	BTN	124779.42
24	St. Lucia	LCA	129636.74
25	Burundi	BDI	131339.39
26	Vanuatu	VUT	138398.99
27	Maldives	MDV	170109.66
28	Barbados	BRB	198518.38
29	Gabon	GAB	209822.26
30	Belize	BLZ	226080.30
31	Guyana	GUY	233625.37
32	Libya	LBY	233985.07
33	Malta	MLT	260867.14
34	Fiji	FJI	270172.73
35	Lesotho	LSO	282608.82
36	Afghanistan	AFG	325545.71
37	Suriname	SUR	357399.52
38	Cabo Verde	CPV	365849.00
39	Swaziland	SWZ	395381.48
40	Brunei Darussalam	BRN	398096.89
41	Bahamas, The	BHS	416387.40
42	Iceland	ISL	496424.08
43	Benin	BEN	506120.65

44	Cameroon	CMR	512341.30
45	Mali	MLI	587411.52
46	Trinidad and Tobago	TTO	612821.42
47	Montenegro	MNE	622842.51
48	Mauritius	MUS	786845.20
49	Botswana	BWA	911762.82
50	Kosovo	KSV	923593.41
51	Kyrgyz Republic	KGZ	974786.72
52	Nicaragua	NIC	980117.86
53	Macao SAR, China	MAC	1048565.53
54	Macedonia, FYR	MKD	1107344.81
55	Papua New Guinea	PNG	1143155.74
56	Iraq	IRQ	1144329.33
57	Cote d'Ivoire	CIV	1147257.31
58	Estonia	EST	1234271.24
59	Qatar	QAT	1335000.51
60	Nepal	NPL	1376035.66
61	Lithuania	LTU	1380196.05
62	Namibia	NAM	1441412.15
63	Albania	ALB	1444783.06
64	Tajikistan	TJK	1520237.38
65	Latvia	LVA	1546476.83
66	Jamaica	JAM	1651758.54
67	Malawi	MWI	1684586.87
68	Madagascar	MDG	1777707.63
69	Mongolia	MNG	1797617.94
70	Moldova	MDA	1806181.43
71	Bosnia and Herzegovina	BIH	1875695.22
72	Zambia	ZMB	1910387.93
73	Kuwait	KWT	1981036.51
74	Jordan	JOR	2080620.05
75	Yemen, Rep.	YEM	2194458.22
76	Algeria	DZA	2314014.62
77	Panama	PAN	2327903.93
78	Sudan	SDN	2412846.98
79	Slovenia	SVN	2531748.56
80	Armenia	ARM	2598393.49
81	Bolivia	BOL	2717715.21
82	Mozambique	MOZ	2827446.96
83	Finland	FIN	3064745.66
84	Tunisia	TUN	3070841.09
85	Lebanon	LBN	3246575.35
86	Hong Kong SAR, China	HKG	3308299.95
87	Ghana	GHA	3394597.44
88	Paraguay	PRY	3566635.79
89	Uganda	UGA	3684568.76
90	Georgia	GEO	3767928.64
91	Honduras	HND	3806124.29
92	Singapore	SGP	4059659.79
93	Uruguay	URY	4576275.97
94	Costa Rica	CRI	5350287.84
95	Denmark	DNK	5607300.66
96	Azerbaijan	AZE	5771775.88
97	Dominican Republic	DOM	5803700.98

98	New Zealand	NZL	5859028.92
99	Bangladesh	BGD	5952644.21
100	Ireland	IRL	6092229.28
101	Czech Republic	CZE	6260328.99
102	Sri Lanka	LKA	6402496.93
103	Tanzania	TZA	6690789.72
104	Morocco	MAR	6954853.75
105	Guatemala	GTM	7093425.07
106	Serbia	SRB	7198981.23
107	Sweden	SWE	7230503.54
108	Croatia	HRV	7745633.77
109	Hungary	HUN	7853548.39
110	Belarus	BLR	8071687.87
111	Kenya	KEN	8096405.57
112	Angola	AGO	9942677.13
113	Bulgaria	BGR	10001299.58
114	Ecuador	ECU	10062331.51
115	Egypt, Arab Rep.	EGY	11406401.12
116	Peru	PER	11469576.75
117	Israel	ISR	13102020.08
118	Pakistan	PAK	13809852.57
119	Netherlands	NLD	13831180.17
120	Saudi Arabia	SAU	13877526.51
121	Switzerland	CHE	14815616.89
122	Belgium	BEL	15161217.15
123	Chile	CHL	16143697.11
124	Malaysia	MYS	16200661.76
125	Philippines	PHL	17341519.24
126	Colombia	COL	24019246.96
127	Vietnam	VNM	28439269.82
128	Poland	POL	30256876.42
129	Nigeria	NGA	37069949.89
130	Iran, Islamic Rep.	IRN	42108430.90
131	South Africa	ZAF	46066382.14
132	Venezuela, RB	VEN	48791735.35
133	Thailand	THA	51433693.13
134	Mexico	MEX	64571833.20
135	Ukraine	UKR	78238970.64
136	Australia	AUS	79805923.22
137	Italy	ITA	80926719.43
138	Indonesia	IDN	85161948.44
139	Spain	ESP	88508930.58
140	Turkey	TUR	97094723.54
141	United Kingdom	GBR	103701130.56
142	France	FRA	105411321.05
143	Canada	CAN	117966536.51
144	Germany	DEU	135269372.93
145	Korea, Rep.	KOR	148892051.58
146	India	IND	153766260.49
147	Japan	JPN	244108114.27
148	Russian Federation	RUS	333053847.47
149	China	CHN	455728899.78
150	United States	USA	553212277.82
151	Brazil	BRA	631777658.77

Table 6: Rank order of national ATM fleet cost

Model

ATM average monthly costs in the United States, c_ω can be decomposed into the maintenance costs, c_m, cost of funds, c_f, and capital expense, c_k.

$$c_\omega = c_m + c_i + c_k$$

Those cost shares are calibrated using a 2006 Dove Consulting study, reported by the Texas chapter of the American Bankers Association in 2011.

Item	Share
Operating expense	75.3%
Cost of funds	6.3%
Depreciation	18.4%

Operating expenses are assumed to be proportional to the price level in each country. The components of maintenance include labor, telecommunications, back office processing, rent and vehicle costs. In short, they are a broad basket of goods and services unlikely to correlate with any specific price index such as headline inflation. Instead we choose the ratio of PPP exchange rates to market exchange rates. The World Bank indicator `Price level ratio` is available here.[1]

Base year cost

Base year costs were $1194. To calculate 2012 price: use the GDP deflator for 2012.[2]

Measure	Value
Cost in 2007	$1194
GDP deflator ratio	1.0804
Cost in 2012, estimated	$1290.05

Stargazer tables

These are the summary statistics from the ATM Costs dataset; and a covariance matrix for unit and national costs with GDP per capita. The stargazer package makes them prettier. See Tables 9 and 10.

[1] World Bank. World Development Indicators. Available at http://data.worldbank.org/indicator/PA.NUS.PPPC.RF

[2] Federal Reserve Economic Data (FRED). Gross Domestic Product: Implicit Price Deflator, Index 2009=100, Annual, Seasonally Adjusted. Available at (http://research.stlouisfed.org/fred2)

Table 9: Summary Statistics for ATM Costs Worldwide

Statistic	N	Mean	St. Dev.	Min	Max
ATMper100k	162	43.080	43.440	0.030	274.500
population	171	40,942,790.000	144,689,018.000	31,060.000	1,344,234,000.000
ATMs	162	19,628.000	60,850.000	10.690	428,830.000
GDPcap	167	16,919.000	19,483.000	732.700	127,698.000
c_maint	166	0.602	0.264	0.266	1.518
c_int	171	10.310	7.842	0.400	57.920
gamma_maint	166	584.600	256.100	258.800	1,474.000
gamma_int	171	837.900	637.300	32.510	4,707.000
gamma_capex	180	237.400	0.000	237.400	237.400
gamma_sum	159	1,669.000	601.300	680.500	5,254.000
national	151	28,343,098.000	86,639,020.000	24,394.000	631,777,659.000
pop_MM	171	40.940	144.700	0.031	1,344.000
ATM_MM	151	28.340	86.640	0.024	631.800

Table 10: Correlation Matrix for ATM Costs

	GDPcap	gamma_maint	gamma_int	gamma_sum	national
GDPcap	1	0.480	-0.417	-0.257	0.125
gamma_maint	0.480	1	-0.399	-0.024	0.203
gamma_int	-0.417	-0.399	1	0.926	-0.085
gamma_sum	-0.257	-0.024	0.926	1	-0.009
national	0.125	0.203	-0.085	-0.009	1

Cleaning up

Save the dataset

After cleaning up the West Africa exchange rates, save the output file in the data directory.

```
save(ATMcost, file="../data/ATMcost.Rda")
save.image("../data/archive.20140930.Rdata")
```

About the author

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